

# **Clinical Guidelines for Stroke Management 2017**

**Chapter 5 of 8:  
Rehabilitation**

**Main editor**

Stroke Foundation

**Publishing Information**

v5.2 published on 10.07.2018

This is the fifth in a series of eight guideline chapters that provide evidence-based recommendations for recovery from stroke and TIA.

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**Sponsors/Funding**

The Stroke Foundation gratefully acknowledges the financial assistance provided by the Australian Government Department of Health. The development of the final recommendations has not been influenced by the views or interests of the funding body.

**Disclaimer**

These Clinical Guidelines are a general guide to appropriate practice, to be followed subject to the clinician's judgment and the patient's preference in each individual case. The Clinical Guidelines are designed to provide information to assist decision-making and are based on the best evidence available at the time of development. The Clinical Guidelines can be viewed at [www.informme.org.au](http://www.informme.org.au) - Citation: Stroke Foundation. Clinical Guidelines for Stroke Management 2017. Melbourne Australia. © No part of this publication can be reproduced by any process without permission from the Stroke Foundation. August 2017.

# Sections

Summary of recommendations.....	5
1 - Introduction .....	19
2 - Methodology.....	22
3 - Clinical questions .....	25
4 - Rehabilitation - overview.....	26
5 - Early supported discharge services .....	27
6 - Home-based rehabilitation .....	42
7 - Goal setting.....	47
8 - Early mobilisation .....	52
9 - Sensorimotor impairment .....	60
9.1 - Weakness.....	60
9.2 - Loss of sensation.....	64
9.3 - Vision.....	69
10 - Physical activity .....	70
10.1 - Amount of rehabilitation .....	70
10.2 - Cardiorespiratory fitness .....	80
10.3 - Sitting.....	88
10.4 - Standing up.....	91
10.5 - Standing balance .....	97
10.6 - Walking .....	106
10.7 - Upper limb activity.....	119
11 - Activities of daily living .....	148
12 - Communication.....	165
12.1 - Assessment of communication deficits.....	165
12.2 - Aphasia.....	165
12.3 - Dysarthria.....	176
12.4 - Apraxia of speech.....	181
12.5 - Cognitive communication disorder in right hemisphere stroke .....	184
13 - Cognition and perception .....	186
13.1 - Assessment of cognition .....	186
13.2 - Executive function.....	186
13.3 - Attention and concentration.....	191
13.4 - Memory .....	197

13.5 - Perception .....	198
13.6 - Limb apraxia.....	199
13.7 - Neglect.....	203
14 - Glossary and abbreviations.....	225
References .....	231

# Summary of recommendations

## 1 - Introduction

## 2 - Methodology

## 3 - Clinical questions

## 4 - Rehabilitation - overview

## 5 - Early supported discharge services

### Strong Recommendation

Where appropriate stroke services are available (*see Practical information section*), early supported discharge services should be offered to stroke patients with mild to moderate disability. (Fearon et al. 2012 [11])

## 6 - Home-based rehabilitation

### Weak Recommendation

Home-based rehabilitation may be considered as a preferred model for delivering rehabilitation in the community. Where home rehabilitation is unavailable, stroke patients requiring rehabilitation should receive centre-based care. (Rasmussen et al. 2016 [21]; Hillier et al. 2010 [23])

## 7 - Goal setting

### Strong Recommendation

- Health professionals should initiate the process of setting goals, and involve stroke survivors and their families and carers throughout the process. Goals for recovery should be client-centred, clearly communicated and documented so that both the stroke survivor (and their families/carers) and other members of the rehabilitation team are aware of goals set. (Sugavanam et al. 2013 [32]; Taylor et al. 2012 [33])
- Goals should be set in collaboration with the stroke survivor and their family/carer (unless they choose not to participate) and should be well-defined, specific and challenging. They should be reviewed and updated regularly. (Sugavanam et al. 2013 [32]; Taylor et al. 2012 [33])

## 8 - Early mobilisation

### Strong Recommendation

### AGAINST

For stroke patients, starting intensive out-of-bed activities within 24 hours of stroke onset is not recommended. (Bernhardt et al. 2015 [36])

**Strong Recommendation**

All stroke patients should commence mobilisation (out-of-bed activity) within 48 hours of stroke onset unless otherwise contraindicated (e.g. receiving end-of-life care). (Bernhardt et al. 2015 [36]; Lynch et al. 2014 [37])

**Weak Recommendation**

For patients with mild and moderate stroke, frequent, short sessions of out-of-bed activity should be provided, but the optimal timing within the 48-hour post-stroke time period is unclear. (Bernhardt et al. 2015 [36])

## 9 - Sensorimotor impairment

### 9.1 - Weakness

**Strong Recommendation**

For stroke survivors with reduced strength in their arms or legs, strength training should be provided. (Ada et al. 2006 [45]; Harris and Eng 2010 [44])

**Weak Recommendation**

For stroke survivors with reduced strength in their arms or legs (particularly for those with less than antigravity strength), electrical stimulation may be used. (Nascimento et al. 2014 [41])

### 9.2 - Loss of sensation

**Weak Recommendation**

For stroke survivors with sensory loss of the upper limb, sensory-specific training may be provided. (de Diego et al. 2013 [46]; Carey et al. 2011 [48]; Doyle et al. 2010 [49])

## 9.3 - Vision

### Practice Statement

#### Consensus-based recommendations

- All stroke survivors should have an:
  - assessment of visual acuity while wearing the appropriate glasses, to check their ability to read newspaper text and see distant objects clearly;
  - examination for the presence of visual field deficit (e.g. hemianopia) and eye movement disorders (e.g. strabismus and motility deficit).

## 10 - Physical activity

### 10.1 - Amount of rehabilitation

#### Strong Recommendation

- For stroke survivors, rehabilitation should be structured to provide as much scheduled therapy (occupational therapy and physiotherapy) as possible. (Lohse et al. 2014 [62]); Schneider et al. 2016 [68]; Veerbeek et al. 2014 [76])
- For stroke survivors, group circuit class therapy should be used to increase scheduled therapy time. (English et al. 2015 [59])

### Practice Statement

#### Consensus-based recommendation

Stroke survivors should be encouraged to continue with active task practice outside of scheduled therapy sessions. This could include strategies such as:

- self-directed, independent practice;
- semi-supervised and assisted practice involving family/friends, as appropriate.

#### Weak Recommendation

A minimum of three hours a day of scheduled therapy (occupational therapy and physiotherapy) is recommended, ensuring at least two hours of active task practice occurs during this time. (Lohse et al. 2014 [62]; Schneider et al. 2016 [68])

## 10.2 - Cardiorespiratory fitness

### Strong Recommendation

For stroke survivors, rehabilitation should include individually-tailored exercise interventions to improve cardiorespiratory fitness. (Saunders et al. 2016 [75])

### Practice Statement

#### Consensus-based recommendations

- All stroke survivors should commence cardiorespiratory training during their inpatient stay.
- Stroke survivors should be encouraged to participate in ongoing regular physical activity regardless of their level of disability.

## 10.3 - Sitting

### Strong Recommendation

For stroke survivors who have difficulty sitting, practising reaching beyond arm's length while sitting with supervision/assistance should be undertaken. (Veerbeek et al. 2014 [95])

## 10.4 - Standing up

### Strong Recommendation

For stroke survivors who have difficulty in standing up from a chair, practice of standing up should be undertaken. (Pollock et al. 2014 [101]; French et al. 2016 [139])

## 10.5 - Standing balance

### Strong Recommendation

For stroke survivors who have difficulty standing, task-specific practice of standing balance should be provided (French et al. 2016 [173]). Strategies could include:

- practising functional tasks while standing (van Duijnhoven et al. 2016 [119]);
- walking training that includes challenge to standing balance (e.g. overground walking, obstacle courses) (van Duijnhoven et al. 2016 [119]);
- providing visual or auditory feedback (Veerbeek et al. 2014 [95]; Stanton et al. 2011 [109]).



Weak Recommendation

For stroke survivors who have difficulty with standing balance, virtual reality including treadmill training with virtual reality or use of Wii Balance Boards may be used. (Corbetta et al. 2015 [103])

## 10.6 - Walking

Strong Recommendation

Stroke survivors with difficulty walking should be given the opportunity to undertake tailored repetitive practice of walking (or components of walking) as much as possible. (French et al. 2016 [173])

The following modalities may be used:

- Circuit class therapy (with a focus on overground walking practice) (Veerbeek et al. 2014 [95]);
- Treadmill training with or without body weight support (Mehrholz et al. 2014 [125]).

Weak Recommendation

For stroke survivors with difficulty walking, one or more of the following interventions may be used in addition to those listed above:

- Virtual reality training. (Corbetta et al. 2015 [133])
- Electromechanically assisted gait training. (Mehrholz et al. 2013 [129])
- Biofeedback. (Stanton et al. 2011 [131])
- Cueing of cadence. (Nascimento et al. 2015 [130])
- Electrical stimulation. (Howlett et al. 2015 [132])

Weak Recommendation

For stroke survivors, individually fitted lower limb orthoses may be used to minimise limitations in walking ability. Improvement in walking will only occur while the orthosis is being worn. (Tyson et al. 2013 [136])

## 10.7 - Upper limb activity

Strong Recommendation

For stroke survivors with some active wrist and finger extension, intensive constraint-induced movement therapy (minimum 2 hours of active therapy per day for 2 weeks, plus restraint for at least 6 hours a day) should be provided to improve arm and hand use. (Corbetta et al. 2015 [177]) Trunk restraint may also be incorporated into the active therapy sessions at any stage post-stroke. (Wee et al. 2014 [164])

Weak Recommendation

For stroke survivors with mild to severe arm weakness, mechanically assisted arm training (e.g. robotics) may be used to improve upper limb function. (Mehrholz et al. 2015 [156])

Strong Recommendation

AGAINST

Hand and wrist orthoses (splints) should not be used as part of routine practice as they have no effect on function, pain or range of movement. (Tyson et al. 2011 [163])

Weak Recommendation

For stroke survivors with mild to moderate arm impairment, virtual reality and interactive games may be used to improve upper limb function. Virtual reality therapy should be provided for at least 15 hours total therapy time and is most effective when used in the first six months after stroke. (Laver et al. 2015 [108])

Weak Recommendation

For stroke survivors with mild to severe arm or hand weakness, electrical stimulation in conjunction with motor training may be used to improve upper limb function. (Howlett et al. 2015 [132])

Weak Recommendation

For stroke survivors with mild to moderate weakness of their arm, mental practice in conjunction with active motor training may be used to improve arm function. (Kho et al. 2014 [157])

Weak Recommendation

For stroke survivors with mild to moderate weakness, complex regional pain syndrome and/or neglect, mirror therapy may be used as an adjunct to routine therapy to improve arm function after stroke. (Thieme et al. 2012 [162])

Weak Recommendation

For stroke survivors with at least some voluntary movement of the arm and hand, repetitive task-specific training may be used to improve arm and hand function. (French et al. 2016 [173])

Weak Recommendation **AGAINST**

Brain stimulation (transcranial direct stimulation or repetitive transcranial magnetic stimulation) should not be used in routine practice for improving arm function, and only used as part of a research framework. (Elsner et al. 2016 [195]; Hao et al. 2013 [149])

## 11 - Activities of daily living

Strong Recommendation

- Community-dwelling stroke survivors who have difficulties performing daily activities should be assessed by a trained clinician. (Legg et al. 2006 [184])
- Community-dwelling stroke survivors with confirmed difficulties in personal or extended ADL should have specific therapy from a trained clinician (e.g. task-specific practice and training in the use of appropriate aids) to address these issues. (Legg et al. 2006 [184])

Weak Recommendation **AGAINST**

For older stroke survivors living in a nursing home, routine occupational therapy is not recommended to improve ADL function. (Sackley et al. 2015 [183])

Strong Recommendation **AGAINST**

For stroke survivors in the acute, sub-acute or chronic phase post-stroke, acupuncture should not be used to improve ADL. (Kong et al. 2010 [196])

Strong Recommendation **AGAINST**

Administration of amphetamines to improve ADL is not recommended. (Martinsson et al. 2007 [199])

Weak Recommendation

For stroke survivors, selective serotonin reuptake inhibitors may be used to improve performance of ADL. (Mead et al. 2012 [209])

Weak Recommendation **AGAINST**

Brain stimulation (transcranial direct stimulation or repetitive transcranial magnetic stimulation) should not be used in routine practice to improve ADL and only used as part of a research framework. (Elsner et al. 2016 [195]; Hao et al. 2013 [149])

Weak Recommendation

For stroke survivors, virtual reality technology may be used to improve ADL outcomes in addition to usual therapy. (Laver et al. 2015 [108])

## 12 - Communication

### 12.1 - Assessment of communication deficits

Info Box

**Practice point**

- All stroke survivors should be screened for communication deficits using a screening tool that is valid and reliable.
- Those stroke survivors with suspected communication difficulties should receive formal, comprehensive assessment by a specialist clinician to determine the nature and type of the communication impairment.

### 12.2 - Aphasia

Practice Statement

**Practice point**

Treatment for aphasia should be offered as early as tolerated.

Strong Recommendation

For stroke survivors with aphasia, speech and language therapy should be provided to improve functional communication. (Brady et al. 2016 [210])

Weak Recommendation

For stroke survivors with aphasia, intensive aphasia therapy (at least 45 minutes of direct language therapy for five days a week) may be used in the first few months after stroke. (Brady et al. 2016 [210])

Weak Recommendation

**AGAINST**

Brain stimulation (transcranial direct current stimulation or repetitive transcranial magnetic stimulation), with or without traditional aphasia therapy, should not be used in routine practice for improving speech and language function and only used as part of a research framework. (Ren et al. 2014 [211]; Elsner et al. 2015 [212])

Info Box

**Practice points**

Where a stroke patient is found to have aphasia, the clinician should:

- Document the provisional diagnosis.
- Explain and discuss the nature of the impairment with the patient, family/carers and treating team, and discuss and teach strategies or techniques which may enhance communication.
- Identify goals for therapy, and develop and initiate a tailored intervention plan, in collaboration with the patient and family/carer.
- Reassess the goals and plans at appropriate intervals over time.
- Use alternative means of communication (such as gesture, drawing, writing, use of augmentative and alternative communication devices) as appropriate.

All written information on health, aphasia, social and community supports (such as that available from the [Australian Aphasia Association](#) or local agencies) should be available in an aphasia-friendly format.

Info Box

**Practice point**

- Stroke survivors with chronic and persisting aphasia should have their mood monitored.
- Environmental barriers facing people with aphasia should be addressed through training communication partners, raising awareness of and educating about aphasia to reduce negative attitudes, and promoting access and inclusion by providing aphasia-friendly formats or other environmental adaptations. People with aphasia from culturally and linguistically diverse backgrounds may need special attention from trained healthcare interpreters.
- The impact of aphasia on functional activities, participation and quality of life, including the impact upon relationships, vocation and leisure, should be assessed and addressed as appropriate from early post-onset and over time for those chronically affected.

## 12.3 - Dysarthria

Weak Recommendation

For stroke survivors with dysarthria, individually tailored interventions provided by a speech and language pathologist or a trained communication partner may be provided. (Bowen et al. 2012 [213])

Weak Recommendation

**AGAINST**

For stroke survivors with dysarthria, non-speech oromotor exercises have not been shown to provide additional benefit to behavioural speech practice and are not recommended. (Mackenzie et al. 2014 [224])

## 12.4 - Apraxia of speech

### Weak Recommendation

For stroke survivors with apraxia of speech, individually tailored interventions incorporating articulatory-kinematic and rate/rhythm approaches may be used. (Ballard et al. 2015 [226])

In addition, therapy may incorporate (Ballard et al. 2015 [226]):

- Use of modelling and visual cueing.
- Principles of motor learning to structure practice sessions.
- Prompts for Restructuring Oral Muscular Phonetic Targets (PROMPT) therapy.
- Self-administered computer programs that use multimodal sensory stimulation.
- For functional activities, the use of augmentative and alternative communication modalities such as gesture or speech-generating devices is recommended.

## 12.5 - Cognitive communication disorder in right hemisphere stroke

### Practice Statement

#### Consensus-based recommendations

Stroke survivors with cognitive involvement who have difficulties in communication should have input from a suitably trained health professional including:

- a comprehensive assessment,
- development of a management plan, and
- family education, support and counselling as required. (Lehman Blake et al. 2013 [228]; Ferre et al. 2011 [229])

Management may include:

- Motoric-imitative, cognitive-linguistic treatments to improve use of emotional tone in speech production. (Rosenbek et al. 2006 [230])
- Semantic-based treatment connecting literal and metaphorical senses to improve comprehension of conversational and metaphoric concept. (Lungren et al. 2011 [231])

## 13 - Cognition and perception

### 13.1 - Assessment of cognition

Info Box

#### **Practice points**

- All stroke survivors should be screened for cognitive and perceptual deficits by a trained person (e.g. neuropsychologist, occupational therapist or speech pathologist) using validated and reliable screening tools, ideally prior to discharge from hospital.
- Stroke survivors identified during screening as having cognitive deficits should be referred for comprehensive clinical neuropsychological investigations.

### 13.2 - Executive function

Info Box

#### **Practice points**

- Stroke survivors considered to have problems associated with executive functioning deficits should be formally assessed by a suitably qualified and trained person, using reliable and valid tools that include measures of behavioural symptoms.
- For stroke survivors with impaired executive functioning, the way in which information is provided should be tailored to accommodate/compensate for the particular area of dysfunction.

#### **Weak Recommendation**

For stroke survivors with cognitive impairment, meta-cognitive strategy and/or cognitive training may be provided. (Zucchella et al. 2014 [232]; Skidmore et al. 2015 [236])

### 13.3 - Attention and concentration

Practice Statement

#### **Consensus-based recommendation**

For stroke survivors with attentional impairments or those who appear easily distracted or unable to concentrate, a formal neuropsychological or cognitive assessment should be performed.

#### **Weak Recommendation**

For stroke survivors with attention and concentration deficits, cognitive rehabilitation may be used. (Loetscher et al. 2013 [242]; Virk et al. 2016 [243])

Weak Recommendation

For stroke survivors with attention and concentration deficits, exercise training and leisure activities may be provided. (Liu-Ambrose et al. 2015 [244])

## 13.4 - Memory

Practice Statement

### Consensus-based recommendations

Any stroke survivor found to have memory impairment causing difficulties in rehabilitation or adaptive functioning should:

- be referred to a suitably qualified healthcare professional for a more comprehensive assessment of their memory abilities;
- have their nursing and therapy sessions tailored to use techniques that capitalise on preserved memory abilities;
- be assessed to see if compensatory techniques to reduce their disabilities, such as notebooks, diaries, audiotapes, electronic organisers and audio alarms are useful;
- have therapy delivered in an environment as similar to the stroke survivor's usual environment as possible to encourage generalisation;
- be taught strategies aimed at assisting their memory, e.g. using a notebook, diary, mobile phone/audio alerts, electronic calendars and/or reminders;
- be taught approaches aimed at directly improving their memory, e.g. computerised memory training games and learning mnemonic strategies.

## 13.5 - Perception

Practice Statement

### Consensus-based recommendations

- Stroke survivors with identified perceptual difficulties should have a formal perceptual (i.e. neurological and neuropsychological) assessment.
- Stroke survivors with an identified perceptual impairment and their carer should receive:
  - verbal and written information about the impairment;
  - an assessment and adaptation of their environment to reduce potential risk and promote independence;
  - practical advice/strategies to reduce risk (e.g. trips, falls, limb injury) and promote independence;
  - intervention to address the perceptual difficulties, ideally within the context of a clinical trial.



## 13.6 - Limb apraxia

### Info Box

#### **Practice point**

Stroke survivors who have suspected difficulties executing tasks but who have adequate limb movement and sensation should be screened for apraxia.

### Weak Recommendation

For stroke survivors with limb apraxia, interventions such as gesture training, strategy training and/or errorless learning may be provided. (Lindsten-McQueen et al. 2014 [252])

## 13.7 - Neglect

### Info Box

#### **Practice point**

Any stroke survivor with suspected or actual neglect or impairment of spatial awareness should have a full assessment using validated tools.

### Weak Recommendation

For stroke survivors with symptoms of unilateral neglect, cognitive rehabilitation (e.g. computerised scanning training, pen and paper tasks, visual scanning training, eye patching, mental practice) may be provided. (Bowen et al. 2013 [268])

### Weak Recommendation

For stroke survivors with symptoms of unilateral neglect, mirror therapy may be used to improve arm function and ADL performance. (Pandian et al. 2015 [259]; Thieme et al. 2012 [256])

### Practice Statement

#### **Consensus-based recommendations**

Stroke survivors with impaired attention to one side should be:

- given a clear explanation of the impairment;
- taught compensatory strategies systematically, such as visual scanning to reduce the impact of neglect on activities such as reading, eating and walking;
- given cues to draw attention to the affected side during therapy and nursing procedures;
- monitored to ensure that they do not eat too little through missing food on one side of the plate.

Weak Recommendation

**AGAINST**

Non-invasive brain stimulation should not be used in routine clinical practice to decrease unilateral neglect, but may be used within a research framework. (Kim et al. 2015 [260]; Cha et al. 2015 [261]; Bang et al. 2015 [262]; Fu et al. 2015 [265])

## 14 - Glossary and abbreviations

## 1 - Introduction

The Stroke Foundation is a national charity that partners with the community to prevent, treat and beat stroke. We stand alongside stroke survivors and their families, healthcare professionals and researchers. We build community awareness and foster new thinking and innovative treatments. We support survivors on their journey to live the best possible life after stroke.

We are the voice of stroke in Australia and we work to:

- Raise awareness of the risk factors, signs of stroke and promote healthy lifestyles.
- Improve treatment for stroke to save lives and reduce disability.
- Improve life after stroke for survivors.
- Encourage and facilitate stroke research.
- Advocate for initiatives to prevent, treat and beat stroke.
- Raise funds from the community, corporate sector and government to continue our mission.

The Stroke Foundation has been developing stroke guidelines since 2002. The existing Clinical Guidelines for Stroke Management 2010 were approved by the National Health and Medical Research Council (NHMRC) in September 2010.

In order for the Australian Government to ensure up-to-date, best practice clinical advice is provided and maintained to healthcare professionals, the NHMRC requires clinical guidelines be kept current and relevant by reviewing and updating them at least every 5-years. As a result, the Stroke Foundation was contracted by the Australian Government Department of Health to update the Clinical Guidelines for Stroke Management 2010, commencing July 2015.

The *Clinical Guidelines for Stroke Management 2017* updates and supersedes the Clinical Guidelines for Stroke Management 2010. The Clinical Guidelines have been updated in accordance with the *2011 NHMRC Standard for clinical practice guidelines* and therefore recommendations are based on the best evidence available. The Clinical Guidelines cover the whole continuum of stroke care, across 8 chapters.

Review of the Clinical Guidelines used an internationally recognised guideline development approach, known as GRADE (Grading of Recommendations Assessment, Development and Evaluation), and an innovative guideline development and publishing platform, known as MAGICapp (Making Grade the Irresistible Choice). GRADE ensures a systematic process is used to develop recommendations that are based on the balance of benefits and harms, patient values, and resource considerations. MAGICapp enables transparent display of this process and access to additional practical information useful for guideline recommendation implementation.

### Purpose

The *Clinical Guidelines for Stroke Management 2017* provides a series of best-practice recommendations to assist decision-making in the management of stroke and transient ischaemic attack (TIA) in adults, using the best available evidence. The Clinical Guidelines should not be seen as an inflexible recipe for stroke management; rather, they provide a guide to appropriate practice to be followed subject to clinical judgment and patient preferences.

### Scope

The Clinical Guidelines cover the most critical topics for effective management of stroke, relevant to the Australian context, and include aspects of stroke management across the continuum of care including pre-hospital, assessment and diagnosis, acute medical and surgical, secondary prevention, rehabilitation, discharge planning, community participation, and management of TIA. Some issues are dealt with in more detail, particularly where current management is at variance with best management, or where the evidence needs translation into practice.

The Clinical Guidelines do not cover:

- Subarachnoid haemorrhage;
- Stroke in infants, children and youth (i.e. <18 years old); or
- Primary prevention of stroke. (Refer to *Guidelines for the management of absolute cardiovascular disease risk 2012* (National Vascular Disease Prevention Alliance [5]) - <https://informme.org.au/en/Guidelines/Guidelines-for-the-assessment-and-management-of-absolute-CVD-risk>, and *Guideline for the diagnosis and management of hypertension in adults 2016* (Heart Foundation [6]) - <https://www.heartfoundation.org.au/for-professionals/clinical-information/hypertension>).

### Target audience

The Clinical Guidelines are intended for use by healthcare professionals, administrators, funders and policy makers who plan, organise and deliver care for people with stroke or TIA during all phases of recovery.

### Development

The Guidelines are published in eight separate chapters:

[Pre-hospital care](#)

[Early assessment and diagnosis](#)

[Acute medical and surgical management](#)  
[Secondary prevention](#)  
[Rehabilitation](#)  
[Managing complications](#)  
[Discharge planning and transfer of care](#)  
[Community participation and long-term care](#)

The Clinical Guidelines have been developed according to processes prescribed by the National Health and Medical Research Council (NHMRC) under the direction of an interdisciplinary working group. Refer to the document on [InformMe](#) that details the Interdisciplinary Working Group Membership and Terms of Reference.

### Use

The primary goal of the Clinical Guidelines is to help healthcare professionals improve the quality of the stroke care they provide. Refer to documents on [InformMe](#) that provide a 2-page summaries of the Clinical Guidelines – one for healthcare professionals, and one for consumers.

Guidelines differ from clinical or care pathways (also referred to as critical pathways, care paths, integrated care pathways, case management plans, clinical care pathways or care maps). Guidelines are an overview of the current best evidence translated into clinically relevant statements. Care pathways are based on best practice guidelines but provide a local link between the guidelines and their use.

In considering implementation of the Guidelines at a local level, healthcare professionals are encouraged to identify the barriers, enablers and facilitators to evidence-based practice within their own environment and determine the best strategy for local needs. Where change is required, initial and ongoing education is essential and is relevant to all recommendations in the Guidelines.

Refer to the document on [InformMe](#) that summarises all the Clinical Guidelines recommendations.

### Aboriginal and Torres Strait Islander People

Refer to the document on [InformMe](#) for information regarding Aboriginal and Torres Strait Islander people.

### Decision-making

Stroke survivors should be treated in accordance with the principles of shared decision-making contained within the *Acute Stroke Care Clinical Standard*, *Acute Stroke Services Framework 2015* and *Rehabilitation Stroke Services Framework 2013*, which include, among other things, that treatment should be patient-centred. Therefore, stroke survivors should be involved in decisions about their care at all times; but where they do not have capacity, or have limited capacity, family members should be involved in the decision-making.

### Consent

The principles of informed consent underpin these Clinical Guidelines and therefore the wording of the recommendations are directed at the healthcare professional; that is, the intervention should/may be used, rather than offered, for the stroke patient. For patients with aphasia and/or cognitive disorders requiring formal consent, Easy English or aphasia-friendly written versions of an information sheet and consent form should be offered and clearly explained to patients and their families in order to assist understanding and agreement.

### Endorsement

The Clinical Guidelines have been endorsed by a number of organisations and associations. Refer to the document on [InformMe](#) that details the organisations formally endorsing the Clinical Guidelines.

### Evidence gaps

Refer to the document on [InformMe](#) that details the gaps in evidence identified, noting areas for further research.

### Reports

Refer to documents on [InformMe](#) - Technical Report, Administrative Report and Dissemination and Implementation Report.

### Resources

Refer to documents on [InformMe](#) that provide supporting resources to assist with implementation of the Clinical Guidelines.

### Publication Approval



**Australian Government**

**National Health and Medical Research Council**

These guideline recommendations were approved by the Chief Executive Officer of the National Health and Medical Research Council (NHMRC) on 25 July 2017, (with a subsequent minor amendment approved on 22 November 2017 and a further updated recommendation

relating specifically to Neurointervention [Chapter 3, Section 8.2] approved on 9 July 2018) under Section 14A of the National Health and Medical Research Council Act 1992. In approving the guidelines recommendations the NHMRC considers that they meet the NHMRC standard for clinical practice guidelines. This approval is valid for a period of 5 years.

NHMRC is satisfied that the guideline recommendations are systematically derived, based on identification and synthesis of the best available scientific evidence and are developed for health professionals practising in an Australian health care setting. The NHMRC expects that all guidelines will be reviewed no less than once every five years.

This publication reflects the views of the authors and not necessarily the views of the Australian Government.

#### Disclaimer

These Clinical Guidelines are a general guide to appropriate practice, to be followed subject to the clinician's judgment and the patient's preference in each individual case. The Clinical Guidelines are designed to provide information to assist decision-making and are based on the best evidence available at the time of development.

#### Funding

The Stroke Foundation gratefully acknowledges the financial assistance provided by the Australian Government Department of Health. The development of the final recommendations has not been influenced by the views or interests of the funding body.

#### Citation

Stroke Foundation. Clinical Guidelines for Stroke Management 2017. Melbourne Australia.

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## 2 - Methodology

### Brief summary of GRADE

The Clinical Guidelines were developed following the GRADE methodology (Grading of Recommendations, Assessment, Development and Evaluation).

GRADE methodology includes four factors to guide the development of a recommendation and determine the strength of that recommendation:

1. The balance between desirable and undesirable consequences.
2. Confidence in the estimates of effect (quality of evidence).
3. Confidence in values and preferences and their variability (clinical and consumer preferences).
4. Resource use (cost and implementation considerations).

For full details of how GRADE is used for developing clinical recommendations, refer to the GRADE handbook, available at: <http://gdt.guidelinedevelopment.org/app/handbook/handbook.html>.

### Strength of recommendations

The GRADE process uses only two categories for the strength of recommendations, based on how confident the guideline panel is that the “desirable effects of an intervention outweigh undesirable effects [...] across the range of patients for whom the recommendation is intended” (GRADE Handbook):

- **Strong** recommendations: where guideline authors are certain that the evidence supports a clear balance towards either desirable or undesirable effects; or
- **Weak** recommendations: where the guideline panel is uncertain about the balance between desirable and undesirable effects.

These strong or weak recommendations can either be for or against an intervention. If the recommendation is against an intervention this means it is recommended NOT to do that intervention. There are a number of recommendations where we have stated that the intervention may only be used in the context of research. We have done this because these are guidelines for clinical practice, and while the intervention cannot be recommended as standard practice at the current time, we recognise there is good rationale to continue further research.

The implications of a strong or weak recommendation for a particular treatment are summarised in the GRADE handbook as follows:

*Table 1: Implications of GRADE recommendation categories (for a positive recommendation) for patients, clinicians and policy makers. Source: GRADE Handbook (<http://gdt.guidelinedevelopment.org/app/handbook/handbook.html>)*

	Strong Recommendation	Weak Recommendation
For patients	Most individuals in this situation would want the recommended course of action and only a small proportion would not.	The majority of individuals in this situation would want the suggested course of action, but many would not.
For clinicians	Most individuals should receive the recommended course of action. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator. Formal decision aids are not likely to be needed to help individuals make decisions consistent with their values and preferences.	Recognise that different choices will be appropriate for different patients, and that you must help each patient arrive at a management decision consistent with his values and preferences. Decision aids may be useful helping individuals making decisions consistent with their values and preferences. Clinicians may expect to spend more time with patients who are uncertain towards a decision.
For policy makers	The recommendation can be adapted as policy in most situations including for the use as performance indicators.	Policy making will require substantial debate and involvement of many stakeholders. Policies are more likely to vary between regions. Performance indicators would have to focus on the fact that there is a need for deliberation about the management options in place.

For topics where there is either a lack of evidence or insufficient quality of evidence on which to base a recommendation but the guideline panel believed advice should be made, statements were developed based on consensus and expert opinion (guided by any underlying or indirect evidence). These statements are labelled as 'Practice statements' and correspond to 'consensus-based recommendations' outlined in the NHMRC procedures and requirements.

For topics outside the search strategy (i.e. where no systematic literature search was conducted), additional considerations are provided. These are labelled 'Info Box' and correspond to 'practice points' outlined in the NHMRC procedures and requirements.

#### **Explanation of absolute effect estimates used**

The standardised evidence profile tables presented in the Clinical Guidelines include "Absolute effect estimates" for dichotomous outcomes. These represent the number of people per 1000 people expected to have the outcome in the control and intervention groups. This estimated risk in people receiving the intervention is based on a relative effect estimate which might be adjusted, e.g. to account for baseline differences between participants or when effect estimates have been pooled from different studies in a systematic review and adjusted to account for the variance of each individual estimate. Therefore, this estimated risk in the intervention group may differ from the raw estimate of the intervention group risk from the corresponding study. The estimated risk reflects the best estimate of the risk in the relevant population, relative to the risk observed among patients receiving the control or comparator intervention.

Wherever possible (i.e. when the relevant study reported enough information to allow the calculation to be done), these estimates were calculated using the following procedure:

1. Obtain the relative effect estimate (odds ratio or relative risk) and confidence interval from the best available study (systematic review or primary study) providing evidence about the effects of the intervention.
2. Use the observed number of events in the control group of the same study to calculate a baseline risk per 1000 people (or "assumed control risk").
3. Calculate an estimate of the corresponding risk per 1000 in people receiving the intervention using the relative effect estimate. This can be done using methods based on the formulas for calculating absolute risk reductions provided in the *Cochrane Handbook for Systematic Reviews of Interventions* (<http://handbook.cochrane.org/>). Applying the same calculations to the upper and lower bounds of the confidence interval for the relative effect estimate gives a confidence interval for the risk in the intervention group, which is then used to calculate the confidence interval for the difference per 1000 people, reported in the evidence tables.

#### **Cost effectiveness summaries**

There are several important points to consider when interpreting the cost-effectiveness information provided in the *Resources and Other Considerations* sections of the Clinical Guidelines.

Firstly, an intervention can be cost-effective without being cost-saving. This means that although there is an additional cost for the health benefits gained from the intervention, the intervention is still considered worthwhile. The incremental cost-effectiveness ratios (ICER) presented (e.g. cost per quality adjusted life year gained) are an indication of the cost-effectiveness or "value-for-money", with lower ICERs indicating better cost-effectiveness of an intervention.

Secondly, whether or not the intervention is cost-effective is a judgment call; and should reflect a society's willingness-to-pay to have the intervention for the potential outcomes achieved. An ICER that is approximately or equivalent to US\$50,000 has been commonly used by researchers in the past as a threshold for judging an intervention as being cost-effective (<http://www.nejm.org/doi/full/10.1056/NEJMp1405158#t=article>). However, no scientific basis for this threshold exists and actual willingness-to-pay may differ. For example, in a survey of 1000 Australian respondents conducted in 2007, the willingness-to-pay for an additional quality adjusted life year in Australia was estimated to be \$64,000 (<https://www.ncbi.nlm.nih.gov/pubmed/19382128>).

Thirdly, there is no absolute threshold for determining whether an intervention should be funded based on the ICER (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5153921/>). ICERs are only one of the major factors considered in priority setting (the process to decide which interventions should be funded within a given resource constraint). Other considerations include affordability, budget impact, fairness, feasibility and other factors that are important in the local context (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5153921/>).

Lastly, in areas where there are no data from economic evaluations that support the recommendations or practice statements, it remains unclear whether the additional costs of providing the intervention above usual care for the additional potential benefits obtained is justified. However, this should not detract from implementing the Clinical Guideline recommendations.

#### **Use of language related to timing of interventions**

**Immediate:** without delay, or within minutes, not hours (life critical action required).

**Urgent:** minutes to several hours (immediate action but not life critical).

**Very early:** within hours and up to 24 hours.

**Early:** within 48 hours.

For all Clinical Guideline recommendations we make the assumption that healthcare professionals will be appropriately qualified and skilled

to carry out the intervention.



### 3 - Clinical questions

- 5.1 Is home-based rehabilitation more effective than hospital-based care in reducing mortality and increasing independence amongst stroke patients?
- 5.2 Does access to early supported discharge services improve outcomes for people with stroke?
- 5.3 What is the minimum amount of task-specific practice within the first six months of a stroke to improve patient outcomes?
- 5.4 Does patient-centred goal setting improve patient outcomes?
- 5.5 Do early mobilisation interventions improve outcomes in acute stroke?
- 5.6 What is the optimal time to screen for dysphagia?
- 5.7 Does comprehensive swallow assessment improve outcomes for people who have failed a swallow screen?
- 5.8 Which interventions improve outcomes in stroke patients with dysphagia?
- 5.9 What interventions for strength improve outcomes for stroke survivors?
- 5.10 What interventions increase sensation in stroke survivors?
- 5.11 What interventions (compensatory or restorative) improve visual field loss?
- 5.12 What task-specific training improves outcomes for stroke survivors who have difficulties sitting?
- 5.13 What task-specific training improves outcomes for stroke survivors who have difficulties standing up?
- 5.14 What task-specific training improves outcomes for stroke survivors who have difficulties standing?
- 5.15 What interventions improve walking ability in stroke survivors?
- 5.16 Does non-invasive brain stimulation in combination with therapy improve outcomes in stroke survivors?
- 5.17 What interventions improve upper limb activity in stroke patients who have difficulty using their upper limbs?
- 5.18 What interventions improve ADL in patients with stroke?
- 5.19 What interventions improve outcomes for patients with aphasia?
- 5.20 What interventions improve outcomes for people with dyspraxia of speech?
- 5.21 What interventions improve outcomes for people with dysarthria?
- 5.22 What interventions improve outcome in stroke patients with cognitive communication difficulties?
- 5.23 What interventions improve perceptual impairment in stroke survivors?
- 5.24 What interventions improve outcomes in stroke patients with attention and concentration deficits?
- 5.25 What interventions improve outcomes in stroke patients with memory difficulties?
- 5.26 What interventions to initiate everyday activities in stroke patients improve impaired executive functioning?
- 5.27 What interventions improve outcomes for stroke patients with limb apraxia?
- 5.28 What interventions improve the outcome of stroke patients with unilateral spatial neglect?

## 4 - Rehabilitation - overview

Rehabilitation is a holistic process that should begin the first day after stroke with the aim of maximising the participation of the person with stroke in the community. To achieve this, tailored interventions that focus on impairment, activity and participation levels (based on the World Health Organisation International Classification of Functioning model) should be considered. Therefore rehabilitation as a process can occur in a variety of settings, including in hospital on acute or specialised rehabilitation wards, in the home, or in community outpatient settings. For some aspects of care (e.g. screening and management of dysphagia) early intervention is critical and therefore this topic has been included in the Acute medical and surgical chapter, but they continue to be relevant beyond the initial few days after stroke. This chapter discusses interventions targeting impairments (sensorimotor, communication and cognitive) and activities. The Managing complications chapter discusses secondary impairments or complications (i.e. impairments that result from the primary impairments). The Community participation and long-term care chapter discusses aspects of care related to participation and reintegration into the community, including self-management.

Stroke survivors being treated within a rehabilitation framework should always be constantly monitored and reviewed for signs of deterioration, and in this situation referred to their treating neurologist or medical stroke specialist.

## 5 - Early supported discharge services

Early supported discharge (ESD) is a model that links inpatient care with community services and provision of rehabilitation services within the home environment, with the aim of reducing the length of stay. ESD services should be considered an extension of stroke unit care rather than an alternative. A key argument for ESD is that the home provides an optimum rehabilitation environment since the goal of rehabilitation is to establish skills that are appropriate to the home setting. To work effectively, ESD services must have similar elements to those of organised stroke teams. The level of services available following discharge from hospital can be limited, and stroke survivors and their families/carers often report being dissatisfied with the information, support services and therapy available. Therefore, while there is great pressure to ensure early discharge from acute services, the evidence is based on early **supported** discharge, i.e. not just **early** discharge, and it is vital to ensure that adequate community services for rehabilitation and carer support services, mirroring those used in the trials, are developed and utilised. Despite good evidence of its effectiveness, patients in Australia are rarely referred to ESD services and have limited access to an ESD stroke specialist team (Stroke Foundation 2016 [9]).

### Strong Recommendation

Where appropriate stroke services are available (see *Practical information section*), early supported discharge services should be offered to stroke patients with mild to moderate disability. (Fearon et al. 2012 [11])

### Practical Info

To work effectively, ESD services must have similar elements to those of organised stroke teams (see [stroke unit care](#)). Typical ESD teams had approximately 3.0 full-time equivalent (FTE) staff (range 2.5 to 4.6) as follows: medical 0.1, nursing (ranged from 0 to 1.2), physiotherapy 1.0, occupational therapy 1.0, speech and language therapy 0.1, assistant 0.2. Variable levels of social work (0 to 0.5 FTE) and secretarial support were also available (Fearon et al. 2012 [11]). Patients tended to be a selected elderly group with moderate disability (Barthel Index scores between 10 to 18 points). Most trials were conducted in the United Kingdom, so there may be subtle differences in care in the Australian context.

### Key Info

#### Benefits and harms

Substantial net benefits of the recommended alternative

In the Cochrane review by Fearon et al. (2012) [11], early supported discharge (ESD) groups showed significant reductions ( $P < 0.0001$ ) in the length of hospital stay equivalent to approximately seven days. The odds ratios (OR) (95% confidence interval (CI)) death or institutionalisation and death or dependency at the end of scheduled follow-up were OR 0.78 (95% CI 0.61 to 1.00,  $P = 0.05$ ) and OR 0.80 (95% CI 0.67 to 0.97,  $P = 0.02$ ) respectively. The greatest benefits were seen in the trials evaluating a coordinated ESD team and in stroke patients with mild to moderate disability. The apparent benefits were no longer statistically significant at five-year follow-up.

#### Quality of evidence

High

The quality of the evidence was rated moderate to high.

#### Preference and values

No substantial variability expected

Improvements were seen in patients' extended activities of daily living scores (standardised mean difference 0.12, 95% CI 0.00 to 0.25,  $P = 0.05$ ) and satisfaction with services (OR 1.60, 95% CI 1.08 to 2.38,  $P = 0.02$ ), but no statistically significant differences were seen in carers' subjective health status, mood or satisfaction with services.

#### Resources and other considerations

No important issues with the recommended alternative

##### Resources considerations

There is some evidence that ESD may be cost-effective or provide a viable alternate model of care to management on a general ward. An economic evaluation has been conducted parallel to a single-centre randomised controlled trial comparing care on a stroke unit, care on a general ward and domiciliary care within 72 hours of stroke onset (Patel et al. 2004 [16]). It was found in this study that a 1% reduction in death and nursing home admission would cost £496 (cost reference year 1997/1998) more with care on a stroke unit compared to domiciliary care. However, care on a stroke unit was not cost-effective (given a willingness to pay of £30,000 per QALY

gained), costing an additional £64,097 per QALY gained (cost reference year 1997/1998) compared to domiciliary care. Domiciliary care was found to result in greater health gains and lower costs than care on a general ward.

An economic evaluation has also been conducted parallel to a single-centre randomised controlled trial comparing stroke unit care and stroke unit care with ESD (Fjaertoft et al. 2005 [17]). No specific cost-effectiveness outcome was tested, but early supported discharge had lower costs at 12 months (Fjaertoft et al. 2005) and fewer deaths/NH admissions at 5 years post-stroke (Fjaertoft et al. 2011 [18]) than the control group.

A Cochrane review (Fearon et al. 2012 [11]) conducted to investigate services such as ESD with rehabilitation at home for reducing duration of hospital care for acute stroke patients, also presented costing data available from seven trials which estimated total costs up to three months, six months or one year after randomisation. Estimated costs ranged from 23% less to 15% greater for the ESD group in comparison to controls. These estimates were reported to be stable in sensitivity analyses.

In a further observational comparative study (Tistad and von Koch 2015 [19]), patients who had received ESD service were compared to a group who had received conventional rehabilitation in terms of the costs of healthcare services utilised during the first year after their stroke. The mean cost per person was SEK 260,425 in the ESD group and SEK 287,964 in the non ESD group (cost reference year 2012).

#### **Implementation considerations**

There are clinical indicators collected in the National Stroke Audit on the number of patients referred to ESD and the proportion of those that go on to access the service. There is also an organisational indicator collected to determine whether hospitals have ongoing access to stroke-specialist ESD.

## **Rationale**

Early supported discharge (ESD) with well-organised discharge teams and coordinated community support showed overall benefit for stroke patients with moderate disability, based on a meta-analysis of 14 trials (N = 1957) (Fearon et al. 2012 [11]). The updated patient data analysis demonstrated that patients receiving ESD services were more likely to be independent and living at home six months after stroke than those who received conventional services. The overall quality of the trials was moderate to high, so we have confidence in these results.

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## **Clinical Question/ PICO**

<b>Population:</b>	Adults with stroke
<b>Intervention:</b>	Early supported discharge service with ESD team co-ordination and delivery
<b>Comparator:</b>	Conventional care

## **Summary**

A Cochrane review by Fearon et al (2012) [11] included 14 trials (N = 1957) comparing conventional care to interventions providing community-based rehabilitation and support and aiming to reduce the duration of hospital care. Different forms of early supported discharge (ESD) services investigated in these trials included:

- ESD team co-ordination and delivery, where a multidisciplinary team "coordinated discharge from hospital, post-discharge care and provided rehabilitation and patient care at home"
- ESD team co-ordination, where a multidisciplinary team planned and supervised immediate post-discharge care but subsequent care was provided by community-based agencies
- No ESD team, where patients received care from a multidisciplinary team in hospital but after discharge care was provided by community stroke services.

Overall, ESD services were associated with a significant reduction in death or dependency at the end of follow-up (OR 0.80, 95% CI 0.67 to 0.97), with non-significant reductions in death (OR 0.91, 95% CI 0.67 to 1.25) and a marginally significant reduction of death or institutionalisation (OR 0.78, 95% CI 0.61 to 1.00). In subgroup analyses comparing different forms of ESD service, ESD team co-ordination and delivery appeared to be associated with the largest reductions in death or dependency, but heterogeneity between the different forms was non-significant.

A subsequent randomised controlled trial (N = 306) by Hofstad et al (2014) [13] compared two different ESD models to usual care. The two ESD models delivered treatment either in a day unit or in patients' homes. Comparisons of modified Rankin scores at 3 and 6 months showed no significant differences between the ESD groups and control in the number of patients who were independent, although ESD groups showed greater improvement in mRS change scores at 3 months. No significant differences were found between the two different ESD models. The evidence from this trial is somewhat equivocal, suggesting a possible benefit from ESD treatment, but also suggesting that usual care may have improved since the studies in the Fearon et al review were conducted, reducing the difference between ESD care and usual care.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Conventional care	ESD team co- ordination and delivery		
<b>Death</b>	Odds Ratio 0.69 (CI 95% 0.44 - 1.07) Based on data from 1,140 patients in 9 studies. <sup>1</sup> (Randomized controlled)	<b>93</b> per 1000	<b>66</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>2</sup>	Early supported discharge services with ESD team co-ordination and delivery probably decrease death
<b>Death or requiring institutional care</b>	Odds Ratio 0.65 (CI 95% 0.45 - 0.93) Based on data from 941 patients in 7 studies. <sup>3</sup> (Randomized controlled)	<b>192</b> per 1000	<b>134</b> per 1000	<b>High</b>	Early supported discharge services with ESD team co-ordination and delivery decrease death or requiring institutional care
<b>Death or dependency</b>	Odds Ratio 0.71 (CI 95% 0.55 - 0.91) Based on data from 1,140 patients in 9 studies. <sup>4</sup> (Randomized controlled)	<b>481</b> per 1000	<b>397</b> per 1000	<b>High</b> 5	Early supported discharge services with ESD team co-ordination and delivery decrease death or dependency
<b>Satisfaction with services</b>	Odds Ratio 1.74 (CI 95% 1.13 - 2.67) Based on data from 450 patients in 4 studies. <sup>6</sup> (Randomized controlled)	<b>608</b> per 1000	<b>730</b> per 1000	<b>High</b> 7	Early supported discharge services with ESD team co-ordination and delivery increase satisfaction with services
<b>Carer satisfaction with services</b>	Odds Ratio 1.6 (CI 95% 0.85 - 3.01) Based on data from 246 patients in 3 studies. (Randomized controlled)	<b>743</b> per 1000	<b>822</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>8</sup>	Early supported discharge services with ESD team co-ordination and delivery probably improve carer satisfaction with services

<b>Activities of daily living (Barthel ADL) score</b>	Measured by: Barthel Index High better Based on data from: 825 patients in 7 studies. <sup>9</sup> (Randomized controlled)	Difference: <b>SMD 0.06 higher</b> ( CI 95% 0.08 lower - 0.2 higher )	<b>High</b> 10	Early supported discharge services with ESD team co-ordination and delivery have little or no difference on activities of daily living
<b>Extended activities of daily living (EADL) score</b>	Measured by: EADL High better Based on data from: 729 patients in 7 studies. <sup>11</sup> (Randomized controlled)	Difference: <b>SMD 0.17 higher</b> ( CI 95% 0.02 higher - 0.32 higher )	<b>High</b>	Early supported discharge services with ESD team co-ordination and delivery slightly improve extended activities of daily living
<b>Subjective health status</b>	Measured by: Various: SF36, Nottingham Health Profile, COOP charts High better Based on data from: 860 patients in 8 studies. <sup>12</sup> (Randomized controlled)	Difference: <b>SMD 0.07 lower</b> ( CI 95% 0.21 lower - 0.06 higher )	<b>High</b> 13	Early supported discharge services with ESD team co-ordination and delivery have little or no difference on subjective health status
<b>Mood status</b>	Measured by: Various e.g. SF36, GDS, MADRS High better Based on data from: 383 patients in 5 studies. <sup>14</sup> (Randomized controlled)	Difference: <b>SMD 0.02 lower</b> ( CI 95% 0.22 lower - 0.18 higher )	<b>Moderate</b> Due to serious imprecision <sup>15</sup>	Early supported discharge services with ESD team co-ordination and delivery probably have little or no difference on mood status
<b>Carer subjective health status</b>	Measured by: Various e.g. SF36, GHQ High better Based on data from: 373 patients in 5 studies. (Randomized controlled)	Difference: <b>SMD 0.15 lower</b> ( CI 95% 0.35 lower - 0.06 higher )	<b>Moderate</b> Due to serious imprecision <sup>16</sup>	Early supported discharge services with ESD team co-ordination and delivery probably have little or no difference on mood status
<b>Carer mood status</b>	Measured by: SF36, HADS High better Based on data from: 58 patients in 2 studies. (Randomized controlled)	Difference: <b>SMD 0.19 lower</b> ( CI 95% 1.6 lower - 1.22 higher )	<b>Low</b> Due to very serious imprecision <sup>17</sup>	Early supported discharge services with ESD team co-ordination and delivery may have little or no difference on carer mood status

1. Systematic review [12] with included studies: Glostrup 2006, Copenhagen 2009, Stockholm 1998, Manchester 2001, London 1999, Newcastle 1997, Montreal 2000, Belfast 2004, Adelaide 2000. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ;

- Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Wide confidence intervals ; **Publication bias: No serious .**
3. Systematic review [12] with included studies: Manchester 2001, Newcastle 1997, Montreal 2000, Copenhagen 2009, Stockholm 1998, London 1999, Glostrup 2006. **Baseline/comparator::** Control arm of reference used for intervention .
4. Systematic review [12] with included studies: Glostrup 2006, Copenhagen 2009, Stockholm 1998, Manchester 2001, London 1999, Newcastle 1997, Montreal 2000, Belfast 2004, Adelaide 2000. **Baseline/comparator::** Control arm of reference used for intervention .
5. **Risk of bias: No serious .** Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious . Publication bias: No serious .**
6. Systematic review [12] with included studies: Stockholm 1998, Belfast 2004, Adelaide 2000, London 1999. **Baseline/comparator::** Control arm of reference used for intervention .
7. **Risk of bias: No serious .** Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious . Publication bias: No serious .**
8. **Risk of bias: No serious .** Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious . Publication bias: No serious .**
9. Systematic review [12] with included studies: Adelaide 2000, Copenhagen 2009, Belfast 2004, London 1999, Glostrup 2006, Montreal 2000, Manchester 2001. **Baseline/comparator::** Control arm of reference used for intervention .
10. **Risk of bias: No serious .** Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious .** Wide confidence intervals: confidence interval covers effect size of 0.2 for a 'small' effect ; **Publication bias: No serious .**
11. Systematic review [12] with included studies: Stockholm 1998, Belfast 2004, Adelaide 2000, Manchester 2001, London 1999, Newcastle 1997, Montreal 2000. **Baseline/comparator::** Control arm of reference used for intervention .
12. Systematic review [12] with included studies: Newcastle 1997, Montreal 2000, Stockholm 1998, Adelaide 2000, Glostrup 2006, Belfast 2004, Manchester 2001, London 1999. **Baseline/comparator::** Control arm of reference used for intervention .
13. **Risk of bias: No serious .** Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious . Publication bias: No serious .**
14. Systematic review [12] with included studies: Montreal 2000, Adelaide 2000, Manchester 2001, Belfast 2004, Newcastle 1997. **Baseline/comparator::** Control arm of reference used for intervention .
15. **Risk of bias: No serious .** Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Wide confidence intervals: covers small effects in both directions ; **Publication bias: No serious .**
16. **Risk of bias: No serious .** Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Wide confidence intervals ; **Publication bias: No serious .**
17. **Risk of bias: No serious .** Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Very Serious .** Low number of patients, Wide confidence intervals ; **Publication bias: No serious .**

## References

[11] Fearon P, Langhorne P : Services for reducing duration of hospital care for acute stroke patients.. The Cochrane database of systematic reviews 2012;9 CD000443 [Pubmed Journal](#)

## Clinical Question/ PICO

**Population:** Adults with stroke

**Intervention:** Early supported discharge services overall  
**Comparator:** Conventional care

### Summary

A Cochrane review by Fearon et al (2012) [11] included 14 trials (N = 1957) comparing conventional care to interventions providing community-based rehabilitation and support and aiming to reduce the duration of hospital care. Different forms of early supported discharge (ESD) services investigated in these trials included:

- ESD team co-ordination and delivery, where a multidisciplinary team "coordinated discharge from hospital, post-discharge care and provided rehabilitation and patient care at home"
- ESD team co-ordination, where a multidisciplinary team planned and supervised immediate post-discharge care but subsequent care was provided by community-based agencies
- No ESD team, where patients received care from a multidisciplinary team in hospital but after discharge care was provided by community stroke services.

Overall, ESD services were associated with a significant reduction in death or dependency at the end of follow-up (OR 0.80, 95% CI 0.67 to 0.97), with non-significant reductions in death (OR 0.91, 95% CI 0.67 to 1.25) and a marginally significant reduction of death or institutionalisation (OR 0.78, 95% CI 0.61 to 1.00). In subgroup analyses comparing different forms of ESD service, ESD team co-ordination and delivery appeared to be associated with the largest reductions in death or dependency, but heterogeneity between the different forms was non-significant.

A subsequent randomised controlled trial (N = 306) by Hofstad et al (2014) [13] compared two different ESD models to usual care. The two ESD models delivered treatment either in a day unit or in patients' homes. Comparisons of modified Rankin scores at 3 and 6 months showed no significant differences between the ESD groups and control in the number of patients who were independent, although ESD groups showed greater improvement in mRS change scores at 3 months. No significant differences were found between the two different ESD models. The evidence from this trial is somewhat equivocal, suggesting a possible benefit from ESD treatment, but also suggesting that usual care may have improved since the studies in the Fearon et al review were conducted, reducing the difference between ESD care and usual care.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Conventional care	Early supported discharge service		
<b>Death</b>  9 Critical	Odds Ratio 0.91 (CI 95% 0.67 - 1.25) Based on data from 1,957 patients in 14 studies. (Randomized controlled)	<b>91</b> per 1000	<b>83</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>1</sup>	Early supported discharge services in general probably have little or no difference on death
<b>Death or requiring institutional care</b>  9 Critical	Odds Ratio 0.78 (CI 95% 0.61 - 1) Based on data from 1,758 patients in 12 studies. (Randomized controlled)	<b>211</b> per 1000	<b>173</b> per 1000	<b>High</b>	Early supported discharge services in general decrease death or requiring institutional care



<p><b>Death or dependency</b></p> <p>9 Critical</p>	<p>Odds Ratio 0.8 (CI 95% 0.67 - 0.97) Based on data from 1,957 patients in 14 studies. (Randomized controlled)</p>	<p><b>470</b> per 1000</p> <p><b>415</b> per 1000</p> <p>Difference: <b>55 fewer</b> per 1000 ( CI 95% 97 fewer - 8 fewer )</p>	<p><b>High</b> 2</p>	<p>Early supported discharge services in general decrease death or dependency</p>
<p><b>Satisfaction with services</b></p> <p>7 Critical</p>	<p>Odds Ratio 1.6 (CI 95% 1.08 - 2.38) Based on data from 513 patients in 5 studies. (Randomized controlled)</p>	<p><b>611</b> per 1000</p> <p><b>715</b> per 1000</p> <p>Difference: <b>104 more</b> per 1000 ( CI 95% 18 more - 178 more )</p>	<p><b>High</b> 3</p>	<p>Early supported discharge services in general improve satisfaction with services</p>
<p><b>Carer satisfaction with services</b></p> <p>7 Critical</p>	<p>Odds Ratio 1.56 (CI 95% 0.87 - 2.81) Based on data from 279 patients in 4 studies. (Randomized controlled)</p>	<p><b>742</b> per 1000</p> <p><b>818</b> per 1000</p> <p>Difference: <b>76 more</b> per 1000 ( CI 95% 28 fewer - 148 more )</p>	<p><b>Moderate</b> Due to serious imprecision<sup>4</sup></p>	<p>Early supported discharge services in general probably improve carer satisfaction with services slightly</p>
<p><b>Activities of daily living (Barthel ADL) score</b></p> <p>8 Critical</p>	<p>Measured by: Barthel Index High better Based on data from: 1,124 patients in 9 studies. (Randomized controlled)</p>	<p>Difference: <b>SMD 0.03 higher</b> ( CI 95% 0.08 lower - 0.15 higher )</p>	<p><b>High</b> 5</p>	<p>Early supported discharge services in general have little or no difference on activities of daily living</p>
<p><b>Extended activities of daily living (EADL) score</b></p> <p>8 Critical</p>	<p>Measured by: EADL High better Based on data from: 1,051 patients in 9 studies. (Randomized controlled)</p>	<p>Difference: <b>SMD 0.14 higher</b> ( CI 95% 0.02 higher - 0.26 higher )</p>	<p><b>High</b> 6</p>	<p>Early supported discharge services in general slightly improve extended activities of daily living</p>
<p><b>Subjective health status</b></p> <p>8 Critical</p>	<p>Measured by: Various: SF36, Nottingham Health Profile, COOP charts High better Based on data from: 1,377 patients in 12 studies. (Randomized controlled)</p>	<p>Difference: <b>SMD 0 lower</b> ( CI 95% 0.1 lower - 0.11 higher )</p>	<p><b>High</b> 7</p>	<p>Early supported discharge services in general have little or no difference on subjective health status</p>
<p><b>Mood status</b></p> <p>7 Critical</p>	<p>Measured by: Various e.g. SF36, GDS, MADRS High better Based on data from: 851 patients in 8 studies.</p>	<p>Difference: <b>SMD 0.06 lower</b> ( CI 95% 0.19 lower - 0.07 higher )</p>	<p><b>High</b> 8</p>	<p>Early supported discharge services in general have little or no difference on mood status</p>

<p><b>Carer subjective health status</b></p> <p>7 Critical</p>	<p>(Randomized controlled)</p> <p>Measured by: Various e.g. SF36, GHQ High better</p> <p>Based on data from: 749 patients in 8 studies.<sup>9</sup> (Randomized controlled)</p>	<p>Difference: <b>SMD 0.03 lower</b> ( CI 95% 0.17 lower - 0.12 higher )</p>	<p><b>High</b> 10</p>	<p>Early supported discharge services in general have little or no difference on carer health status</p>
<p><b>Carer mood status</b></p> <p>7 Critical</p>	<p>Measured by: SF36, HADS High better</p> <p>Based on data from: 58 patients in 2 studies.<sup>11</sup> (Randomized controlled)</p>	<p>Difference: <b>SMD 0.19 lower</b> ( CI 95% 1.6 lower - 1.22 higher )</p>	<p><b>Low</b> Due to very serious imprecision<sup>12</sup></p>	<p>Early supported discharge services in general may have little or no difference on carer mood status</p>

1. **Risk of bias: No serious** . Lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
2. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
3. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
4. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
5. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
6. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
7. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
8. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
9. Systematic review [11] . **Baseline/comparator::** Control arm of reference used for intervention .
10. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
11. Systematic review [11] . **Baseline/comparator::** Control arm of reference used for intervention .
12. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients, Wide confidence intervals ; **Publication bias: No serious** .

## References

[11] Fearon P, Langhorne P : Services for reducing duration of hospital care for acute stroke patients.. The Cochrane database of systematic reviews 2012;9 CD000443 [PubMed Journal](#)

**Clinical Question/ PICO**

<b>Population:</b>	Adults with stroke
<b>Intervention:</b>	Early supported discharge service - No ESD team co-ordination or delivery
<b>Comparator:</b>	Conventional care

**Summary**

A Cochrane review by Fearon et al (2012) [11] included 14 trials (N = 1957) comparing conventional care to interventions providing community-based rehabilitation and support and aiming to reduce the duration of hospital care. Different forms of early supported discharge (ESD) services investigated in these trials included:

- ESD team co-ordination and delivery, where a multidisciplinary team "coordinated discharge from hospital, post-discharge care and provided rehabilitation and patient care at home"
- ESD team co-ordination, where a multidisciplinary team planned and supervised immediate post-discharge care but subsequent care was provided by community-based agencies
- No ESD team, where patients received care from a multidisciplinary team in hospital but after discharge care was provided by community stroke services.

Overall, ESD services were associated with a significant reduction in death or dependency at the end of follow-up (OR 0.80, 95% CI 0.67 to 0.97), with non-significant reductions in death (OR 0.91, 95% CI 0.67 to 1.25) and a marginally significant reduction of death or institutionalisation (OR 0.78, 95% CI 0.61 to 1.00). In subgroup analyses comparing different forms of ESD service, ESD team co-ordination and delivery appeared to be associated with the largest reductions in death or dependency, but heterogeneity between the different forms was non-significant.

A subsequent randomised controlled trial (N = 306) by Hofstad et al (2014) [13] compared two different ESD models to usual care. The two ESD models delivered treatment either in a day unit or in patients' homes. Comparisons of modified Rankin scores at 3 and 6 months showed no significant differences between the ESD groups and control in the number of patients who were independent, although ESD groups showed greater improvement in mRS change scores at 3 months. No significant differences were found between the two different ESD models. The evidence from this trial is somewhat equivocal, suggesting a possible benefit from ESD treatment, but also suggesting that usual care may have improved since the studies in the Fearon et al review were conducted, reducing the difference between ESD care and usual care.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Conventional care	Early supported discharge service - No ESD team		
<b>Death</b>	Odds Ratio 1.9 (CI 95% 0.9 - 3.98) Based on data from 353 patients in 2 studies. <sup>1</sup> (Randomized controlled)	<b>68</b> per 1000	<b>122</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>2</sup>	Early supported discharge services without an ESD team probably increase death
<b>Death or requiring institutional care</b>	Odds Ratio 1.32 (CI 95% 0.75 - 2.33) Based on data from 353 patients in 2 studies. <sup>3</sup> (Randomized controlled)	<b>158</b> per 1000	<b>199</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>4</sup>	Early supported discharge services with no ESD team support probably increase death or requiring institutional care

<b>Death or dependency</b>	Odds Ratio 1.23 (CI 95% 0.79 - 1.91) Based on data from 353 patients in 2 studies. <sup>5</sup> (Randomized controlled)	<b>407</b> per 1000	<b>458</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>6</sup>	Early supported discharge services without ESD team support probably increase death or dependency
<b>Satisfaction with services</b>	Odds Ratio 0 (CI 95% 0 - 0) <sup>7</sup>	<b>0</b> per 1000	<b>0</b> per 1000	No studies that assessed patient satisfaction for early supported discharge without ESD team co-ordination or delivery were found.	No studies were found that looked at satisfaction with services
<b>Carer satisfaction with services</b>	n/a Based on data from 0 patients in 0 studies. (Randomized controlled)	<b>0</b> per 1000	<b>0</b> per 1000	No studies that assessed carer satisfaction with services were found	No studies were found that looked at carer satisfaction with services
<b>Activities of daily living (Barthel ADL) score</b>	Measured by: Barthel Index High better Based on data from: 251 patients in 1 studies. <sup>8</sup> (Randomized controlled)	Difference: <b>SMD 0 lower</b> (CI 95% 0.25 lower - 0.25 higher)		<b>Moderate</b> Due to serious imprecision <sup>9</sup>	Early supported discharge services with no ESD team co-ordination or delivery probably have little or no difference on activities of daily living
<b>Extended activities of daily living (EADL) score</b>	Based on data from: 0 patients in 0 studies. <sup>10</sup>	Difference: <b>SMD 0 lower</b> (CI 95% 0 lower - 0 lower)		No studies assessing EADL among ESD without co-ordination or delivery were available.	No studies were found that looked at extended activities of daily living
<b>Subjective health status</b>	Measured by: Various: SF36, Nottingham Health Profile, COOP charts High better Based on data from: 147 patients in 1 studies. <sup>11</sup> (Randomized controlled)	Difference: <b>SMD 0.14 higher</b> (CI 95% 0.19 lower - 0.47 higher)		<b>Low</b> Due to very serious imprecision <sup>12</sup>	Early supported discharge services without ESD team co-ordination or delivery may have little or no difference on subjective health status
<b>Mood status</b>	Measured by: Various e.g. SF36, GDS, MADRS High better	Difference: <b>SMD 0.12 lower</b> (CI 95% 0.45 lower - 0.2 higher)		<b>Low</b> Due to very serious	Early supported discharge services without ESD team co-

	Based on data from: 147 patients in 1 studies. <sup>13</sup> (Randomized controlled)		imprecision <sup>14</sup>	ordination or delivery may have little or no difference on mood status
<b>Carer subjective health status</b>	Based on data from: 0 patients in 0 studies. (Randomized controlled)	CI 95%	No studies that assessed carer health status were found	No studies were found that looked at carer subjective health status
<b>Carer mood status</b>	Based on data from: 0 patients in 0 studies. (Randomized controlled)	CI 95%	No studies that assessed carer mood status were found	No studies were found that looked at carer mood status

1. Systematic review [12] with included studies: Akershus 1998, Bangkok 2002. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
3. Systematic review [12] with included studies: Akershus 1998, Bangkok 2002. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
5. Systematic review [12] with included studies: Bangkok 2002, Akershus 1998. **Baseline/comparator::** Control arm of reference used for intervention .
6. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
7. Systematic review [12] . **Baseline/comparator::** Control arm of reference used for intervention .
8. Systematic review [12] with included studies: Akershus 1998. **Baseline/comparator::** Control arm of reference used for intervention .
9. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals, Only data from one study ;
10. Systematic review [12] . **Baseline/comparator::** Control arm of reference used for intervention .
11. Systematic review [12] with included studies: Akershus 1998. **Baseline/comparator::** Control arm of reference used for intervention .
12. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Wide confidence intervals, Only data from one study ; **Publication bias: No serious** .
13. Systematic review [12] with included studies: Akershus 1998. **Baseline/comparator::** Control arm of reference used for intervention .
14. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Wide confidence intervals, Only data from one study ; **Publication bias: No serious** .

## References

[11] Fearon P, Langhorne P : Services for reducing duration of hospital care for acute stroke patients.. The Cochrane database of systematic reviews 2012;9 CD000443 [Pubmed Journal](#)

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Early supported discharge service - ESD team co-ordination only  
**Comparator:** Conventional care

## Summary

A Cochrane review by Fearon et al (2012) [11] included 14 trials (N = 1957) comparing conventional care to interventions providing community-based rehabilitation and support and aiming to reduce the duration of hospital care. Different forms of early supported discharge (ESD) services investigated in these trials included:

- ESD team co-ordination and delivery, where a multidisciplinary team "coordinated discharge from hospital, post-discharge care and provided rehabilitation and patient care at home"
- ESD team co-ordination, where a multidisciplinary team planned and supervised immediate post-discharge care but subsequent care was provided by community-based agencies
- No ESD team, where patients received care from a multidisciplinary team in hospital but after discharge care was provided by community stroke services.

Overall, ESD services were associated with a significant reduction in death or dependency at the end of follow-up (OR 0.80, 95% CI 0.67 to 0.97), with non-significant reductions in death (OR 0.91, 95% CI 0.67 to 1.25) and a marginally significant reduction of death or institutionalisation (OR 0.78, 95% CI 0.61 to 1.00). In subgroup analyses comparing different forms of ESD service, ESD team co-ordination and delivery appeared to be associated with the largest reductions in death or dependency, but heterogeneity between the different forms was non-significant.

A subsequent randomised controlled trial (N = 306) by Hofstad et al (2014) [13] compared two different ESD models to usual care. The two ESD models delivered treatment either in a day unit or in patients' homes. Comparisons of modified Rankin scores at 3 and 6 months showed no significant differences between the ESD groups and control in the number of patients who were independent, although ESD groups showed greater improvement in mRS change scores at 3 months. No significant differences were found between the two different ESD models. The evidence from this trial is somewhat equivocal, suggesting a possible benefit from ESD treatment, but also suggesting that usual care may have improved since the studies in the Fearon et al review were conducted, reducing the difference between ESD care and usual care.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Conventional care	Early supported discharge service - ESD team co- ordination		
Death	Odds Ratio 0.95 (CI 95% 0.52 - 1.74) Based on data from 464 patients in 3 studies. <sup>1</sup> (Randomized controlled)	<b>104</b> per 1000	<b>99</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>2</sup>	Early supported discharge services with ESD team co-ordination only probably have little or no difference on death
		Difference: <b>5 fewer</b> per 1000			

		( CI 95% 47 fewer - 64 more )			
<b>Death or requiring institutional care</b>	Odds Ratio 0.75 (CI 95% 0.5 - 1.14) Based on data from 464 patients in 3 studies. <sup>3</sup> (Randomized controlled)	<b>290</b> per 1000	<b>235</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>4</sup>	Early supported discharge services with ESD team co-ordination (only) probably decrease death or requiring institutional care
<b>Death or dependency</b>	Odds Ratio 0.77 (CI 95% 0.54 - 1.11) Based on data from 464 patients in 3 studies. <sup>5</sup> (Randomized controlled)	<b>489</b> per 1000	<b>424</b> per 1000	<b>Moderate</b> Due to serious imprecision <sup>6</sup>	Early supported discharge services with ESD team co-ordination probably decrease death or dependency
<b>Satisfaction with services</b>	Odds Ratio 1.01 (CI 95% 0.36 - 2.83) Based on data from 63 patients in 1 studies. <sup>7</sup> (Randomized controlled)	<b>633</b> per 1000	<b>635</b> per 1000	<b>Low</b> Due to very serious imprecision <sup>8</sup>	Early supported discharge services with ESD team co-ordination only may have little or no difference on satisfaction with services
<b>Carer satisfaction with services</b>	Odds Ratio 1.28 (CI 95% 0.24 - 6.7) Based on data from 33 patients in 1 studies. (Randomized controlled)	<b>727</b> per 1000	<b>773</b> per 1000	<b>Low</b> Due to very serious imprecision <sup>9</sup>	Early supported discharge services with ESD team co-ordination may improve carer satisfaction with services
<b>Activities of daily living (Barthel ADL) score</b>	Measured by: Barthel Index High better Based on data from: 48 patients in 1 studies. <sup>10</sup> (Randomized controlled)			<b>Low</b> Due to very serious imprecision <sup>11</sup>	Early supported discharge services with ESD team co-ordination only may decrease activities of daily living slightly
<b>Extended activities of daily living (EADL) score</b>	Measured by: EADL High better Based on data from: 322 patients in 2 studies. <sup>12</sup> (Randomized controlled)			<b>Moderate</b> Due to serious imprecision <sup>13</sup>	Early supported discharge services with ESD team co-ordination only probably improve extended activities of daily living
<b>Subjective health status</b>	Measured by: Various: SF36, Nottingham Health Profile, COOP charts			<b>Moderate</b> Due to serious	Early supported discharge services with ESD team co-ordination
		Difference: <b>55 fewer</b> per 1000 ( CI 95% 120 fewer - 28 more )			
		Difference: <b>65 fewer</b> per 1000 ( CI 95% 148 fewer - 26 more )			
		Difference: <b>2 more</b> per 1000 ( CI 95% 250 fewer - 197 more )			
		Difference: <b>46 more</b> per 1000 ( CI 95% 337 fewer - 220 more )			
		Difference: <b>SMD 0.23 lower</b> ( CI 95% 0.79 lower - 0.34 higher )			
		Difference: <b>SMD 0.07 higher</b> ( CI 95% 0.15 lower - 0.29 higher )			
		Difference: <b>SMD 0.14 higher</b> ( CI 95% 0.07 lower - 0.34 higher )			

	High better Based on data from: 370 patients in 3 studies. <sup>14</sup> (Randomized controlled)		imprecision <sup>15</sup>	only probably have little or no difference on subjective health status
<b>Mood status</b>	Measured by: Various e.g. SF36, GDS, MADRS High better Based on data from: 321 patients in 2 studies. <sup>16</sup> (Randomized controlled)	Difference: <b>SMD 0.08 lower</b> ( CI 95% 0.3 lower - 0.14 higher )	<b>Moderate</b> Due to serious imprecision <sup>17</sup>	Early supported discharge services with ESD team co-ordination only probably have little or no difference on mood status
<b>Carer subjective health status</b>	Measured by: Various e.g. SF36, GHQ High better Based on data from: 376 patients in 3 studies. (Randomized controlled)	Difference: <b>SMD 0.09 higher</b> ( CI 95% 0.12 lower - 0.29 higher )	<b>Moderate</b> Due to serious imprecision <sup>18</sup>	Early supported discharge services with ESD team co-ordination probably have little or no difference on carer subjective health status
<b>Carer mood status</b>	High better Based on data from: 0 patients in 0 studies. (Randomized controlled)	CI 95%	No studies assessing carer mood status were found	No studies were found that looked at carer mood status

- Systematic review [12] with included studies: Oslo 2000, Trondheim 2004, Trondheim 2000. **Baseline/comparator::** Control arm of reference used for intervention .
- Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
- Systematic review [12] with included studies: Trondheim 2000, Oslo 2000, Trondheim 2004. **Baseline/comparator::** Control arm of reference used for intervention .
- Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
- Systematic review [12] with included studies: Trondheim 2000, Oslo 2000, Trondheim 2004. **Baseline/comparator::** Control arm of reference used for intervention .
- Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
- Systematic review [12] with included studies: Oslo 2000. **Baseline/comparator::** Control arm of reference used for intervention .
- Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Wide confidence intervals, Low number of patients, Only data from one study ; **Publication bias: No serious** .
- Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients, Wide confidence intervals, Only data from one study ; **Publication bias: No serious** .
- Systematic review [12] with included studies: Trondheim 2004. **Baseline/comparator::** Control arm of reference used for intervention .
- Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Wide confidence intervals, Low number of patients, Only data from one study ; **Publication bias: No serious** .
- Systematic review [12] with included studies: Trondheim 2000, Oslo 2000. **Baseline/comparator::** Control arm of reference



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used for intervention .

13. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
14. Systematic review [12] with included studies: Oslo 2000, Trondheim 2004, Trondheim 2000. **Baseline/comparator::** Control arm of reference used for intervention .
15. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
16. Systematic review [12] with included studies: Trondheim 2000, Oslo 2000. **Baseline/comparator::** Control arm of reference used for intervention .
17. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
18. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .

### References

[11] Fearon P, Langhorne P : Services for reducing duration of hospital care for acute stroke patients.. The Cochrane database of systematic reviews 2012;9 CD000443 [Pubmed Journal](#)

## 6 - Home-based rehabilitation

Home-based rehabilitation is different to early supported discharge. Stroke rehabilitation for people living in the community is commonly delivered either in a centre, outpatient or day hospital setting (Hillier 2000 [23]), although referral to community rehabilitation offered in the home is increasing (Stroke Foundation 2015 [8]). In the National Stroke Audit of Acute Services, 7% of patients were referred to home-based community rehabilitation (Stroke Foundation 2015 [8]), while in the National Stroke Audit of Rehabilitation Services, this increased to 29% (Stroke Foundation 2016 [9]). On the other hand, 105 out of 121 (86%) surveyed in the National Stroke Audit of Rehabilitation Services reported having access to community-based rehabilitation provided in the home (Stroke Foundation 2016 [9]). Stroke survivors report a strong preference for undertaking rehabilitation in the home and it has been shown to increase carer satisfaction and may lower risk of readmission (Crotty et al. 2008).

### Weak Recommendation

Home-based rehabilitation may be considered as a preferred model for delivering rehabilitation in the community. Where home rehabilitation is unavailable, stroke patients requiring rehabilitation should receive centre-based care. (Rasmussen et al. 2016 [21]; Hillier et al. 2010 [23])

### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

One review found benefits related to function in short term and quality of life, but benefits were small, particularly for function (Hillier et al. 2010 [23]). An additional study showed that 3 months after stroke, patients undergoing rehabilitation at home were less disabled and experienced a higher quality of life than patients receiving standard care (Rasmussen et al. 2016 [21]). Patients trained at home achieved better modified Rankin Scale and EuroQol-5D scores. Additionally, three months after stroke the total amount of home-based training in minutes positively correlated with modified Barthel ADL index, Motor Assessment Scale and EuroQol-5D scores, and negatively correlated with the modified Rankin Scale scores. The chosen home-based rehabilitation scheme was more effective than the existing rehabilitation services and did not increase rehabilitation costs. Overall, the authors' results suggested that early supported discharge teams should start acting before discharge by training inpatients at home.

#### Quality of evidence

Low

Included studies have some risk of bias and overall quality is rated as low.

#### Preference and values

No substantial variability expected

Home-based rehabilitation is preferred by the majority of stroke patients.

#### Resources and other considerations

No important issues with the recommended alternative

##### Economics considerations

In a review conducted by Jones and Brown (personal communication, 2010), six economic evaluations of community stroke rehabilitation were identified (Andersson et al. 2002 [26]; Beech et al. 1999 [27]; Gladman et al. 1994 [28]; McNamee et al. 1998 [29]; Roderick et al. 2001 [30]; Young and Forster 1993 [31]). They found that stroke rehabilitation services were heterogeneous and that further research on the cost-effectiveness of home-based rehabilitation was required.

Differences in costs, from a societal perspective, between adults receiving rehabilitation in an inpatient rehabilitation setting versus an alternative setting have been investigated in a systematic review and meta-analysis (Brusco et al. 2014 [24]). This review consisted of a mixed population: geriatric, hip fracture, and stroke. A meta-analysis of four trials comparing inpatient rehabilitation versus home-based rehabilitation was conducted (included 732 participants post moderate to severe stroke, with an appropriate home environment and adequate social support). There was evidence in this group that inpatient rehabilitation was more costly compared with rehabilitation in the home. However, the authors also concluded that rehabilitation in the home may be more cost-effective for some patient groups. A single trial with a similar standardised mean difference reported an average cost difference of £6770 per person in favour of rehabilitation in the home (cost reference year 1998).

In a randomised controlled trial conducted in Denmark, home-based rehabilitation was compared to standard care (Rasmussen et al. 2016 [21]). Information on costs was limited to the delivery of the intervention and costs of hospital admission. The average total cost was US\$54,118 for patients provided home-based rehabilitation and US\$54,242 for patients provided standard care (cost reference year not reported).

**Implementation considerations**

There are clinical indicators collected in the National Stroke Audit on the number of patients referred to home-based community rehabilitation and the proportion of those that go on to access the service. There is also an organisational indicator collected to determine whether hospitals have ongoing access to community-based rehabilitation provided in the home.

**Rationale**

Home-based rehabilitation resulted in a small improvement in short-term functional independence compared with centre-based rehabilitation, but little or no difference for medium-term functional independence. Home-based rehabilitation may improve quality of life and disability, however the findings were based on data from one study (N = 61) [21].

**Clinical Question/ PICO**

- Population:** Adults with stroke
- Intervention:** Home-based rehabilitation
- Comparator:** Community-based rehabilitation

**Summary**

Hillier et al (2010) [23] compared outcomes from home-based and centre-based rehabilitation for people living in the community following stroke in a systematic review and meta-analysis. Centre-based rehabilitation was delivered in settings such as outpatient clinics or day hospitals. Eleven randomised controlled trials were included, with most reporting Barthel Index scores as a measure of overall functioning or activity. Meta-analysis showed significantly increased Barthel Index scores at 3 months for home-based rehabilitation (MD 1 point, 95% CI 0.12 to 1.88), with non-significant differences at 6 months. A subsequent randomised trial by Rasmussen et al (2016) [21] assessed quality of life and disability outcomes among patients (N = 71) randomly assigned to home-based or standard care. The trial commenced during hospitalisation. Standard care included inpatient rehabilitation with therapy provided by the multidisciplinary team 5 days a week. Intervention participants received in-home rehabilitation 1 to 3 days a week during hospitalisation, and 1 to 5 days a week post-discharge. Details about standard care after discharge was not provided. Quality of life, assessed using EuroQol-5D, was significantly improved in the home-based rehabilitation group (Intervention median = 0.77, IQR = 0.66-0.79; Control median = 0.66, IQR = 0.56 - 0.72; P=0.03), as was disability measured using the modified Rankin scale (Intervention median = 2, IQR = 2-3; Control median = 3, IQR = 2-4; P=0.04).

A systematic review by Doig et al (2010) [22] included trials comparing home-based and hospital-based rehabilitation for patients with acquired brain injury, including 17 studies, 15 of which included stroke patients. Meta-analysis was not performed, but the review found that home-based rehabilitation appeared to be at least equivalent to hospital-based care in improving impairment and activity limitations.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Community-based rehabilitation	Home-based rehabilitation		
<b>Short-term functional independence</b> 6-8 weeks	Measured by: Barthel index High better Based on data from: 245 patients in 2 studies. (Randomized controlled)	Difference: <b>MD 1 higher</b> ( CI 95% 0.12 higher - 1.88 higher )		<b>Low</b> Due to serious imprecision, Due to serious risk of	Home-based rehabilitation may have little or no difference on short-term functional independence

8 Critical	Follow up 6-8 weeks			bias <sup>1</sup>	
<b>Medium-term functional independence</b> 6 months	Measured by: Barthel Index High better Based on data from: 912 patients in 6 studies. (Randomized controlled) Follow up 6 months	Difference: <b>MD 0.65 higher</b> ( CI 95% 0.5 lower - 1.81 higher )		<b>Low</b> Due to very serious inconsistency <sup>2</sup>	Home-based rehabilitation may have little or no difference on medium-term functional independence
8 Critical	Follow up 6 months				
<b>Quality of Life</b> 90 days post stroke	Measured by: Euro-Qol-5D High better Based on data from: 61 patients in 1 studies. (Randomized controlled) Follow up 90 days	<b>0.66</b> points (Median)	<b>0.77</b> points (Median)	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>3</sup>	Home-based rehabilitation may improve quality of life
9 Critical	Follow up 90 days				
<b>Disability</b> 90 days	Measured by: mRS Scale: 0-6 Lower better Based on data from: 61 patients in 1 studies. (Randomized controlled) Follow up 90 days	<b>3</b> (Median)	<b>2</b> (Median)	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>4</sup>	Home-based rehabilitation may improve disability
9 Critical	Follow up 90 days	CI 95%			

- Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
- Inconsistency: Very Serious** . The magnitude of statistical heterogeneity was high, with I<sup>2</sup>:80%, The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies. ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
- Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias. ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
- Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

## References

- [20] Ghazipura M : Home-based versus centre-based rehabilitation for community- dwelling post acute stroke patients: a rapid review (Structured abstract). 2015; [Website](#)
- [23] Hillier S, Inglis-Jassiem G : Rehabilitation for community-dwelling people with stroke: home or centre based? A systematic review.. International Journal of Stroke 2010;5(3):178-86 [Pubmed Journal](#)

**Clinical Question/ PICO**

**Population:** Community-dwelling adults with stroke  
**Intervention:** Home-based rehabilitation  
**Comparator:** Centre-based rehabilitation

**Summary**

Hillier et al (2010) [23] compared outcomes from home-based and centre-based rehabilitation for people living in the community following stroke in a systematic review and meta-analysis. Centre-based rehabilitation was delivered in settings such as outpatient clinics or day hospitals. Eleven randomised controlled trials were included, with most reporting Barthel Index scores as a measure of overall functioning or activity. Meta-analysis showed significantly increased Barthel Index scores at 3 months for home-based rehabilitation (MD 1 point, 95% CI 0.12 to 1.88), with non-significant differences at 6 months. A subsequent randomised trial by Rasmussen et al (2016) [21] assessed quality of life and disability outcomes among patients (N = 71) randomly assigned to home-based or standard care. The trial commenced during hospitalisation. Standard care included inpatient rehabilitation with therapy provided by the multidisciplinary team 5 days a week. Intervention participants received in-home rehabilitation 1 to 3 days a week during hospitalisation, and 1 to 5 days a week post-discharge. Details about standard care after discharge was not provided. Quality of life, assessed using EuroQol-5D, was significantly improved in the home-based rehabilitation group (Intervention median = 0.77, IQR = 0.66–0.79; Control median = 0.66, IQR = 0.56 – 0.72; P=0.03), as was disability measured using the modified Rankin scale (Intervention median = 2, IQR = 2-3; Control median = 3, IQR = 2-4; P=0.04).

A systematic review by Doig et al (2010) [22] included trials comparing home-based and hospital-based rehabilitation for patients with acquired brain injury, including 17 studies, 15 of which included stroke patients. Meta-analysis was not performed, but the review found that home-based rehabilitation appeared to be at least equivalent to hospital-based care in improving impairment and activity limitations.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Centre-based rehabilitation	Home-based rehabilitation		
<b>Functional independence</b> 6-8 week post intervention  8 Critical	Measured by: Barthel index High better Based on data from: 245 patients in 2 studies. (Randomized controlled)	Difference: <b>MD 1 higher</b> ( CI 95% 0.12 lower - 1.88 higher )		<b>Low</b> Due to serious indirectness, Due to serious imprecision <sup>1</sup>	Home-based rehabilitation may improve functional independence.
<b>Functional independence</b> 6 months post- intervention  8 Critical	Measured by: Barthel index High better Based on data from: 912 patients in 6 studies. (Randomized controlled)	Difference: <b>MD 0.65 higher</b> ( CI 95% 0.5 lower - 1.81 higher )		<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>2</sup>	Home-based rehabilitation may improve functional independence.

1. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: Serious** . Differences between the population of interest and those studied ; **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

2. **Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

### References

[23] Hillier S, Inglis-Jassiem G : Rehabilitation for community-dwelling people with stroke: home or centre based? A systematic review.. International Journal of Stroke 2010;5(3):178-86 [Pubmed Journal](#)

## 7 - Goal setting

Goal setting helps direct rehabilitation efforts throughout the various stages of recovery (Rosewilliam et al. 2015 [34]). Goal setting for patients should take into consideration that the needs of each individual will vary depending on the type of stroke, symptoms and the individual's psycho-social circumstances. Therefore, a 'patient' or 'person-centred' approach is required which establishes rehabilitation goals that are relevant to an individual's needs (Rosewilliam et al. 2015 [34]). The National Stroke Audit revealed 39% of acute stroke patients and 11% of patients in inpatient rehabilitation did not have documented evidence that goals were set jointly with the interdisciplinary team and patient (Stroke Foundation 2015 [8]; Stroke Foundation 2016 [9]). Goals developed in team meetings should be documented and agreed to by the stroke survivor and/or family/carer. Outcome measures based on goal attainment scales can be considered by the interdisciplinary team to improve the use of goal setting.

### Strong Recommendation

- Health professionals should initiate the process of setting goals, and involve stroke survivors and their families and carers throughout the process. Goals for recovery should be client-centred, clearly communicated and documented so that both the stroke survivor (and their families/carers) and other members of the rehabilitation team are aware of goals set. (Sugavanam et al. 2013 [32]; Taylor et al. 2012 [33])
- Goals should be set in collaboration with the stroke survivor and their family/carer (unless they choose not to participate) and should be well-defined, specific and challenging. They should be reviewed and updated regularly. (Sugavanam et al. 2013 [32]; Taylor et al. 2012 [33])

### Practical Info

The SMART principles are a useful tool for goal setting:



- **SPECIFIC**
- Define the goal as much as possible with no unclear language
- **Who** is involved, **WHAT** do I want to accomplish, **WHERE** will it be done, **WHY** am I doing this – reasons, purpose, **WHICH** constraints and/or requirements do I have?



- **MEASURABLE**
- Can you track the progress and measure the outcome?
- How much, how many, how will I know when my goal is accomplished?



- **ATTAINABLE/ACHIEVABLE**
- Is the goal reasonable enough to be accomplished? How so?
- Make sure the goal is not out or reach or below standard performance.



- **RELEVANT**
- Is the goal worthwhile and will it meet your needs?
- Is each goal consistent with the other goals you have established and fits with your immediate and long term plans



- **TIMELY**
- Your objective should include a time limit. Ex: I will complete this step by month/day/year.
- It will establish a sense of urgency and prompt you to have better time management.

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

A systematic review (Sugavanam et al. 2013 [32]) reports favourable effects of goal setting, although these have not been demonstrated in randomised controlled trials to date. No harms have been identified.

### Quality of evidence

Low



There is a lack of high quality trials and thus the evidence is low.

#### Preference and values

No substantial variability expected

Individual preferences and cultural background may influence involvement of the stroke survivor and their family in goal setting.

#### Resources and other considerations

No important issues with the recommended alternative

##### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

##### Implementation considerations

Stroke survivors can use the [EnableMe](#) website to enter goals which can be monitored and updated over time. There is a clinical indicator collected in the National Stroke Audit on whether rehabilitation goals were set with input from both the interdisciplinary team and the patient, if the patient had no cognitive or communication difficulties. If the patient had identified cognitive or communication difficulties, a clinical indicator is collected on whether the patient's family or carer(s) had input in the goal setting process. There are also organisational indicators collected to determine whether a formal process is in place at the hospital for goal setting and, if there is, through what means patient-directed goals are usually established.

## Rationale

The process of setting goals is a key component of person-centred care and has a number of functions, including directing treatment, motivating the patient and starting a dialogue between the health professional and stroke survivor and their families/carers about the expected level of recovery. There is a lack of evidence from randomised controlled trials regarding the benefits of goal setting on stroke patient outcomes, but in general the literature suggests that goal setting is positively regarded by clients and health professionals. There is clear consensus, both within the Content Working Parties and in published literature, that goal setting is beneficial for the rehabilitation process and should always take place with the stroke survivor and family/carer (Playford et al. 2009 [35]). In the absence of information about the most effective method of goal setting it is sensible to recommend the simple and widely used SMART process of setting specific and challenging goals which are reviewed regularly (see Practical info section for further information about SMART).

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Patient centred goal setting  
**Comparator:** Usual care

### Summary

A cluster randomised trial in New Zealand reported by Taylor et al (2012) [33] was small (N = 41) and evaluated an intervention centred around the Canadian Occupational Performance Measure. The intervention emphasised person-centred goal setting and feedback and communication. As a feasibility study, the trial was not powered to detect between-group differences.

Systematic reviews have failed to identify high-quality studies. A systematic review by Rosewilliam et al (2011) [34] identified eighteen qualitative and eight quantitative and one mixed method study conducted in stroke rehabilitation services ranging from acute to community rehabilitation. The authors concluded that effects of following patient-centred goal-setting practice have been studied mostly with weak methodologies, but the studies showed some benefit with psychological outcomes. A later systematic review by Sugavanam et al (2013) [32] included 17 observational studies, but failed to identify any randomised trials. The authors reported that four observational studies found improved performance and satisfaction at discharge and that two studies reported perceived improvements in self-care skills and better ability to recall treatment goals and manage more tasks.

Given the lack of high-quality evidence, it is uncertain whether goal setting is associated with improved quality of life, activities of daily living function, length of stay or self-efficacy.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Patient centred goal setting		
<b>Quality of life</b> 12 weeks post admission  7 Critical	Measured by: SEIQOL-DW Scale: 0-100 High better Based on data from: 41 patients in 1 studies. (Randomized controlled) Follow up 12 weeks	Difference: <b>MD 3.1 higher</b> ( CI 95% 40 lower - 46.2 higher )		<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>1</sup>	It is uncertain whether goal setting leads to improved quality of life.
<b>ADL function</b> <sup>2</sup> 12 weeks post admission  7 Critical	Measured by: Functional Independence Measure Scale: 18-126 High better Based on data from: 41 patients in 1 studies. (Randomized controlled) Follow up 12 weeks	Difference: <b>MD 0.9 higher</b> ( CI 95% 9.1 lower - 10.8 higher )		<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>3</sup>	The systematic review (Sugavanam et al) reported that all four studies reported improved 'performance and 'satisfaction' at discharge implying recovery.
<b>Length of stay</b> at time of discharge  7 Critical	Measured by: Days Lower better Based on data from: 41 patients in 1 studies. (Randomized controlled) Follow up at discharge	<b>26.8</b> (Mean)	<b>51.7</b> (Mean)  CI 95%	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>4</sup>	It is uncertain whether goal setting leads to a difference in length of stay.
<b>Self efficacy</b> Not specified  7 Critical	Based on data from 142 patients in 2 studies.	A systematic review (Sugavanam et al) reported that two studies measured 'perceived ability and engagement in rehabilitation'. One quasi experimental study found improved perceived self care ability following intervention. Another study found that those participating in goal setting could recall their treatment goals better and 'manage more tasks'		<b>Very Low</b> Due to very serious risk of bias, Due to serious inconsistency, Due to serious indirectness, Due to serious imprecision <sup>5</sup>	It is uncertain whether goal setting leads to improved self efficacy; two studies suggest improved perception of performance and improved recall of treatment goals.

1. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Selective outcome reporting ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Based on 1 study with 41 participants ; **Publication bias: No serious** .

2. Measured using FIM (Functional Independence Measure)

3. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Selective outcome reporting ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

4. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Selective outcome reporting ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

5. **Risk of bias: Very Serious** . No randomised trials ; **Inconsistency: No serious** . **Indirectness: Serious** . Differences between the outcomes of interest and those reported (e.g short-term/surrogate,not patient-important) ; **Imprecision: Serious** . Low number of

patients ; **Publication bias: No serious .**

### References

- [32] Sugavanam T, Mead G, Bulley C, Donaghy M, van Wijck F : The effects and experiences of goal setting in stroke rehabilitation - a systematic review. Disability & Rehabilitation 2013;35(3):177-90 [Journal Website](#)
- [33] Taylor WJ, Brown M, William L, McPherson KM, Reed K, Dean SG, Weatherall M : A pilot cluster randomized controlled trial of structured goal-setting following stroke. Clinical Rehabilitation 2012;26(4):327-38 [Journal](#)
- [34] Rosewilliam S., Roskell CA, Pandyan AD : A systematic review and synthesis of the quantitative and qualitative evidence behind patient-centred goal setting in stroke rehabilitation. Clinical rehabilitation 2011;25(6):501-514 [Journal Website](#)

## 8 - Early mobilisation

Mortality and morbidity are reduced when people with stroke receive care in stroke units (Stroke Unit Trialists 2013 [38]). One component of stroke unit care is early mobilisation. "Mobilisation" is defined as out-of-bed activities and can include sitting out of bed, standing and walking (Bernhardt et al. 2015 [36]).

The efficacy of commencing early, intensive mobilisation within 24 hours of stroke (compared to usual care) was investigated in the AVERT study, a large Phase III randomised controlled trial involving 2104 patients (Bernhardt 2015 [36]). The very early mobilisation protocol involved at least 3 sessions of out-of-bed activity per day, commencing within 24 hours of stroke onset. On average, intervention participants engaged in 6.5 out-of-bed sessions per day, commencing 18.5 hours post-stroke. Participants in the usual care arm of the trial had an average of 3 out-of-bed activity sessions per day, commencing at a median of 22.4 hours post-stroke, with 93% mobilised within 48 hours of stroke onset (Bernhardt et al. 2015 [36]).

This high-quality study found that the very early, more intensive mobilisation protocol compared to usual stroke unit care was associated with reduced odds of a favourable outcome at 3 months. There were no significant differences between groups in non-fatal adverse events, immobility-related adverse events, or odds of dying. Exploratory sub-group analyses found no significant effects, however there was an indication of less favourable outcome (mRS > 2) in those with more severe stroke (NIHSS > 16) or intracerebral haemorrhage. A pre-specified dose analysis investigating the effect of timing and dose of mobilisation on outcomes regardless of group assignment (controlling for age and stroke severity) indicated that better outcomes were associated with having more frequent but shorter duration mobilisation sessions (Bernhardt 2016 [39]).

A 2014 systematic review included data from small randomised controlled trials and observational studies comparing outcomes when physical rehabilitation (mobilisation or mobility training) was commenced at different time-points after stroke (Lynch 2014 [37]). The review provided weak evidence that commencing out of bed mobilisation training within 3 days of stroke was associated with better outcomes than waiting for longer than 3 days.

Strong Recommendation

AGAINST

For stroke patients, starting intensive out-of-bed activities within 24 hours of stroke onset is not recommended. (Bernhardt et al. 2015 [36])

### Practical Info

Baseline stroke severity and stroke type should be considered when deciding when and how much to mobilise after stroke. Intensive out-of-bed activities in the AVERT trial were an average of 6 out-of-bed activities per day (Bernhardt et al. 2015 [36]). Patients who are independently mobile should not have their mobility restricted during the early phase after stroke.

### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

Subgroup analysis of a very large, multi-centre randomised controlled trial found that in patients with intracerebral haemorrhage and more severe stroke, very early, intensive mobilisation (less than 24 hours post-stroke) may cause harm (78 fewer patients with favourable outcome per 1000 patients treated) (Bernhardt et al. 2015 [36]).

#### Quality of evidence

Low

The quality of evidence regarding shorter, more frequent sessions is based on pre-specified dose-response sub-group analyses (n = 2104 patients) of a high-quality, multi-centre randomised controlled trial.

#### Preference and values

Substantial variability is expected or uncertain

Baseline stroke severity and stroke type should be considered when deciding when and how much to mobilise after stroke.

#### Areas of major debate

There is debate on the optimal timing of early mobilisation based on interpretation of the AVERT trial. Some clinicians believe that

mobilisation within 24 hours should not be used due to harms reported, while others believe that a negative recommendation may lead to prolonged immobilisation, and a recommendation of a wider time window shown to be safe should be made instead.

## Resources and other considerations

Factors not considered

## Rationale

Secondary analysis of a large, multi-centre randomised controlled trial found poorer outcomes with early mobilisation for those with intracerebral haemorrhage and more severe stroke (Bernhardt et al. 2015 [36]).

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Very early mobilisation (<24 hrs)  
**Comparator:** Usual care

## Summary

The AVERT trial reported by Bernhardt et al (2015) [36] was a large (N = 2104), multicentre, single-blind randomised trial assessing the efficacy of early mobilisation following stroke. Patients in the intervention group began mobilisation within 24 hours, including sitting, standing and walking activity with at least three out-of-bed sessions compared to usual care. Results showed that patients mobilised early had significantly lower odds of a favourable outcome (modified Rankin Scale score of 0-2) at 3 months (OR 0.73, 95% CI 0.59 to 0.90). The proportion of deaths at 3 months was also non-significantly higher in the early mobilisation group (OR 1.34, 95% 0.93 to 1.93).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Very early mobilisation (<24 hrs)		
<b>Favourable outcome (mRS 0-2)</b> 3 months  8 Critical	Odds Ratio 0.73 (CI 95% 0.59 - 0.9) Based on data from 2,083 patients in 1 studies. <sup>1</sup> (Randomized controlled) Follow up 3 months	<b>502</b> per 1000  Difference: <b>78 fewer</b> per 1000 ( CI 95% 129 fewer - 26 fewer )	<b>462</b> per 1000	<b>High</b>	Very early mobilisation (<24 hrs) decreases the odds of a favourable outcome (mRS 0-2)
<b>Change in functional outcome (odds of better mRS outcome)<sup>2</sup></b> 3 months  8 Critical	Odds Ratio 0.94 (CI 95% 0.85 - 1.03) Based on data from 2,083 patients in 1 studies. (Randomized controlled) Follow up 3 months			<b>High</b>	Very early mobilisation (<24 hrs) has little or no difference on change in functional outcome

<p><b>Death</b> 3 months</p> <p>9 Critical</p>	<p>Odds Ratio 1.34 (CI 95% 0.93 - 1.93) Based on data from 2,104 patients in 1 studies. (Randomized controlled) Follow up 3 months</p>	<p><b>69</b> per 1000</p> <p><b>90</b> per 1000</p> <p>Difference: <b>21 more</b> per 1000 (CI 95% 5 fewer - 56 more)</p>	<p><b>High</b></p>	<p>Very early mobilisation (&lt;24 hrs) has little or no difference on death</p>
<p><b>Time to unassisted walking</b><sup>3</sup> 3 months</p> <p>7 Critical</p>	<p>Hazard Ratio 1.04 (CI 95% 0.94 - 1.15) Based on data from 2,100 patients in 1 studies. (Randomized controlled) Follow up 3 months</p>		<p><b>High</b></p>	<p>Very early mobilisation (&lt;24 hrs) has little or no difference on time to assisted walking</p>
<p><b>Non-fatal serious adverse events (Incidence Rate Ratio)</b><sup>4</sup> 3 months</p> <p>7 Critical</p>	<p>0.88 (CI 95% 0.72 - 1.07) Based on data from 2,104 patients in 1 studies. (Randomized controlled) Follow up 3 months</p>		<p><b>High</b></p>	<p>Very early mobilisation (&lt;24 hrs) may have little or no difference on non-fatal serious adverse events</p>

1. Primary study [36]. **Baseline/comparator::** Control arm of reference used for intervention .
2. To assess differences between intervention and control across the full range of mRS, Bernhardt et al. (2015) use a generalized odds ratio method that estimates 'the odds that a patient who received the investigational treatment will have a better outcome than a patient receiving standard treatment' (from Churilov et al. (2014): An improved method for simple, assumption-free ordinal analysis of the modified Rankin Scale using generalized odds ratios)
3. Time until patients could walk unassisted for 50m. Analyzed using time-to-event/survival analysis.
4. Non-fatal serious adverse events were reported in Bernhardt (2015) in terms of incidence rate ratios. This takes into account the fact that each patient can have multiple adverse events. MAGICapp currently doesn't provide specific options for incidence rate ratios.

## References

[36] Bernhardt J, Langhorne P, Lindley RI, Thrift AG, Ellery F, Collier J, Churilov L, Moodie M, Dewey H, Donnan G : Efficacy and safety of very early mobilisation within 24 h of stroke onset (AVERT): a randomised controlled trial.. *Lancet* (London, England) 2015;386(9988):46-55 [Pubmed Journal](#)

## Strong Recommendation

All stroke patients should commence mobilisation (out-of-bed activity) within 48 hours of stroke onset unless otherwise contraindicated (e.g. receiving end-of-life care). (Bernhardt et al. 2015 [36]; Lynch et al. 2014 [37])

## Practical Info

Patients with baseline NIHSS scores above 4 and below 7 have higher odds of a favourable outcome when they are mobilised more than once per day and spend less than 13.5 minutes per day mobilising with physiotherapy staff (Bernhardt et al. 2016 [39]).

For patients who have difficulty moving after stroke, an assessment by an appropriately trained health professional as to the most appropriate and safe methods of assisting transfers and out-of-bed activity should be conducted as soon as possible and preferably within 24 hours.

## Key Info

### Benefits and harms

Substantial net benefits of the recommended alternative

There is evidence in a broad sample of participants that mobilising within 48 hours of stroke is associated with a low risk of death and adverse events (Bernhardt et al. 2015 [36]). There is moderate evidence that commencing physical rehabilitation within 3 days of stroke reduces complications, and there is no evidence that commencing physical rehabilitation within 3 days is harmful (Lynch et al. 2014 [37]).

### Quality of evidence

Low

The overall evidence is low, based on a systematic review (Lynch et al. 2014 [37]) that included three studies that looked at physical rehabilitation within 3 days of stroke.

### Preference and values

No substantial variability expected

It is usual care in Australia to commence physical rehabilitation for the majority of patients with stroke within 48 hours of stroke, unless they are receiving palliative care.

### Resources and other considerations

No important issues with the recommended alternative

#### Resources considerations

In a pilot randomised controlled trial, there were no significant differences in resource use found at three months between patients commencing early mobilisation and those who did not. However, the costs associated with the resource use were not estimated (Langhorne et al. 2010 [30]).

#### Implementation and consideration

There is a clinical indicator collected in the National Stroke Audit on whether patients with stroke were mobilised within 24 hours of their admission. There are also clinical indicators collected on the total number of patients with stroke who commenced rehabilitation therapy within 48 hours of their initial assessment and the total number who received a physiotherapy assessment within 48 hours of their presentation to hospital. These latter two clinical indicators are both included in the Acute Stroke Clinical Care Standard.

## Rationale

A small number of poor quality studies provides some evidence that mobilisation should commence within 3 days post-stroke. This assessment is based on a systematic review that included three studies (Lynch et al. [37]). In a subsequent large, high-quality trial (n = 2104) that included broad sample of participants, mobilising within 48 hours of stroke was associated with a low risk of death and adverse events (Bernhardt et al. 2015 [36]).

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Physical rehabilitation (<3 days)  
**Comparator:** Usual care

## Summary

Lynch et al (2015) [37] conducted a systematic review of early physical rehabilitation studies, including 5 randomised controlled trials and 38 cohort studies. Limited evidence was available regarding rehabilitation started within 3 days of stroke, as only a small randomised trial and two cohort studies directly compared the < 3 day period to later rehabilitation. The randomised trial showed significantly fewer serious complications following early rehabilitation, while the cohort studies reported reduced disability and better ADL function. These studies provide insufficient evidence to determine the benefits of early rehabilitation.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Physical rehabilitation (<3 days)		
<b>Mortality</b> <sup>1</sup> 9 Critical	Based on data from 5,482 patients in 1 studies.		A systematic review collated evidence regarding the effects of starting physical rehabilitation at different time points. 1 observational study (n=5482) was included that reported on effects on mortality. There was no significant association between mobilising within 3 days (vs later than 3 days) and inhospital mortality (1.6% vs 1.7% respectively)	<b>Moderate</b> Due to serious risk of bias <sup>2</sup>	physical rehabilitation commencing within 3 days of stroke may have little or no difference on mortality
<b>Disability</b> <sup>3</sup> 3 months 8 Critical	Based on data from 6,292 patients in 4 studies.		Findings from 1 RCT and 3 observational studies investigating the effect of commencing physical rehabilitation within 3 days were synthesised in a systematic review	<b>Moderate</b> Due to serious risk of bias <sup>4</sup>	physical rehabilitation commenced within 3 days may improve disability
<b>Functional outcome</b> <sup>5</sup> in hospital 8 Critical	Based on data from 30 patients in 1 studies.		A small observational study indicated that commencing rehabilitation within 3 days of stroke was associated with better walking ability and activities of daily living function.	<b>Very Low</b> Due to serious risk of bias as non-randomised <sup>6</sup>	Commencing physical rehabilitation early (<3 days) may increase functional outcome slightly
<b>Complications</b> <sup>7</sup> until hospital discharge 7 Critical	Based on data from 42 patients in 1 studies.		One small randomised controlled trial (N=42) commencing rehabilitation within 3 days of stroke compared to 7 days post stroke was associated with significant reductions in severe complications (8% vs 47%).	<b>Moderate</b> Due to serious imprecision, Due to serious risk of bias <sup>8</sup>	Commencing physical rehabilitation early (<3 days) probably improves complications

1. A systematic review collating evidence about timing of mobilisation after stroke included one cohort study which reported that commencing mobility within 3 days (compared to longer than 3 days) had no significant association with mortality
2. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
3. Studies examined the effect of timing of commencement of physical rehabilitation on Barthel Index at 3 months



4. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
5. improved walking ability and ADL function
6. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, due to lack of randomisation ;
7. 1 RCT with 42 participants provided evidence that commencing rehabilitation at 3 days (compared to 7 days) resulted in significantly fewer complications during the hospital admission
8. **Risk of bias: Serious** . Incomplete data and/or large loss to follow up ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Only data from one study, Low number of patients ;

## References

[37] Lynch E, Hillier S, Cadilhac D : When should physical rehabilitation commence after stroke: a systematic review.. International journal of stroke : official journal of the International Stroke Society 2014;9(4):468-78 [Pubmed Journal](#)

## Weak Recommendation

For patients with mild and moderate stroke, frequent, short sessions of out-of-bed activity should be provided, but the optimal timing within the 48-hour post-stroke time period is unclear. (Bernhardt et al. 2015 [36])

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

There are no clear benefits around commencing mobilisation very early (less than 24 hours post-stroke) in terms of change in functional outcome, time to unassisted walking or death (Bernhardt et al. 2015 [36]). The odds of a favourable outcome (modified Rankin Scale score 0–2) are decreased when mobilisation is commenced very early (less than 24 hours post-stroke) (Bernhardt et al. 2015 [36]). On the other hand, there is evidence in a broad sample of participants that mobilising within 48 hours of stroke is associated with a low risk of death and adverse events (Bernhardt et al. 2015 [36]). The odds of a favourable outcome are increased when the mobilisation sessions are shorter and more frequent (Bernhardt et al. 2015 [36]).

### Quality of evidence

High

The overall quality of evidence against commencing mobilisation very early is high, based on a large randomised controlled trial that included 2104 patients (Bernhardt et al. 2015 [36]). The quality of evidence regarding shorter, more frequent sessions is lower, based on data from 2104 patients irrespective of group allocation in a pre-specified subgroup analysis.

### Preference and values

Substantial variability is expected or uncertain

Age and baseline stroke severity should be considered when commencing mobilisation after stroke.

### Resources and other considerations

No important issues with the recommended alternative

#### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

## Rationale

The majority of patients receiving usual care in Australian acute stroke units are mobilised out of bed within 48 hours of stroke onset. There is no evidence to support mobilising earlier than the first 24 hours of stroke, but there is evidence that more frequent, shorter mobility sessions that commence within this 24-hour period are beneficial to patients with stroke, after accounting for baseline stroke severity and age (Bernhardt et al. 2015 [36]).

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Very early mobilisation (<24 hrs)  
**Comparator:** Usual care

### Summary

The AVERT trial reported by Bernhardt et al (2015) [36] was a large (N = 2104), multicentre, single-blind randomised trial assessing the efficacy of early mobilisation following stroke. Patients in the intervention group began mobilisation within 24 hours, including sitting, standing and walking activity with at least three out-of-bed sessions compared to usual care. Results showed that patients mobilised early had significantly lower odds of a favourable outcome (modified Rankin Scale score of 0-2) at 3 months (OR 0.73, 95% CI 0.59 to 0.90). The proportion of deaths at 3 months was also non-significantly higher in the early mobilisation group (OR 1.34, 95% 0.93 to 1.93).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Very early mobilisation (<24 hrs)		
<b>Favourable outcome (mRS 0-2)</b> 3 months  8 Critical	Odds Ratio 0.73 (CI 95% 0.59 - 0.9) Based on data from 2,083 patients in 1 studies. <sup>1</sup> (Randomized controlled) Follow up 3 months	<b>502</b> per 1000  Difference: <b>78 fewer</b> per 1000 ( CI 95% 129 fewer - 26 fewer )	<b>462</b> per 1000	<b>High</b>	Very early mobilisation (<24 hrs) decreases the odds of a favourable outcome (mRS 0-2)
<b>Change in functional outcome (odds of better mRS outcome)<sup>2</sup></b> 3 months  8 Critical	Odds Ratio 0.94 (CI 95% 0.85 - 1.03) Based on data from 2,083 patients in 1 studies. (Randomized controlled) Follow up 3 months			<b>High</b>	Very early mobilisation (<24 hrs) has little or no difference on change in functional outcome
<b>Death</b> 3 months  9 Critical	Odds Ratio 1.34 (CI 95% 0.93 - 1.93) Based on data from 2,104 patients in 1 studies. (Randomized controlled) Follow up 3 months	<b>69</b> per 1000  Difference: <b>21 more</b> per 1000 ( CI 95% 5 fewer - 56 more )	<b>90</b> per 1000	<b>High</b>	Very early mobilisation (<24 hrs) has little or no difference on death

<p><b>Time to unassisted walking</b><sup>3</sup> 3 months</p> <p>7 Critical</p>	<p>Hazard Ratio 1.04 (CI 95% 0.94 - 1.15) Based on data from 2,100 patients in 1 studies. (Randomized controlled) Follow up 3 months</p>		<p><b>High</b></p> <p>Very early mobilisation (&lt;24 hrs) has little or no difference on time to assisted walking</p>
<p><b>Non-fatal serious adverse events (Incidence Rate Ratio)</b><sup>4</sup> 3 months</p> <p>7 Critical</p>	<p>0.88 (CI 95% 0.72 - 1.07) Based on data from 2,104 patients in 1 studies. (Randomized controlled) Follow up 3 months</p>		<p><b>High</b></p> <p>Very early mobilisation (&lt;24 hrs) may have little or no difference on non-fatal serious adverse events</p>

1. Primary study [36]. **Baseline/comparator::** Control arm of reference used for intervention .
2. To assess differences between intervention and control across the full range of mRS, Bernhardt et al. (2015) use a generalized odds ratio method that estimates 'the odds that a patient who received the investigational treatment will have a better outcome than a patient receiving standard treatment' (from Churilov et al. (2014): An improved method for simple, assumption-free ordinal analysis of the modified Rankin Scale using generalized odds ratios)
3. Time until patients could walk unassisted for 50m. Analyzed using time-to-event/survival analysis.
4. Non-fatal serious adverse events were reported in Bernhardt (2015) in terms of incidence rate ratios. This takes into account the fact that each patient can have multiple adverse events. MAGICapp currently doesn't provide specific options for incidence rate ratios.

### References

[36] Bernhardt J, Langhorne P, Lindley RI, Thrift AG, Ellery F, Collier J, Churilov L, Moodie M, Dewey H, Donnan G : Efficacy and safety of very early mobilisation within 24 h of stroke onset (AVERT): a randomised controlled trial.. *Lancet* (London, England) 2015;386(9988):46-55 [Pubmed Journal](#)

## 9 - Sensorimotor impairment

Weakness, loss of sensation and vision are discussed separately below.

### 9.1 - Weakness

Weakness is the most common impairment after stroke. Traditionally, strength training and task-oriented training have been used to improve weakness. In recent years, technologies have been developed to assist this process using the principles of motor learning. For example, electromechanical and robot-assisted training assist passive and active movements (Mehrholz et al. 2015 [43]). Research on the effects of electrical stimulation has also increased. Electrical stimulation may have the potential to improve strength after stroke by increasing activation of motor units and/or the cross-sectional area of a muscle, even when patients are unable to undertake interventions involving resistance exercises (Nascimento et al. 2014 [41]).

#### Strong Recommendation

For stroke survivors with reduced strength in their arms or legs, strength training should be provided. (Ada et al. 2006 [45]; Harris and Eng 2010 [44])

#### Practical Info

Average dose of resistance training provided in trials was 1 hour a day, 2 to 3 days a week for 4 weeks. Differences in not only dose, but also types of interventions and participant characteristics (particularly in terms of degree of weakness), mean that the optimal strengthening protocol is not known.

#### Key Info

##### Benefits and harms

Substantial net benefits of the recommended alternative

There is evidence that strength training provides benefit for improving grip strength and upper limb function (Ada et al. 2006 [45]; Harris and Eng 2010 [44]). There is no evidence of harm.

##### Quality of evidence

Moderate

Evidence quality is moderate due to some degree of statistical heterogeneity.

##### Preference and values

No substantial variability expected

##### Resources and other considerations

Factors not considered

#### Rationale

Systematic reviews of evidence (Ada et al. 2006 [45]; Harris and Eng 2010 [44]) have found moderate improvements in strength with a range of interventions, most commonly progressive resistance training.

#### Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Strength training

**Comparator:** Control

### Summary

A systematic review by Harris et al (2010) [44] investigating the effectiveness of upper-limb strength training included 13 randomised controlled trials with 517 total participants. Interventions had to include an element of strength or resistance training, while control groups received no treatment, placebo, or non-strengthening treatments. In the meta-analysis, strength training significantly improved upper limb function (SMD 0.21) and grip strength (SMD 0.95), but did not significantly improve ADL. There was large variation in the types of interventions used in the trials and the outcome measurements, creating some uncertainty about the degree of benefit expected following any particular treatment method. Another meta-analysis by Ada et al (2006) found similar results. Across all stroke participants, strengthening interventions had a small positive effect on both strength (SMD 0.33, 95% CI 0.13 to 0.54) and activity (SMD 0.32, 95% CI 0.11 to 0.53). There was very little effect on spasticity (SMD -0.13, 95% CI -0.75 to 0.50).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Strength training		
<p><b>ADL</b></p> <p>Post-intervention (mean 4 weeks of treatment)</p> <p>9 Critical</p>	<p>Measured by: SF-36 Physical Function Subscale, Functional Independence Measure, Barthel Index High better</p> <p>Based on data from: 210 patients in 5 studies.<sup>1</sup> (Randomized controlled) Follow up Mean 4 weeks of treatment</p>	<p>Difference: <b>SMD 0.26 higher</b> ( CI 95% 0.1 lower - 0.63 higher )</p>		<p><b>Low</b> Due to serious risk of bias, Due to serious indirectness<sup>2</sup></p>	<p>Strength training may have little or no difference on activities of daily living</p>
<p><b>Strength</b></p> <p>Post-intervention (mean 4 weeks of treatment)</p> <p>7 Critical</p>	<p>Measured by: Hand Dynamometer Scale: 0-90 High better Based on data from: 306 patients in 6 studies.<sup>3</sup> (Randomized controlled) Follow up Mean 4 weeks of treatment</p>	<p>Difference: <b>SMD 0.95 higher</b> ( CI 95% 0.05 higher - 1.85 higher )</p>		<p><b>Moderate</b> Due to serious inconsistency<sup>4</sup></p>	<p>Strength training probably improves grip strength</p>
<p><b>Upper limb function</b></p> <p>8 Critical</p>	<p>Measured by: Various - Motor Assessment Scale, TEMPA, Rivermead Motor Assessment, Purdue Peg Board, Wolf Motor Function Test, Box and Block, Action Research Arm Test, Functional Test of the Hemiparetic Upper</p>	<p>Difference: <b>SMD 0.21 higher</b> ( CI 95% 0.03 higher - 0.39 higher )</p>		<p><b>Moderate</b> Due to serious indirectness<sup>6</sup></p>	<p>Strength training probably improves upper limb function slightly</p>

Extremity.

Based on data from: 465 patients in 11 studies.<sup>5</sup> (Randomized controlled) Follow up Mean 4 weeks of treatment

1. Systematic review [44]. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . 63% from studies with a PEDro score of 7 or above. 37% with a PEDro score of 4 or less ; **Inconsistency: No serious** . I<sup>2</sup>=39%, p=0.16 ; **Indirectness: Serious** . Differences between the intervention/comparator of interest and those studied ; **Imprecision: No serious** . Low number of patients ; **Publication bias: No serious** .
3. Systematic review [44]. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Inconsistency: Serious** . Directions are consistent but there is significant and large heterogeneity Tau<sup>2</sup>=1.1;chi<sup>2</sup>=58.21(p<0.00001), I<sup>2</sup>=91%. ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** . Asymmetrical funnel plot ;
5. Systematic review [44]. **Baseline/comparator::** Control arm of reference used for intervention .
6. **Risk of bias: No serious** . 89% of participants came from studies with a PEDRO score of 7 or 8 ; **Inconsistency: No serious** . I<sup>2</sup> was 0%, p=0.74 ; **Indirectness: Serious** . Pooled results were used from studies that used different outcome measures and there were large variations in the nature of the interventions applied. ; **Imprecision: No serious** . Many small studies. Only 1 of 11 had n=100 (largest) ; **Publication bias: No serious** . Asymmetrical funnel plot ;

## References

[44] Harris JE, Eng JJ : Strength training improves upper-limb function in individuals with stroke: a meta-analysis.. Stroke; a journal of cerebral circulation 2010;41(1):136-40 [Pubmed Journal](#)

[45] Ada L, Dorsch S, Canning CG : Strengthening interventions increase strength and improve activity after stroke: a systematic review.. The Australian journal of physiotherapy 2006;52(4):241-8 [Pubmed](#)

## Weak Recommendation

For stroke survivors with reduced strength in their arms or legs (particularly for those with less than antigravity strength), electrical stimulation may be used. (Nascimento et al. 2014 [41])

## Practical Info

There is currently no consensus as to the optimal dosage of electrical stimulation and further research is needed to establish which groups of patients benefit more (i.e. weak vs very weak), optimal parameters (frequency and pulse width), timing and duration of the intervention.

## Key Info

### Benefits and harms

There are small to moderate benefits for improvements in strength following electrical stimulation and no evidence of harm

Small net benefit, or little difference between alternatives

(Nascimento et al. 2014 [41]).

### Quality of evidence

Low

There are methodological issues with the trials used in the most recent systematic review (Nascimento et al. 2014 [41]), therefore it is difficult to say with certainty if electrical stimulation improves strength in people following stroke.

### Preference and values

Substantial variability is expected or uncertain

Electrical stimulation is not always tolerated by everyone.

### Resources and other considerations

Important issues, or potential issues not investigated

#### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified

## Rationale

There are small to moderate benefits for improvements in strength following electrical stimulation and no evidence of harm (Nascimento et al. 2014 [41]). There are methodological issues with the trials used in the most recent systematic review, therefore it is difficult to say with certainty if electrical stimulation improves strength in people following stroke (Nascimento et al. 2014 [41]). However, there appears to be some evidence of effectiveness based on individual randomised controlled trials used in the meta-analysis.

Electrical stimulation is not always tolerated by everyone, however the intervention is relatively inexpensive and easy to apply.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Electrical stimulation  
**Comparator:** Control

### Summary

Based on a systematic review by Nascimento et al (2014) [41], there is evidence to suggest that electrical stimulation improves strength in people following stroke. However, there is uncertainty in the results of this systematic review for the following reasons:

- Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias (6/11 did not have blinded assessors)
- Inadequate concealment of allocation during randomization process, resulting in potential for selection bias (10/11 did not have concealed allocation)
- Missing intention-to-treat analysis (9/11 trials missing intention-to-treat analysis)

When the trials were grouped according to the initial level of strength, electrical stimulation increased strength in very weak participants (8/11 trials) with an effect size of 0.40 (95% CI 0.17 to 0.65), and in weak participants (3/11 trials) with an effect size of 0.66 (95% CI 0.21 to 1.11). When the trials were grouped according to the time after stroke, electrical stimulation increased the strength in sub-acute participants (6/11 trials) with an effect size of 0.55 (95% CI 0.28 to 0.81), while in chronic participants (5/11 trials) the effect size was 0.33 (95% CI -0.02 to 0.69).

Due to the methodological bias in the trials it is difficult to say with certainty whether electrical stimulation improves strength in people following stroke. However, there appears to be some evidence of effectiveness based on individual randomised controlled

trials used in the meta-analysis.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Electrical stimulation		
<b>Strength</b> Post intervention  7 Critical	Measured by: Continuous measures of force or torque (9 trials), or ordinal measures such as manual muscle testing (2 trials) High better Based on data from: 359 patients in 11 studies. (Randomized controlled) Follow up 3 - 12 weeks of treatment		Difference: <b>SMD 0.47 higher</b> ( CI 95% 0.26 higher - 0.68 higher )	<b>Moderate</b> Due to serious risk of bias <sup>1</sup>	Electrical stimulation may improve strength in people following stroke

1. **Risk of bias: Serious** . - Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias (6/11 did not have blinded assessors) - Inadequate concealment of allocation during randomization process, resulting in potential for selection bias (10/11 did not have concealed allocation) - 9/11 trials Missing intention-to-treat analysis ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** . The Systematic review used did not search for gray literature ;

## References

[41] Nascimento LR, Michaelsen SM, Ada L, Polese JC, Teixeira-Salmela LF : Cyclical electrical stimulation increases strength and improves activity after stroke: a systematic review.. Journal of physiotherapy 2014;60(1):22-30 [PubMed Journal](#)

## 9.2 - Loss of sensation

Approximately 40% of stroke patients are assessed as having sensory deficits on admission (Stroke Foundation 2015 [8]), with impairments in touch sensation, proprioception and kinaesthesia in most cases (de Diego et al. 2013 [46]). Sensation (or somatosensory) deficits can negatively affect motor recovery (Doyle et al. 2010 [49]). Moreover, sensation is essential for safety even if there is adequate motor recovery, with secondary complications such as sores, abrasions, and shoulder-hand syndrome being associated with the impairment of sensation (Doyle et al. 2010 [49]).

Doyle et al. (2014) [47] interviewed stroke survivors and found that sensory impairments significantly impacted stroke survivors' roles and participation but seemed to be ignored in the rehabilitation process. The National Stroke Audit indicated that 84 out of 108 (78%) Australian hospitals had locally agreed assessment protocols for identifying sensory deficits (Stroke Foundation 2015 [8]). A survey of Australian occupational therapists and physiotherapists reported that the majority routinely assessed and provided treatments to stroke survivors with sensory loss, but experienced barriers including a lack of access to evidence-based assessments and treatments as well as large workload (Pumpa et al. 2015 [51]). Most sensory intervention trials have focussed on the arm and hand. Only one small randomised controlled trial has investigated sensory retraining for the foot and lower limb, with no benefits found (Lynch et al. 2007 [52]).



There is a lack of evidence to guide interventions for sensory loss of the lower limb and foot.

### Weak Recommendation

For stroke survivors with sensory loss of the upper limb, sensory-specific training may be provided. (de Diego et al. 2013 [46]; Carey et al. 2011 [48]; Doyle et al. 2010 [49])

### Practical Info

Sensory discrimination training should be provided as part of a goal directed rehabilitation program. Key components of sensory discrimination training are outlined in Carey et al. (2011) [48], but include graded and progressive discrimination tasks for various textures and object recognition, augmented feedback and self-checking for accuracy as well as intensity of training. A total of ten 60-minute sessions were provided over 3 weeks.

### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

Sensory-specific training, combined with motor function training or by itself, showed small benefits in sensation and activities of daily living (de Diego et al. 2013 [46]; Carey et al. 2011 [48]; Doyle et al. 2010 [49]).

#### Quality of evidence

Low

Included studies have low quality due to small sample size. Heterogeneity also makes pooling data difficult.

#### Preference and values

No substantial variability expected

Stroke survivors with sensation loss report that this greatly impacts on their roles and participation, and they value therapy aimed at improving it (Doyle et al. 2014 [47]). Despite only small benefits shown in sensory discrimination training, patients are likely to want to receive it to address sensation loss.

#### Resources and other considerations

Important issues, or potential issues not investigated

##### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

##### Implementation considerations

There is an organisational indicator collected on whether hospitals have locally agreed protocols in place for patients with sensory impairment.

### Rationale

Several small trials have shown benefits of sensory retraining on improving sensation and possibly activities of daily living after stroke. The most recent trial (Carey et al. 2011 [48]) showed benefits from sensory discrimination training compared to non-specific exposure to sensory stimuli. An earlier Cochrane review (Doyle et al. 2010 [49]) reported preliminary evidence of the effectiveness of a range of different types of sensation training, including mirror therapy, thermal therapy and pneumatic compression therapy, all from single small studies.

**Clinical Question/ PICO**

<b>Population:</b>	All stroke patients with reduced sensation
<b>Intervention:</b>	Sensory-specific training plus motor function training
<b>Comparator:</b>	Conventional treatment

**Summary**

de Diego et al (2013) [46] compared a sensorimotor stimulation program to standard rehabilitation. The intervention was intensive therapy by means of a sensory and motor stimulation: 16 sessions of sensory stimulation and functional activity training in the rehabilitation centre, and daily sessions of tactile stimulation, mental imagery and practice of ADL at home for 8 weeks. The control group received standard rehabilitation according to the Bobath concept with 2 sessions per week, without prioritising therapy of the upper limb. The results show that in both groups, upper limb function and ADL improved during the 8 weeks. The between-group difference was significant for ADL but not upper limb function. Significant improvements were observed for the sensory tests in the intervention group. However, the result for the control group was not reported and thus no comparison can be made.

A Cochrane review by Doyle et al (2010) [47] included studies that targeted upper limb sensory impairment after stroke and were published prior to January 2009. Thirteen studies were identified with 467 participants. No meta-analysis was performed due to a high degree of clinical heterogeneity in both interventions and outcomes. There was some limited preliminary evidence (based on a single small randomised controlled trials with low risk of bias) for:

- the effects of mirror therapy for improving detection of light touch, pressure and temperature pain
- a thermal stimulation intervention for improving the rate of recovery of sensation
- intermittent pneumatic compression for improving tactile and kinesthetic sensation.

Overall this review did not find sufficient evidence to support or refute the effectiveness of any intervention in improving sensory impairment, upper limb function, or participants' functional status and participation.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Conventional treatment	Sensory-specific training plus motor function training		
<b>Improvement in ADL</b> After 8 weeks of treatment  8 Critical	Measured by: Improvement from baseline on Stroke Impact Scale - 16 Scale: 16-80 High better Based on data from: 21 patients in 1 studies. (Randomized controlled) Follow up 8 weeks	<b>0.25</b> (Mean)	<b>9.83</b> (Mean)	<b>Low</b> Due to very serious imprecision <sup>1</sup>	Sensory-specific treatment plus motor function training may improve ADL
<b>Improvement in upper limb function</b> After 8 weeks of treatment  7 Critical	Measured by: Improvement from baseline on Fugl Meyer Assessment scale High better Based on data from: 21 patients in 1 studies. (Randomized controlled) Follow up 8 weeks	<b>3</b> (Mean)	<b>5.1</b> (Mean)	<b>Moderate</b> Due to serious imprecision <sup>2</sup>	Both intervention and control group showed significant improvement from baseline with no significant differences between them.

<b>Sensation</b> 8 weeks  7 Critical	Based on data from 21 patients in 1 studies.	Sensory discrimination test showed significant improvement in the intervention group. However the result for control group was not reported and no comparison was made.	<b>Very Low</b> Due to serious indirectness, serious imprecision, and serious risk of bias <sup>3</sup>	We are uncertain whether sensory-specific treatment plus motor function training increases or decreases sensation
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1. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Very Serious .** Low number of patients, Only data from one study; between groups difference was very poorly reported, with no CI ; **Publication bias: No serious .**
2. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Only data from one study, Low number of patients ; **Publication bias: No serious .**
3. **Risk of bias: Serious .** Selective outcome reporting ; **Inconsistency: No serious . Indirectness: Serious .** Within-subject comparison - no comparison between intervention and control group ; **Imprecision: Serious .** Low number of patients, Only data from one study ; **Publication bias: No serious .**

## References

[46] de Diego C, Puig S, Navarro X : A sensorimotor stimulation program for rehabilitation of chronic stroke patients.. Restorative neurology and neuroscience 2013;31(4):361-71 [Pubmed Journal](#)

[49] Doyle S, Bennett S, Fasoli SE, McKenna KT : Interventions for sensory impairment in the upper limb after stroke.. The Cochrane database of systematic reviews 2010;(6):CD006331 [Pubmed Journal](#)

## Clinical Question/ PICO

**Population:** All stroke patients with reduced sensation  
**Intervention:** Sensory-specific training  
**Comparator:** Conventional treatment

## Summary

Carey et al (2011) [48] compared somatosensory discrimination training and non-specific repeated exposure to stimuli in a randomised trial (N = 50). The primary outcome was a composite somatosensory discrimination index, combining scores from the Fabric Matching Test, Wrist Position Sense Test and the function Tactile Object Recognition Test. The intervention group showed significantly greater improvement in somatosensory discrimination immediately following treatment. These improvements appeared to be maintained at 6-week and 6-month follow-ups, but as this was a cross-over trial it was not possible to assess between-group differences at follow-up. Previous work by the same authors includes a meta-analysis of outcomes from task-specific and transfer-enhanced approaches to sensory retraining across 30 single-case experiments supports both modes of training (Carey and Matyas 2005 [50]).

A Cochrane systematic review was conducted by Doyle et al (2010) [47] of studies that targeted upper limb sensory impairment after stroke, and were published prior to January 2009. Thirteen studies were identified with 467 participants. No meta-analysis was performed due to a high degree of clinical heterogeneity in both interventions and outcomes. There was some limited preliminary evidence for:

- the effects of mirror therapy for improving detection of light touch, pressure and temperature pain
- a thermal stimulation intervention for improving the rate of recovery of sensation
- intermittent pneumatic compression for improving tactile and kinesthetic sensation

Overall this review did not find sufficient evidence to support or refute the effectiveness of any intervention for improving sensory impairment, upper limb function, or participants' functional status and participation.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Conventional treatment	Sensory-specific training		
<b>Sensation</b> <sup>1</sup> After 10 sessions of treatment (approx 3 weeks)  7 Critical	Measured by: Improvement from baseline on Standardized Somatosensory Deficit scale High better Based on data from: 50 patients in 1 studies. <sup>2</sup> (Randomized controlled) Follow up 10 sessions of treatment, 3 sessions per week	<b>8</b> points (Mean)  Difference: <b>MD 11.1 higher</b> ( CI 95% 3 higher - 19.2 higher )	<b>19.1</b> points (Mean)	<b>Moderate</b> Due to serious imprecision <sup>3</sup>	Sensory-specific treatment probably improves sensation
<b>Upper limb sensation</b>  7 Critical	Based on data from 467 patients in 13 studies.	One trial of repetitive thermal stimulation in addition to standard therapy compared to standard therapy alone found beneficial effects in favour of experimental group in rate of recovery of sensation (MD 0.21, 95% CI 0.10 to 0.32), and arm function (Motor Assessment Scale, MD 1.58, 95% CI 0.98 to 2.18) One study of mirror therapy compared to sham intervention found beneficial effects in favour of experimental group in light touch (Quantitative Sensory Test, MD -2.05, 95% CI -2.42 to -1.68). One study of intermittent pneumatic compression compared to sham short-wave therapy found beneficial effects in favour of experimental group in sensation (Nottingham Sensory Assessment, MD 37.10, 95% CI 8.16 to 66.04)		<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>4</sup>	Sensory-specific training may improve upper limb sensation

1. Composite index of FMT for texture discrimination, WPST for limb position sense, and fTORT for textile object recognition
2. Primary study [48]. **Baseline/comparator**:: Control arm of reference used for intervention .
3. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Only data from one study, n=50, but sufficiently powered ; **Publication bias: No serious .**
4. **Risk of bias: Serious .** Unclear sequence generation/ generation of comparable groups, resulting in potential for selection bias ;

**Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ranging from 10 to 40 except two with 90 and 100. No mention of power calculations in most trials. ; **Publication bias: No serious .**

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## 9.3 - Vision

Visual field loss occurs in approximately 30–40% of stroke survivors (Stroke Foundation 2015 [8]; Stroke Foundation 2016 [9]), and usually affects half of the field of vision in both eyes (homonymous hemianopia). Visual impairments include diplopia (double vision), difficulties with ocular convergence (both eyes looking at the same point), impaired saccadic movement (both eyes looking from one point to another), oversensitivity to light, nystagmus (rapid involuntary rhythmic movement of eyes from midline to one side) and dry eyes. These impairments can result in significant functional difficulties with activities such as reading, writing, mobilising and driving. Pre-existing visual deficits should be clarified as many stroke survivors are elderly and normal visual loss is common.

There is currently insufficient evidence for either restitutive or compensatory strategies for visual dysfunction (such as Fresnel prism glasses, computer-based visual retraining programs or visual scanning) to make any recommendations on interventions.

### Practice Statement

#### Consensus-based recommendations

- All stroke survivors should have an:
  - assessment of visual acuity while wearing the appropriate glasses, to check their ability to read newspaper text and see distant objects clearly;
  - examination for the presence of visual field deficit (e.g. hemianopia) and eye movement disorders (e.g. strabismus and motility deficit).

## 10 - Physical activity

Amount of rehabilitation, cardiorespiratory fitness and specific physical activities (sitting, standing up, standing balance, walking, upper limb activity) are discussed separately below.

### 10.1 - Amount of rehabilitation

Understanding the evidence about whether more therapy is better for people after stroke is fraught with issues. The single most important barrier to understanding the dose-response relationship between amount of therapy and outcome is how 'amount of therapy' is defined. Many different systematic reviews have attempted to answer this question, yet all have different ways of defining amount of therapy, or have different outcomes of interest (e.g. upper limb function, walking function, ADL ability or length of hospital stay). This means that different papers are included and direct comparison of results are difficult to make.

We know that time in therapy is a very poor proxy for time engaged in active task practice (Kaur et al. 2013 [68]). Yet scheduled therapy time is often the only metric used (Lohse et al. 2014 [60]). The meta-data regression paper by Lohse et al. (2014) pulls together data based on time in therapy only and suggests that greater amounts of scheduled therapy time lead to improved outcomes. However, due to the data modelling approach used, equating the results to magnitude of benefit on specific outcomes of interest is not possible. It does however give a robust overall message that more therapy is better.

To add to the complexity, some rehabilitation interventions, such as treadmill training and constraint-induced movement therapy, are designed to provide a greater dose or intensive amount of therapy. It is difficult then to determine if the effect of these interventions are due to the dose or the type of intervention. Where the focus of trials is on a specific named intervention, such as treadmill training or constraint-induced movement therapy, that evidence has been included in relevant sections of these Clinical Guidelines.

There are two broad types of trials that have been considered. First there are trials that have increased the amount of scheduled therapy time provided to stroke survivors, using weekend therapy or group circuit class therapy models of care. Second, there are trials that have provided additional training (more of the same). Often these trials compare 'usual care' and 'usual care plus additional training'. The type of extra training differs between trials. Some systematic reviews have investigated the effect of additional walking training and additional upper limb task-specific training. Therefore this section considers the evidence for additional amount of therapy under the following PICO questions: "What is the effect of increased scheduled therapy time on outcomes after stroke" and "What is the effect of additional specific training on specific outcomes?"

To understand this complex relationship better, future trials need to include specific measures of active practice time (e.g. number of repetitions, time in active task practice, objective physical activity monitoring) for each participant, so that future reviews and data modelling work can better discern the dose-response relationship between active therapy and outcomes.

#### Strong Recommendation

- For stroke survivors, rehabilitation should be structured to provide as much scheduled therapy (occupational therapy and physiotherapy) as possible. (Lohse et al. 2014 [62]); Schneider et al. 2016 [68]; Veerbeek et al. 2014 [76])
- For stroke survivors, group circuit class therapy should be used to increase scheduled therapy time. (English et al. 2015 [59])

#### Practical Info

Therapists should seek to maximise the amount of active task practice stroke survivors engage in during therapy sessions. Given that therapists tend to overestimate time spent in active task practice, use of objective measurement of activity (recording repetitions, accelerometers, video analysis of therapy sessions) should be considered. Group circuit class therapy is an efficient way of increasing time spent in therapy (English et al. 2015 [59]). Other methods could include use of therapy assistants and family members.

#### Key Info

##### Benefits and harms

There is consistent evidence from systematic reviews (Schneider et al. 2016 [68], Veerbeek et al. 2011 [62]) and meta-regression

Substantial net benefits of the recommended alternative

analyses (Lohse et al. 2014 [62]) that increased scheduled therapy time has a small to moderate benefit on improving walking ability, arm function and quality of life (Lohse et al. 2014 [62]). There is uncertainty as to the optimal amount of therapy time, related to differences in the actual amount of active therapy time delivered in intervention and control groups. There are no harms reported in relation to increased scheduled therapy time (Lohse et al. 2014 [62]).

#### Quality of evidence

Moderate

The evidence comes from a high-quality meta-regression study (Lohse et al. 2014 [62]) and systematic review (Schneider et al. 2016 [68]). The evidence for circuit class therapy increasing therapy time comes from a high-quality randomised controlled trial (English et al. 2015 [59]). The evidence applies to both upper and lower limb.

#### Preference and values

No substantial variability expected

Stroke survivors value physical activity during rehabilitation but report often being bored and alone and having insufficient exercises to do in hospital, however they also express individual preferences as to the mode of therapy delivery (individual versus circuit classes) (Luker et al. 2015 [71]).

#### Resources and other considerations

No important issues with the recommended alternative

##### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified

##### Implementation considerations

There is a clinical indicator collected in the National Stroke Audit to determine the total number of patients with stroke who undergo treatment for an identified rehabilitation goal during their acute hospital admission. This clinical indicator is included in the Acute Stroke Clinical Care Standard, with patients excluded if they declined rehabilitation, returned to pre-morbid function, were unresponsive or where treatment was deemed futile. There is also an organisational indicator collected on whether documented processes and systems are in place in participating hospitals to ensure that patients receive evidence-based intensity of therapy related to their goals. Additionally, there is an organisational indicator to ascertain whether patients with motor impairments usually undertake at least one hour of active therapy (physiotherapy or occupational therapy) per day at least five times per week.

## Rationale

This recommendation pertains to therapy for improving motor function, including mobility, walking and arm function, predominantly provided by physiotherapists and occupational therapists. For recommendations regarding amount of speech and language therapy see **Aphasia** in the Communications section.

Lohse et al. 2014 [62] analysed data based on **time in therapy** only and suggest that greater amounts of scheduled therapy time leads to improved outcomes.

With regards to timing of therapy post-stroke, while providing too much therapy very early (within 24 hours of stroke) may be harmful (see Early mobilisation section in this chapter), most of the papers in the Lohse review included participants at least 2 weeks and up to 5 years post-stroke, and the benefits of increased therapy time were consistent regardless of time post-stroke (Lohse et al. 2014 [62]). Twelve (86%) of the 14 papers in the Schneider review included participants within 6 months of stroke (Schneider et al. 2016 [68]).

With regards to 5 versus 7 days per week therapy, a recent individual patient data meta-analysis (English et al. 2016 [69]) found no benefit of additional weekend therapy was seen with regards to improvements in walking speed or activities of daily living, although weekend therapy may have led to a shorter length of rehabilitation hospital stay. A systematic review of out-of-hours or weekend therapy by Scrivener et al. (2015) [58] included seven trials and participants with a range of diagnoses, three of which included only people with stroke. The review found no effect of additional scheduled therapy (out-of-hours or weekend therapy sessions) on physical function or walking speed, but a small positive effect (standardised mean difference 0.1) in ability to perform activities of daily living.

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Increased scheduled therapy time  
**Comparator:** Usual care

**Summary**

Lohse et al (2014) [60] conducted a meta-analysis of rehabilitation studies where intervention groups received more total therapy time than control groups. Mean therapy time for control groups was 24 (SD 30) hours and the mean scheduled therapy time in the intervention groups was 57 (SD 45) hours. Meta-analysis showed that additional scheduled therapy is associated with a small effect size in relation to improved function ( $g=0.35$ , 95% CI 0.26 to 0.45). A meta-regression analysis that attempted to quantify the degree of benefit predicted from additional therapy time, finding a significant linear association between treatment effect size and the number of additional therapy hours received. Participants in the studies were between 1 day and 5 years post-stroke, and the benefits of increased therapy were similar regardless of time post-stroke. A recently published systematic review found a similar effect size in favour of increased amount of therapy for improving arm activity and mobility (SMD=0.39, 95% CI 0.07 to 0.71), with a larger effect size when only studies with at least 100% increase in therapy time (average 90 minutes additional therapy, 120 minutes total therapy time in the intervention group) were included (SMD 0.59, 95% CI 0.23 to 0.94) (Schneider et al 2016 [66]). In this review, 86% of the studies included participants within 6 months of stroke. Similarly, a systematic review and meta-analysis of trials where intervention groups spent additional time in lower-limb exercise therapy compared to control groups included 14 trials with 725 total participants (Veerbeek et al 2011 [62]) showed small to moderate benefits of additional therapy time in walking ability, comfortable and maximum walking speed, and extended activities of daily living, but non-significant differences in basic ADL. Intervention participants received on average an additional 37 minutes of therapy time per day. The meta-analysis found a small but significant benefit for increased walking ability (measured on a range of outcome measures, SMD 0.32, 95% CI 0.11 to 0.52) and comfortable walking speed (SMD = 0.22, 95% CI 0.01 to 0.43). An in-depth review of the specific interventions delivered in the included studies revealed that of the 80 included trials, 70 (88%) compared either outcomes for participants receiving usual care therapy to those receiving usual care plus additional practice, or low intensity versus high intensity task-specific practice. (English and Veerbeek 2015 [69]) Only 10 trials (12%) compared the effect of additional scheduled therapy time, without specifying what people practiced in that time (English and Veerbeek 2015 [69]). Thus, the result of this meta-analysis can be considered evidence for the effectiveness of additional active task practice on outcome.

However, another systematic review by Hayward et al (2014) [63] assessing the effects of changing single components of rehabilitation interventions included 9 trials that manipulated the dose or intensity of therapy, found no significant differences in function in a meta-analysis (MD -0.30, 95% CI -2.20 to 1.60). The differences in type of intervention between the pooled studies may have influenced results, as may the timing post-stroke at which interventions were delivered. A meta-analysis of 23 trials of constraint-induced movement therapy found significant improvements in arm motor function and arm motor activity overall. However, meta-regression found no significant effect of treatment duration (Thrane et al 2014 [171]). The CIRCIIT randomised trial (English et al 2015 [59]) compared usual care, usual care delivered 7 days a week, and circuit class therapy 5 days a week. Both weekend therapy and circuit class therapy increased scheduled therapy time, with much larger effects (22 hours in 4 weeks) for circuit class therapy compared to weekend therapy (3 hours in 4 weeks) without the need to increase staffing resources. However, there were no significant differences between groups in walking ability.

In summary, we still don't know what the threshold of active therapy is to provide benefit. Evidence from animal studies suggests it is much higher than what is currently provided in clinical practice.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Increased scheduled therapy time		



<b>Various function and impairment measures - pooled<sup>1</sup></b> Variable - end of treatment estimates  7 Critical	Based on data from 2,284 patients in 34 studies.	Pooling data from 34 trials, there was a significant benefit for people receiving more therapy time compared to less (standardised effect size $g=0.35$ ; 95% CI 0.26 to 0.45 indicating moderate effect size). This finding is difficult to interpret in terms of benefit for specific outcomes (eg walking ability, upper limb function, health related quality of life), as it represents pooling across all reported outcome measures. The mean amount of therapy time scheduled for people in the intervention groups was 57 hours compared to 24 hours in the control groups. The benefit of increased therapy time remained, even when controlling for time after stroke.	<b>Moderate</b> Due to serious risk of bias <sup>2</sup>	Increased scheduled therapy time probably improves various function and impairment measures
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1. The meta-analysis computed standardised effect sizes from studies using different outcome measures. The measures included were limited to "validated behavioral measures of function or impairment" Effect sizes (Hedges  $g$ ) from individual studies computed from terminal differences in treatment and control groups or differences in change scores between treatment and control divided by SD within groups.
2. **Risk of bias: Serious** . overall quality of included papers in the meta-regression was moderate ; **Inconsistency: No serious** . **Indirectness: No serious** . test for heterogeneity was not significant ; **Imprecision: No serious** . relatively narrow confidence intervals around the effect size (0.26 to 0.45) ; **Publication bias: No serious** . **Upgrade: Clear dose-response gradient** .

## References

[60] Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis.. PloS one 2014;9(2):e87987 [Pubmed Journal](#)

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## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Additional active practice  
**Comparator:** Usual care

## Summary

Schneider et al ([68]) pooled data from 14 studies (954 participants) in which extra therapy of the same type was provided. This included studies that focussed on upper limb activity, walking ability or a combination. They found a beneficial effect of increased

therapy time for improving activity (upper limb and lower limb combined, SMD 0.39, 95% CI 0.07 to 0.71, I2=66%). When the experimental group received at least double the amount of therapy time, the effect size increased and statistical heterogeneity decreased (SMD 0.59, 95% CI 0.23 to 0.94, I2=44%). Hayward et al (2014) [63] pooled data from nine studies that specifically compared interventions focussed on improving arm function in which only the amount (dose) of therapy was different between groups. Between 2 and 7 hours a week of additional therapy was provided to intervention participants. Outcomes were pooled for both activities of daily living and arm function together and no effect was found (SMD -0.30, 95% CI -2.2 to 1.6). Pooled data for arm function and activities of daily living separately are not reported, and the heterogeneity in the analysis was very high (I2 93%). The differences in types of intervention between the pooled studies may have influenced results, as may the timing post-stroke at which interventions were delivered. Findings of a recent large randomised controlled trial (iCARE) are consistent with these findings with no additional benefit found from doubling therapy dose of arm motor therapy (Winstein et al 2016 [67]). However, the increased therapy dose of 28 hours may still be sub-threshold.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Additional active practice		
<b>Activities of daily living</b>  8 Critical	Measured by: Variety of ADL scales High better Based on data from: 3,064 patients in 36 studies. <sup>1</sup> (Randomized controlled) Follow up Post intervention	Difference: <b>SMD 0.22 higher</b> ( CI 95% 0.09 higher - 0.34 higher )		<b>Moderate</b> The effect sizes were small. The difference in dosage (amount of extra therapy) was not well reported in studies, making direct comparisons between trials difficult. <sup>2</sup>	Additional active practice probably improves activities of daily living
<b>Walking ability</b> Immediate treatment effects  8 Critical	Measured by: Comfortable walking speed Scale: 0-1.4 High better Based on data from: 1,097 patients in 22 studies. (Randomized controlled)	Difference: <b>SMD 0.29 higher</b> ( CI 95% 0.17 higher - 0.41 higher )		<b>High</b> The difference in dosage (amount of extra therapy) was not well reported in studies, making direct comparisons between trials difficult. Consistent favourable findings were reported for both comfortable and maximal walking speed, but not walking distance or walking ability (general scales). <sup>3</sup>	Additional active practice improves walking speed

<b>Arm function and walking ability</b> <sup>4</sup> End of intervention  7 Critical	Based on data from 954 patients in 14 studies.	Pooled data from 14 studies for both arm function and walking ability together found beneficial effect (SMD 0.39, 95% CI 0.07 to 0.71). This was higher when only studies with at least 100% increase in therapy time were included (SMD 0.59, 95% CI 0.23 to 0.94).	<b>Moderate</b> Many of the included studies had small sample size and the statistical heterogeneity was high (66%) <sup>5</sup>	Additional active practice probably improves arm function and walking ability
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1. Systematic review [144]. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Inconsistency: No serious** . The magnitude of statistical heterogeneity was moderate, with  $I^2$ : 62% . ; **Indirectness: No serious** . The differences in dosage between the different trials were not well reported ; **Imprecision: No serious** . small effect sizes ; **Publication bias: No serious** .
3. **Risk of bias: No serious** . Range of quality of included studies in overall meta-analysis. Risk of bias for studies included in the walking speed meta-analysis only not separately reported ; **Inconsistency: No serious** . Effect size for walking speed was homogenous ; **Indirectness: No serious** . Direct comparisons not available ; **Imprecision: No serious** . Wide confidence intervals but consistent findings for both comfortable and maximal walking speed ; **Publication bias: No serious** .
4. Pooled data from 14 studies for both arm function and walking ability together found beneficial effect (SMD 0.39, 95% CI 0.07 to 0.71). This was higher when only studies with at least 100% increase in therapy time were included (0.59, 95% CI 0.23 to 0.94).
5. **Risk of bias: No serious** . Missing intention-to-treat analysis in 60% of included papers ; **Inconsistency: No serious** . The magnitude of statistical heterogeneity was high, with  $I^2$ : 66%. This dropped to 44% when only trials with a high treatment contrast were included . ; **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients in many of the included trials . ; **Publication bias: No serious** .

## References

[60] Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis.. PloS one 2014;9(2):e87987 [Pubmed Journal](#)

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## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Circuit therapy  
**Comparator:** 5-day week therapy (usual care)

## Summary

A large multi-centre 3-armed randomised controlled trial, n=283 (English et al 2015 [59]) included participants admitted to inpatient rehabilitation facilities after stroke and compared the effectiveness of physiotherapy delivered in group circuit class therapy to usual care physiotherapy (5 days a week) and 7-day week usual care physiotherapy. The primary outcome was walking

ability using the six minute walk test, and no statistically significant between group differences were found (data extracted for the circuit class therapy and usual care [5 days a week] group). Providing physiotherapy in group circuit classes was highly effective at increasing the time participants spent in physiotherapy sessions (mean difference for total therapy time 22.2 hours, 95% CI 19.1 to 25.3 compared to usual care 5 days a week) (English et al 2014 [73]). Video analysis of a subset of therapy sessions showed that despite the increased time in therapy sessions, the amount of walking practice was not different between groups (English et al 2014 [69]).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		5-day week therapy (usual care)	Circuit therapy		
<b>Distance walked on the six minute walk test</b> <sup>1</sup> Four weeks post- randomisation 8 Critical	Measured by: Six minute walk test High better Based on data from: 283 patients in 1 studies. (Randomized controlled) Follow up Four weeks	<b>105.5</b> metres (Median)	<b>116</b> metres (Median)	<b>Moderate</b> Due to serious imprecision <sup>2</sup>	Circuit class therapy probably has little or no difference on distance walked on the six minute walk test
<b>Time in therapy</b> During inpatient rehabilitation up to 4 weeks 7 Critical	Measured by: Total therapy time during inpatient stay High better Based on data from: 283 patients in 1 studies.	<b>15.1</b> (Mean)	<b>37.3</b> (Mean)	<b>High</b> Due to serious imprecision, Upgraded due to Large magnitude of effect <sup>3</sup>	Circuit class therapy increases time in therapy

1. The six minute walk test is a valid and reliable measure of walking capacity and previous trials have demonstrated that circuit class therapy is particularly effective for improving walking capacity after stroke.
2. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Only data from one study, Difference between groups was not statistically significant. ; **Publication bias: No serious .**
3. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Only data from one study ; **Publication bias: No serious . Upgrade: Large magnitude of effect .**

## References

[59] English C, Bernhardt J, Crotty M, Esterman A, Segal L, Hillier S : Circuit class therapy or seven-day week therapy for increasing rehabilitation intensity of therapy after stroke (CIRCIT): a randomized controlled trial.. International journal of stroke : official journal of the International Stroke Society 2015;10(4):594-602 [Pubmed Journal](#)

[69] English C, Shields N, Brusco NK, Taylor NF, Watts JJ, Peiris C, Bernhardt J, Crotty M, Esterman A, Segal L, Hillier S : Additional weekend therapy may reduce length of rehabilitation stay after stroke: a meta-analysis of individual patient data.. Journal of

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[74] English C, Hillier S, Kaur G, Hundertmark L : People with stroke spend more time in active task practice, but similar time in walking practice, when physiotherapy rehabilitation is provided in circuit classes compared to individual therapy sessions: an observational study.. Journal of physiotherapy 2014;60(1):50-4 [Pubmed Journal](#)

#### Practice Statement

##### **Consensus-based recommendation**

Stroke survivors should be encouraged to continue with active task practice outside of scheduled therapy sessions. This could include strategies such as:

- self-directed, independent practice;
- semi-supervised and assisted practice involving family/friends, as appropriate.

#### Weak Recommendation

A minimum of three hours a day of scheduled therapy (occupational therapy and physiotherapy) is recommended, ensuring at least two hours of active task practice occurs during this time. (Lohse et al. 2014 [62]; Schneider et al. 2016 [68])

#### Practical Info

There is no direct evidence that people with fatigue and/or attention and concentration issues would not benefit from the same amount of scheduled therapy and active task practice time. However, not all stroke survivors will tolerate this amount of therapy. Strategies to maximise therapy time within tolerance limits may include reducing background distractions and noise, introducing frequent rests and scheduling several shorter therapy sessions across the day.

#### Key Info

##### **Benefits and harms**

There is uncertainty about the benefits of increased scheduled therapy time on improving walking ability, arm function and quality of life (Lohse et al. 2014 [62]). This may be related to differences in the actual amount of active therapy time delivered in intervention and control groups. A more recent systematic review (Schneider et al. 2016 [68]) found consistent improvements in function related to increased therapy time for both upper and lower limb function. There are no harms reported in relation to increased scheduled therapy time (Lohse et al. 2014 [62], Schneider et al. 2016 [68]).

#### Rationale

The recommended 3 hours per day of therapy is based on a mean 57 hours in the paper by Lohse et al. 2014 [62], delivered 5 days a week

over 4 weeks. This is consistent with a large, 3-armed multicentre randomised controlled trial (English et al. 2015 [59]), which found that 3 hours of physiotherapy per day delivered in group circuit classes was safe and feasible within existing staffing resources.

However, therapy time is a poor proxy for time spent in actual active task practice (Kaur et al. 2013 [70]). A more recent systematic review (Schneider et al. 2016 [68]) included 14 studies (954 participants) and found that at least 240% more **active therapy time** was needed before benefits were seen. This equated to an average of 2 hours a day of active motor training (mean usual care therapy time 25 minutes, mean additional therapy time 90 minutes).

### Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Additional active practice  
**Comparator:** Usual care

#### Summary

Schneider et al ([68]) pooled data from 14 studies (954 participants) in which extra therapy of the same type was provided. This included studies that focussed on upper limb activity, walking ability or a combination. They found a beneficial effect of increased therapy time for improving activity (upper limb and lower limb combined, SMD 0.39, 95% CI 0.07 to 0.71, I2=66%). When the experimental group received at least double the amount of therapy time, the effect size increased and statistical heterogeneity decreased (SMD 0.59, 95% CI 0.23 to 0.94, I2=44%). Hayward et al (2014) [63] pooled data from nine studies that specifically compared interventions focussed on improving arm function in which only the amount (dose) of therapy was different between groups. Between 2 and 7 hours a week of additional therapy was provided to intervention participants. Outcomes were pooled for both activities of daily living and arm function together and no effect was found (SMD -0.30, 95% CI -2.2 to 1.6). Pooled data for arm function and activities of daily living separately are not reported, and the heterogeneity in the analysis was very high (I2 93%). The differences in types of intervention between the pooled studies may have influenced results, as may the timing post-stroke at which interventions were delivered. Findings of a recent large randomised controlled trial (iCARE) are consistent with these findings with no additional benefit found from doubling therapy dose of arm motor therapy (Winstein et al 2016 [67]). However, the increased therapy dose of 28 hours may still be sub-threshold.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Additional active practice		
<b>Activities of daily living</b>  8 Critical	Measured by: Variety of ADL scales High better Based on data from: 3,064 patients in 36 studies. <sup>1</sup> (Randomized controlled) Follow up Post intervention	Difference: <b>SMD 0.22 higher</b> ( CI 95% 0.09 higher - 0.34 higher )		<b>Moderate</b> The effect sizes were small. The difference in dosage (amount of extra therapy) was not well reported in studies, making direct comparisons between trials difficult. <sup>2</sup>	Additional active practice probably improves activities of daily living
<b>Walking ability</b> Immediate	Measured by: Comfortable walking speed	Difference: <b>SMD 0.29 higher</b>		<b>High</b> The difference in	Additional active practice improves walking speed

<p>treatment effects</p> <p>8 Critical</p>	<p>Scale: 0-1.4 High better Based on data from: 1,097 patients in 22 studies. (Randomized controlled)</p>	<p>( CI 95% 0.17 higher - 0.41 higher )</p>	<p>dosage (amount of extra therapy) was not well reported in studies, making direct comparisons between trials difficult. Consistent favourable findings were reported for both comfortable and maximal walking speed, but not walking distance or walking ability (general scales).<sup>3</sup></p>
<p><b>Arm function and walking ability<sup>4</sup></b> End of intervention</p> <p>7 Critical</p>	<p>Based on data from 954 patients in 14 studies.</p>	<p>Pooled data from 14 studies for both arm function and walking ability together found beneficial effect (SMD 0.39, 95% CI 0.07 to 0.71). This was higher when only studies with at least 100% increase in therapy time were included (SMD 0.59, 95% CI 0.23 to 0.94).</p>	<p><b>Moderate</b> Many of the included studies had small sample size and the statistical heterogeneity was high (66%)<sup>5</sup></p> <p>Additional active practice probably improves arm function and walking ability</p>

1. Systematic review [144]. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Inconsistency: No serious** . The magnitude of statistical heterogeneity was moderate, with I<sup>2</sup>: 62%. ; **Indirectness: No serious** . The differences in dosage between the different trials were not well reported ; **Imprecision: No serious** . small effect sizes ; **Publication bias: No serious** .
3. **Risk of bias: No serious** . Range of quality of included studies in overall meta-analysis. Risk of bias for studies included in the walking speed meta-analysis only not separately reported ; **Inconsistency: No serious** . Effect size for walking speed was homogenous ; **Indirectness: No serious** . Direct comparisons not available ; **Imprecision: No serious** . Wide confidence intervals but consistent findings for both comfortable and maximal walking speed ; **Publication bias: No serious** .
4. Pooled data from 14 studies for both arm function and walking ability together found beneficial effect (SMD 0.39, 95% CI 0.07 to 0.71). This was higher when only studies with at least 100% increase in therapy time were included (0.59, 95% CI 0.23 o 0.94).
5. **Risk of bias: No serious** . Missing intention-to-treat analysis in 60% of included papers ; **Inconsistency: No serious** . The magnitude of statistical heterogeneity was high, with I<sup>2</sup>: 66%. This dropped to 44% when only trials with a high treatment contrast were included. ; **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients in many of the included trials. ; **Publication bias: No serious** .

## References

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[63] Hayward KS, Barker RN, Carson RG, Brauer SG : The effect of altering a single component of a rehabilitation programme on

the functional recovery of stroke patients: a systematic review and meta-analysis.. Clinical rehabilitation 2014;28(2):107-117  
[Pubmed Journal](#)

## 10.2 - Cardiorespiratory fitness

The cardiorespiratory fitness of stroke survivors is low (Marsden et al. 2013 [77]; Saunders et al. 2016 [71]), with peak oxygen consumption (VO<sub>2</sub> peak) values ranging from 26 to 87% of those of healthy age- and gender-matched individuals (Smith et al. 2012 [77]). In the meta-analysis examining cardiorespiratory levels after training undertaken by Saunders et al. [71], baseline levels ranged from 8 to 24 mL O<sub>2</sub>/kg/min. This is an issue as everyday physical activities are often undertaken at light (3.5 to 10.4 mL O<sub>2</sub>/kg/min) or moderate intensities (10.5 to 21.0 mL O<sub>2</sub>/kg/min) (Norton et al. 2010 [78]; ACSM 2010 [80]; Ainsworth et al. 2000 [81]).

For people with stroke these VO<sub>2</sub> requirements approach or reach their maximum capacities, whereas healthy people can perform activities of daily living comfortably, with fitness reserve to spare. Consequently, low levels of fitness can make undertaking many everyday activities difficult to sustain for any length of time, and more physically demanding activities almost impossible (Ivey et al. 2005 [83]). Low levels of cardiorespiratory fitness can increase the risk of recurrent stroke and other cardiometabolic diseases (Billinger et al. 2014 [76]).

Improving the cardiorespiratory fitness of stroke survivors has the potential to enhance their ability to undertake activities of daily living and reduce the risk of subsequent events. With improved fitness, the percentage of VO<sub>2</sub> peak required to undertake a task is reduced. This can increase submaximal exercise tolerance and endurance (Billinger et al 2014 [76]). Even modest amounts of aerobic training can improve cardiorespiratory fitness by 10 to 15% (Marsden et al. 2013 [77]).

After stroke, the regaining of physical function to support independent living is often prioritised in therapy, with little or no focus on training cardiorespiratory fitness. Clinicians may have limited knowledge and experience in prescribing fitness programs for the diverse stroke population they manage (Gordon et al 2004 [82]). Inpatient therapy sessions are often below the intensity and duration recommended for providing a cardiovascular challenge (Polese et al. 2014 [84]; Kuys et al. 2006 [85]; Mackay-Lyons et al. 2002 [86]).

### Strong Recommendation

For stroke survivors, rehabilitation should include individually-tailored exercise interventions to improve cardiorespiratory fitness. (Saunders et al. 2016 [75])

### Practical Info

All people after stroke should undergo a pre-exercise evaluation to minimise the potential for adverse events before commencing on a physical activity program (Billinger et al. 2014 [80]). This includes a medical and physical examination to identify comorbidities or neurological complications that may be a precaution or contraindication to exercise (Billinger et al. 2014 [80]). Relative and absolute contraindications to exercise including for people after stroke have been outlined (American College of Sports Medicine 2010 [84]; Mead & van Wijck 2013 [92]). A graded exercise test with ECG monitoring may be included as part of the pre-exercise evaluation (Billinger et al. 2014 [80]).

Once the person is medically stable and has passed a screen for inclusion in cardiorespiratory fitness training an individually tailored program can be prescribed. Billinger et al. (2014) [80] recommend aerobic programs should typically include:

- Mode – large-muscle activities such as walking; arm, leg or arm-leg ergometry; functional activities
- Frequency – 3–5 days/week
- Duration – 20–60 min/session (or multiple 10-min sessions) with an additional 5–10 min of warm-up and cool-down activities
- Intensity – 40–70% VO<sub>2</sub> reserve or HR reserve; 55–80% HR<sub>max</sub>; RPE 11–14 (6–20 scale).



To individually tailor cardiorespiratory fitness training for people after stroke, including those with severe disability, the person's stage of recovery, exercise tolerance, environment, available social support, physical activity preferences, and their specific impairments, activity limitations, and participation restrictions need to be considered (Billinger et al. 2014 [80]).

Barriers and enablers to undertaking exercise post-stroke and post-discharge should be addressed with the stroke survivor and carer. Barriers may include lack of motivation, environmental factors such as transport, health concerns, and stroke impairments (Nicholson et al. 2013 [78]).

## Key Info

### Benefits and harms

Substantial net benefits of the recommended alternative

Cardiorespiratory fitness training can improve cardiorespiratory fitness and walking ability (speed and capacity), and reduce disability (Saunders et al. 2016 [75]). Very few adverse events occur in cardiorespiratory fitness training studies (Saunders et al. 2016 [75]).

### Quality of evidence

High

There is high-quality, consistent evidence from multiple RCTs of reasonable quality for the effects of training on disability, mobility and cardiorespiratory fitness level (Saunders et al. 2016 [75]).

### Preference and values

No substantial variability expected

Patient preferences may vary. However, cardiorespiratory training may enhance social support and the ability to perform daily tasks (Nicholson et al. 2013 [78]).

### Resources and other considerations

Factors not considered

## Rationale

Cardiorespiratory fitness training after stroke can improve level of disability, walking speed, walking capacity and capacity cardiorespiratory fitness (high level evidence) during or immediately after training.

The most effective time to commence cardiorespiratory training is unclear. However given people after stroke have low levels of cardiorespiratory fitness (Marsden et al. 2013 [81]) and are very sedentary (English et al. 2014 [85]), commencing training while an inpatient can promote 'being active' as part of adopting a healthy lifestyle, which is important for secondary prevention of stroke.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Cardiorespiratory training  
**Comparator:** Control

### Summary

A Cochrane review by Saunders et al (2016) [71] included 58 trials of fitness training interventions with a total of 2797 stroke patients. Interventions included cardiorespiratory training, resistance training or mixed interventions that combined the two. To date, there have been very few studies that have followed participants up after the end of the intervention. Participants receiving cardiorespiratory training showed improved walking speed and walking capacity. The review authors concluded that there was sufficient evidence to support the use of cardiorespiratory or mixed cardiorespiratory and resistance training in post-stroke rehabilitation.

A systematic review by Veerbeek et al (2014) [60] assessed a broad range of physical therapy interventions. This included 13 randomised controlled trials of cardiorespiratory exercise interventions. Meta-analysis showed non-significant effects of exercise interventions on motor function, comfortable gait speed, maximum gait speed and diastolic and systolic blood pressure, but significant improvements on respiratory functions such as forced expiratory volume. As this review included a large number of studies investigating multiple interventions, limited detail was available on specific interventions so it is unclear why fewer trials of cardiorespiratory training were included compared to the later review. The smaller number of trials, with reduced power to detect an effect, could explain the negative results seen in this review.

An earlier systematic review by Pang et al (2013) [72] also found significant improvements in maximum gait speed and walking endurance based on 25 randomised trials of aerobic exercise for stroke patients.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Cardiorespiratory training		
<b>Case fatality</b> End of intervention  9 Critical	Odds Ratio 1 (CI 95% 0.14 - 7.33) Based on data from 1,437 patients in 28 studies. <sup>1</sup> (Randomized controlled)	<b>3</b> per 1000	<b>3</b> per 1000	<b>Moderate</b> Due to serious risk of bias <sup>2</sup>	There were too few people in these studies who died to determine whether cardiorespiratory training made a difference to case fatality
<b>Case fatality</b> End of follow-up  9 Critical	Odds Ratio 1 (CI 95% 0.06 - 16.48) Based on data from 304 patients in 5 studies. (Randomized controlled)	<b>7</b> per 1000	<b>7</b> per 1000	<b>Low</b> Due to serious risk of bias, Due to very serious imprecision <sup>3</sup>	There were too few who died to determine whether cardiorespiratory training made a difference to case fatality at the end of follow-up
<b>Mobility - preferred gait speed</b> End of intervention  8 Critical	Measured by: Speed (m/ min) High better Based on data from: 505 patients in 10 studies. <sup>4</sup> (Randomized controlled)	Difference: <b>MD 4.28 higher</b> ( CI 95% 1.71 higher - 6.84 higher )		<b>High</b> 5	Cardiorespiratory training improves preferred gait speed
<b>Mobility - preferred gait speed</b> End of follow-up  8 Critical	Measured by: Speed (m/ min) High better Based on data from: 176 patients in 3 studies. <sup>6</sup> (Randomized controlled)	Difference: <b>MD 1.67 higher</b> ( CI 95% 3.27 lower - 6.62 higher )		<b>Low</b> Due to serious imprecision <sup>7</sup>	Cardiorespiratory training may have little or no difference on preferred gait speed at the end of follow-up

<p><b>Mobility - gait endurance</b> End of intervention</p> <p>8 Critical</p>	<p>Measured by: 6 Minute Walk Test (metres) High better</p> <p>Based on data from: 826 patients in 15 studies.<sup>8</sup> (Randomized controlled)</p>	<p>Difference: <b>MD 30.29 higher</b> ( CI 95% 16.19 higher - 44.39 higher )</p>	<p><b>High</b> 9</p>	<p>Cardiorespiratory training improves walking endurance</p>
<p><b>Mobility - gait endurance</b> End of follow-up</p> <p>8 Critical</p>	<p>Measured by: 6 Minute Walk Test (metres) High better</p> <p><sup>10</sup> (Randomized controlled)</p>	<p>CI 95%</p>	<p><b>High</b> 11</p>	<p>Cardiorespiratory training may improve walking endurance at the end of follow-up</p>
<p><b>Disability - combined disability scales</b> End of intervention</p> <p>9 Critical</p>	<p>Measured by: Various: Functional Independence measurement, Barthel Index, Rivermead Mobility Index High better</p> <p>Based on data from: 462 patients in 8 studies.<sup>12</sup> (Randomized controlled)</p>	<p>Difference: <b>SMD 0.52 higher</b> ( CI 95% 0.19 higher - 0.84 higher )</p>	<p><b>High</b> 13</p>	<p>Cardiorespiratory training improves disability - combined disability scales</p>
<p><b>Disability - combined disability scales</b> End of follow-up</p> <p>9 Critical</p>	<p>Measured by: Various: Functional Independence measurement, Barthel Index, Rivermead Mobility Index High better</p> <p>Based on data from: 220 patients in 3 studies.<sup>14</sup> (Randomized controlled)</p>	<p>Difference: <b>SMD 0.2 higher</b> ( CI 95% 0.07 lower - 0.46 higher )</p>	<p><b>Moderate</b> Due to serious imprecision<sup>15</sup></p>	<p>Cardiorespiratory training may improve disability slightly at the end of follow-up (using combined disability scales)</p>
<p><b>Physical fitness - peak VO<sub>2</sub> (ml/kg/min)</b> End of intervention</p> <p>8 Critical</p>	<p>Measured by: Peak VO<sub>2</sub> (ml/kg/minute) High better</p> <p>Based on data from: 425 patients in 9 studies.<sup>16</sup> (Randomized controlled)</p>	<p>Difference: <b>MD 2.86 higher</b> ( CI 95% 1.76 higher - 3.96 higher )</p>	<p><b>High</b> 17</p>	<p>Cardiorespiratory training improves physical fitness - peak VO<sub>2</sub> (ml/kg/min)</p>
<p><b>Physical fitness - peak VO<sub>2</sub> (ml/kg/min)</b> End of follow-up</p>	<p>Measured by: Peak VO<sub>2</sub> (ml/kg/minute) High better</p> <p>Based on data from: 50 patients in 1 studies.<sup>18</sup> (Randomized controlled)</p>	<p><b>15.1</b> ml/kg/min (Mean)</p> <p><b>18</b> ml/kg/min (Mean)</p> <p>Difference: <b>MD 2.9 higher</b> ( CI 95% 0.56 higher - 5.24 higher )</p>	<p><b>Low</b> Due to very serious imprecision<sup>19</sup></p>	<p>Cardiorespiratory training may improve physical fitness - peak VO<sub>2</sub> (ml/kg/min) at the end of follow-up</p>

8 Critical				
<b>Mobility - maximal gait speed</b> End of intervention	Measured by: Speed (m/min over 5 to 10 metres) High better Based on data from: 631 patients in 14 studies. <sup>20</sup> (Randomized controlled)	Difference: <b>MD 6.71 higher</b> ( CI 95% 2.73 higher - 10.69 higher )	<b>High</b> 21	Cardiorespiratory training improves maximal gait speed
7 Critical				
<b>Mobility - maximal gait speed</b> End of follow-up	Measured by: Speed (m/min over 5 to 10 metres) High better Based on data from: 312 patients in 5 studies. <sup>22</sup> (Randomized controlled)	Difference: <b>MD 6.71 higher</b> ( CI 95% 2.4 higher - 11.02 higher )	<b>Moderate</b> Due to serious imprecision <sup>23</sup>	Cardiorespiratory training probably improves maximal gait speed at the end of follow-up
7 Critical				
<b>HRQoL</b> End of intervention	Based on data from 294 patients in 4 studies. <sup>24</sup>	No included RCT investigated HRQoL during usual care. Four included studies (294 patients) examined HRQoL after usual care. Three of these studies used 2 measures each and one used one. Data was not pooled. All 7 analyses favoured intervention however only 4 had statistically significant results.	<b>Very Low</b> Due to serious risk of bias, Due to serious inconsistency, Due to serious imprecision <sup>25</sup>	We are uncertain whether cardiorespiratory training improves or worsen HRQoL
8 Critical				
<b>HRQoL</b> End of follow-up	Based on data from 122 patients in 1 studies. <sup>26</sup>	Retention of HRQoL was investigated in one included RCT (122 patients) using the EuroQoL EQ-5D, when training occurred after usual care. The results favoured control but were not statistically significant (MD -6.96, 95% CI -14.86 to 0.93).	<b>Very Low</b> Due to very serious imprecision <sup>27</sup>	We are uncertain whether cardiorespiratory training improves or worsens health related quality of life at the end of follow-up
8 Critical				
<b>Mood</b> End of intervention	Based on data from 80 patients in 2 studies. <sup>28</sup>	One included RCT investigated mood during usual care (60 patients) and 1 study after usual care (20 patients). The two studies used the Beck Depression Index and the Hospital Anxiety and Depression Scale. The pooled result (SMD -0.18, 95% CI -0.75 to 0.38) favoured training but was non-significant	<b>Very Low</b> Due to serious inconsistency, Due to very serious imprecision <sup>29</sup>	We are uncertain whether cardiorespiratory training improves or worsen mood
7 Critical				
<b>Mood</b> End of follow-up	Based on data from 73 patients in 2 studies. <sup>30</sup>	Retention of improvements in mood was investigated in one included RCT (53 patients) where training occurred during usual care and one study (20 patients) where training	<b>Very Low</b> Due to very serious imprecision <sup>31</sup>	Cardiorespiratory training may improve mood slightly at the end of follow-up

7 Critical		occurred after usual care. The trials used the Beck Depression Inventory or the Hospital Anxiety and Depression Scale. The pooled results showed a significant difference in favour of training (SMD -0.70, 95% CI -1.18 to -0.22)		
<b>Cognitive function</b> End of intervention	Based on data from 52 patients in 1 studies. <sup>32</sup>	One included RCT (52 patients) investigated cognitive function using FIM cognitive scores during usual care. The results (MD 2.17 points, 95% CI -1.02 to 5.36) favoured training but were not statistically significant. No studies investigated cognition after usual care.	<b>Very Low</b> Due to very serious imprecision <sup>33</sup>	We are uncertain whether cardiorespiratory training improves or worsen cognitive function
7 Critical				
<b>Cognitive function</b> End of follow-up	Based on data from 0 patients in 0 studies. <sup>34</sup>	Retention of improvements in cognitive function was not investigated in any included study.	No studies were found that looked at retention of cognitive function	No studies were found that looked at retention of cognitive function
7 Critical				
<b>Risk factors</b> End of intervention	Based on data from 363 patients in 6 studies. <sup>35</sup>	Five risk factors were investigated. Reductions in systolic and diastolic blood pressure were investigated in 1 study (12 patients) during usual care and 4 studies (306 patients) after usual care. Reduction in body mass index was investigated in 2 studies (174 patients) after usual care. The pooled results for each of these 3 risk factors favoured training but were non-significant. One study (45 patients) investigated abnormal glucose tolerance and total triglycerides during usual care. Both favoured training and were statistically significant.	<b>Very Low</b> Due to very serious inconsistency, Due to serious imprecision <sup>36</sup>	We are uncertain whether cardiorespiratory training improves or worsen risk factors
8 Critical				
<b>Risk factors</b> End of follow-up	Based on data from 0 patients in 0 studies. <sup>37</sup>	Retention of improvements in risk factors was not investigated in any included study.	No studies were found that looked at retention of improvements in risk factors	No studies were found that looked at retention of improvements in risk factors
8 Critical				
<b>Physical function</b> End of intervention	Based on data from 586 patients in 11 studies.	Three measures were used to assess physical function. Seven trials (435 patients) used the Berg Balance Scale. Three studies (131 participants) used Timed Up and Go (TUG). One study (20 participants) used Functional Reach. All three meta-analyses favoured training but only the study using Functional Reach was statistically significant".	<b>Low</b> Due to serious imprecision <sup>38</sup>	Cardiorespiratory training may have little or no difference on physical function
7 Critical				

<p><b>Physical function</b> End of follow-up</p> <p>Based on data from 134 patients in 2 studies.</p> <p>7 Critical</p>	<p>Retention of physical function (balance) was investigated in two included RCTs (134 patients) using the Berg Balance scale, where training occurred during usual care. The results favoured training but were not statistically significant (MD 0.04, 95% CI -2.48 to 2.56).</p>	<p><b>Very Low</b> Due to very serious imprecision<sup>39</sup></p>	<p>We are uncertain whether cardiorespiratory training improves or worsens physical function at the end of follow-up</p>
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1. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Incomplete data and/or large loss to follow up ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious . Publication bias: No serious .**
3. **Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Very Serious** . Low number of patients, Only data from one study ; **Publication bias: No serious .**
4. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
5. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious . Publication bias: No serious .**
6. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
7. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious** . Low number of patients ; **Publication bias: No serious .**
8. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
9. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious** . Wide confidence intervals ; **Publication bias: No serious .**
10. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
11. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious** . Wide confidence intervals ; **Publication bias: No serious .**
12. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
13. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious . Publication bias: No serious .**
14. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
15. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious** . Low number of patients ; **Publication bias: No serious .**
16. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
17. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious** . Low number of patients ; **Publication bias: No serious .**
18. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
19. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Very Serious** . Low number of patients, Only data from one study ; **Publication bias: No serious .**
20. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
21. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious** . Wide confidence intervals ; **Publication bias: No serious .**

22. Systematic review [75]. **Baseline/comparator::** Control arm of reference used for intervention .
23. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
24. Systematic review [75].
25. **Risk of bias: Serious** . **Inconsistency: Serious** . The direction of the effect is not consistent between the 4 small trials that included QoL measures ; **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients, Wide confidence intervals ; **Publication bias: No serious** .
26. Systematic review [75].
27. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients, Only data from one study, Wide confidence intervals ; **Publication bias: No serious** .
28. Systematic review [75].
29. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: Serious** . Point estimates vary widely, The direction of the effect is not consistent between the included studies ; **Imprecision: Very Serious** . Low number of patients ; **Publication bias: No serious** .
30. Systematic review [75].
31. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients ; **Publication bias: No serious** .
32. Systematic review [75].
33. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . due to [reason], due to [reason] ; **Indirectness: No serious** . **Imprecision: Very Serious** . Only data from one study, Low number of patients ; **Publication bias: No serious** .
34. Systematic review [75].
35. Systematic review [75].
36. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: Very Serious** . Point estimates vary widely, The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies., The direction of the effect is not consistent between the included studies ; **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals, Low number of patients ; **Publication bias: No serious** .
37. Systematic review [75].
38. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . Differences between the intervention/comparator of interest and those studied ; **Imprecision: Serious** . Wide confidence intervals, Low number of patients ;
39. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . Differences between the intervention/comparator of interest and those studied ; **Imprecision: Very Serious** . Wide confidence intervals, Low number of patients ;

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#### Practice Statement

#### Consensus-based recommendations

- All stroke survivors should commence cardiorespiratory training during their inpatient stay.
- Stroke survivors should be encouraged to participate in ongoing regular physical activity regardless of their level of disability.

## 10.3 - Sitting

Sitting balance difficulties are common after stroke, and sitting balance is a predictor of recovery. Sitting training interventions have included lateral weight transfer training, trunk exercises, body vibration, and practice of reaching beyond arm's length while sitting. The latter, ideally undertaken using everyday tasks (e.g. reaching for a cup) has the strongest theoretical basis and evidence with other approaches having limited or mixed results.

#### Strong Recommendation

For stroke survivors who have difficulty sitting, practising reaching beyond arm's length while sitting with supervision/assistance should be undertaken. (Veerbeek et al. 2014 [95])

#### Practical Info

- Therapists should consider safety of patients with severe weakness.
- Feedback about weight transfer or reaching length should be used to continue to motivate patients.
- Consider incorporating functional training (such as reaching out to pick up a cup from a table).
- For stroke survivors with very weak leg extensors on the affected side, sitting with the person's non-affected hip, shoulder and arm against a wall may be useful for encouraging extensor activity in the affected leg.

#### Key Info

##### Benefits and harms

Small net benefit, or little difference between alternatives

In a systematic review of all interventions aimed at improving sitting balance (6 trials, 150 participants), a significant effect was found only for interventions involving reaching beyond arm's length (Veerbeek et al. 2014 [95]). No harms were noted.

##### Quality of evidence

Low

Best evidence comes from two moderate quality RCTs, but there are many trials of variable quality on this topic.

##### Preference and values

No substantial variability expected

No variation in preferences was found or expected.

##### Resources and other considerations

No important issues with the recommended alternative

##### Implementation considerations

There is currently no clinical indicator for sitting balance collected in the National Stroke Audit. However, a clinical indicator is collected on whether, if a patient was mobilised during the admission, the method of mobilisation involved sitting.



## Rationale

The clearest evidence based on systematic review of multiple studies is for practising reaching beyond arm's length to challenge balance (Veerbeek et al. 2014 [95]). Ideally, this should be undertaken using everyday tasks (e.g. reaching for a cup) to maximise benefits in everyday activities.

### Clinical Question/ PICO

**Population:** Adults with stroke with difficulty with sitting balance  
**Intervention:** Sitting balance training (reaching beyond arms length)  
**Comparator:** Control

### Summary

A systematic review by Veerbeek et al (2014) [95] included a broad range of physical therapy interventions for stroke rehabilitation, including 467 RCTs in total. Limited detail was reported for individual interventions, making it hard to determine the specifics of trials of sitting balance training with reaching beyond arms length. Pooled data from 6 studies (150 participants) showed significant improvements in reach distance, with a non-significant improvement in ground reaction force. A larger effect size for improving reach distance was found when only studies involving reaching beyond arms length (3 trials, 50 participants) were included.

Other systematic reviews have assessed the efficacy of sitting balance training. These are summarized below:

Bank et al (2016) [93] included 11 randomised controlled trials that investigated the addition of physiotherapy treatments to standard physiotherapy. The interventions in the included trials were not specific to sitting balance, including additional trunk exercises and standing exercise. No significant difference was seen on the Trunk Control test when pooling results from 5 trials, while meta-analysis of 4 trials reporting Trunk Impairment Scale results showed a significant improvement following additional physiotherapy. In all, 9 out of 11 trials showed significant improvements on a sitting balance measure. No intervention in the papers included in this systematic review clearly improved sitting balance, although this is not surprising, as no intervention seem to address the underlying problems of sitting balance.

Cabanas-Valdés et al (2013) [99] included 11 trials of trunk training exercises, with interventions including sitting training or trunk exercises. Specific details of the interventions were unclear. No meta-analysis was conducted due to small numbers of participants and variation in outcomes, but the review concluded that trunk training exercises improved sitting balance.

Sorinola et al (2014) [96] included 6 randomised trials with 155 subjects in a systematic review of trials adding trunk exercises to conventional rehabilitation. Meta-analysis showed no significant differences on trunk performance, standing balance and functional independence, but a significant improvement of walking ability. It is possible that the improvements in standing balance and walking found in this review have nothing to do with the intervention. From a task specificity perspective it is improbable that training trunk muscles will improve standing or walking as the muscles of the base of support in sitting are different from those involved in standing and walking. These findings might be a factor of the low subject numbers (28 and 34 respectively) in the intervention groups and variability.

Dae-Sik et al (2014) [97] reviewed 6 trials of lumbar stabilisation. No meta-analysis was performed but the authors concluded that lumbar stabilisation exercises improve balance.

Subsequent to these systematic reviews, 3 recent small randomised trials have assessed interventions such as training on a tilted platform, weight-shift training and combined TENS and task-related trunk training (Fujino et al 2016 [100]; Chan et al 2015 [94]; Kim et al 2014 [98]). These small trials provide limited evidence for the effects of the interventions on sitting balance.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates	Plain text summary
		Control	Sitting balance		

			(Quality of evidence)	
<b>Sitting while reaching beyond arms length</b>	Measured by: Reach distance, sitting equilibrium test High better Based on data from: 50 patients in 3 studies. (Randomized controlled) Follow up Unclear	Difference: <b>SMD 2.47 higher</b> ( CI 95% 0.84 higher - 4.11 higher )	<b>Moderate</b> Due to serious imprecision, Due to serious inconsistency <sup>1</sup>	Sitting balance probably improves sitting while reaching beyond arms length
7 Critical				
<b>Ground reaction force</b>	High better Based on data from: 50 patients in 6 studies. (Randomized controlled) Follow up Unclear	Difference: <b>SMD 4.18 higher</b> ( CI 95% 0.17 lower - 8.53 higher )	<b>Low</b> Due to serious imprecision, Due to serious inconsistency <sup>2</sup>	Sitting balance may have little or no difference on ground reaction force
7 Critical				

1. **Inconsistency: No serious** . The magnitude of statistical heterogeneity was high, with  $I^2$ :74% . ; **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals, Low number of patients ; **Publication bias: No serious** .
2. **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with  $I^2$ :94% . ; **Indirectness: No serious** . Early rehabilitation phase only ; **Imprecision: Serious** . Wide confidence intervals, Low number of patients ; **Publication bias: No serious** .

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## 10.4 - Standing up

The ability to transfer from sitting to standing (and then walking) is an important aspect of functioning after a stroke. Therapy generally includes practice standing up, along with other interventions (e.g. strength training). Practising standing up can be done to combine strength training for leg muscles along with functional practice. Two Cochrane reviews have been undertaken in this area including repetitive task practice (French et al. 2007 [135]) and general interventions to improve sit-to-stand (Pollock et al. 2014 [97]). Other interventions such as biofeedback can be used to enhance training and improve standing up (Stanton et al. 2011 [105]).

### Strong Recommendation

For stroke survivors who have difficulty in standing up from a chair, practice of standing up should be undertaken. (Pollock et al. 2014 [101]; French et al. 2016 [139])

### Practical Info

The specific type of physiotherapy intervention selected probably makes little or no difference to the improvement in time taken to sit-to-stand (or sit-to-walk). Feedback on the number of repetitions per session/day, and time to complete a specific number of sit-to-stands may help to motivate patients, and provide a measure of change. For people who are very weak, consider using a tilt-table to enable extensor activity in the person's affected leg, in preparation for standing from a high plinth or chair.

### Key Info

#### Benefits and harms

Substantial net benefits of the recommended alternative

Sit-to-stand training does not seem to increase falls, therefore benefits outweigh harms. A previous Cochrane review (French et al. 2007 [139]) found moderate benefits for repetitive task practice (SMD 0.35), with a more recent Cochrane review (Pollock et al. 2014 [101]) in agreement.

#### Quality of evidence

Low

Quality of evidence was moderate to low.

#### Preference and values

No substantial variability expected

No substantial variability in preference anticipated.

#### Resources and other considerations

No important issues with the recommended alternative

#### Implementation considerations

A clinical indicator is collected in the National Stroke Audit to determine if a patient was mobilised during their admission and whether the method of mobilisation involved standing.

### Rationale

One previous Cochrane review (French et al. 2007 [139]) and one additional Cochrane review (Pollock et al. 2014 [101]) found specific sit-to-stand training improves the ability to stand up from sitting. Sit-to-stand practice is often included as a key part of other interventions, e.g. task-specific walking training and circuit class therapy.

### Clinical Question/ PICO

**Population:** Adults with stroke

**Intervention:** Interventions for improving sit to stand  
**Comparator:** Control

### Summary

In a Cochrane review, Pollock et al (2014) [97] assessed interventions for improving sit-to-stand ability after stroke. 13 trials with 603 total participants were included, Interventions used in the trials included repetitive sit-to-stand training, exercise programs that included sit-to-stand training, sitting training and augmented feedback. Only 1 study with high risk of bias (N = 48) used ability to sit-to-stand independently as an outcome, reporting significantly increased odds of independent standing following training (OR 4.86, 95% CI 1.43 to 16.50). Other measurements such as time taken to stand or lateral symmetry were reported in 7 and 5 trials respectively, and both showed significant improvements. The review authors concluded that there was moderate quality evidence that interventions improved time taken to sit-to-stand and lateral symmetry, but insufficient evidence to assess the benefits on standing independently.

One previous Cochrane review (including seven randomised controlled trials) found repetitive task-specific training has consistent, moderate benefits on the ability to stand from sitting (SMD 0.35, 95% CI 0.13–0.56).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Interventions for improving sit to stand		
<b>Ability to sit-to-stand independently</b> Until hospital discharge  8 Critical	Odds Ratio 4.86 (CI 95% 1.43 - 16.5) Based on data from 48 patients in 1 studies. <sup>1</sup> (Randomized controlled) Follow up Until hospital discharge	<b>304</b> per 1000	<b>680</b> per 1000	<b>Low</b> Due to serious risk of bias, Due to serious imprecision, single study only <sup>2</sup>	Repetitive task specific training may slightly improve the ability to sit to stand independently
<b>Falls (number of participants falling)</b> During intervention  8 Critical	Odds Ratio 0.75 (CI 95% 0.46 - 1.22) Based on data from 319 patients in 5 studies. <sup>3</sup> (Randomized controlled) Follow up 2 to 12 weeks	<b>386</b> per 1000	<b>320</b> per 1000	<b>Moderate</b> Due to serious risk of bias <sup>4</sup>	There is probably little or no difference in falls between those undergoing sit to stand training and controls.
<b>Time taken to sit-to-stand or sit-to-walk</b> Follow-up after less than 6 months  8 Critical	Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 8 patients in 1 studies. <sup>5</sup> (Randomized controlled) Follow up 2 months	Difference: <b>SMD 0.15 lower</b> ( CI 95% 1.54 lower - 1.24 higher )		<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>6</sup>	There may be little or no difference between those who underwent sit to stand training and controls at follow up after less than 6 months

<p><b>Time taken to sit-to-stand or sit-to-walk</b> Follow-up after 6 months or more  8 Critical</p>	<p>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 141 patients in 3 studies.<sup>7</sup> (Randomized controlled) Follow up &gt; 6 months</p>	<p>Difference: <b>SMD 0.48 lower</b> ( CI 95% 0.88 lower - 0.08 lower )</p>	<p><b>Low</b> Due to serious risk of bias; a single low quality study (Cheng) significantly influences overall confidence in pooled outcomes<sup>8</sup></p>	<p>Sit to stand training may slightly improve performance at follow up after 6 months or more compared to controls</p>	
<p><b>Time taken to stand or walk - Repetitive sit-to-stand interventions</b> Post-intervention  7 Critical</p>	<p>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 104 patients in 3 studies.<sup>9</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>		<p>Difference: <b>SMD 0.57 lower</b> ( CI 95% 0.96 lower - 0.17 lower )</p>	<p><b>Moderate</b> Due to serious risk of bias and influence of a single low quality study (Cheng)<sup>10</sup></p>	<p>Repetitive sit-to-stand interventions probably decrease time taken to sit-to-stand or sit-to-walk</p>
<p><b>Time taken to stand or walk - Exercise programme interventions</b> Post-intervention  7 Critical</p>	<p>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 231 patients in 4 studies.<sup>11</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>		<p>Difference: <b>SMD 0.22 lower</b> ( CI 95% 0.56 lower - 0.12 higher )</p>	<p><b>Moderate</b> Due to serious risk of bias in 2 of 4 studies<sup>12</sup></p>	<p>Exercise programme interventions probably have little or no difference on time taken to sit-to-stand or sit-to-walk</p>
<p><b>Time taken to sit-to-stand or sit-to-walk - 2 to 3 weeks of treatment</b> Post-intervention  8 Critical</p>	<p>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 72 patients in 2 studies.<sup>13</sup> (Randomized controlled) Follow up 2 to 3 weeks of treatment</p>		<p>Difference: <b>SMD 0.67 lower</b> ( CI 95% 1.15 lower - 0.19 lower )</p>	<p><b>Low</b> Due to serious risk of bias, Due to serious imprecision<sup>14</sup></p>	<p>Interventions lasting 2 to 3 weeks may decrease time taken to sit-to-stand or sit-to-walk</p>
<p><b>Time taken to sit-to-stand or sit-to-walk - 4 weeks of treatment</b> Post-intervention  7 Critical</p>	<p>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 71 patients in 3 studies.<sup>15</sup> (Randomized controlled) Follow up 4 weeks of treatment</p>		<p>Difference: <b>SMD 0.49 lower</b> ( CI 95% 0.96 lower - 0.01 lower )</p>	<p><b>Moderate</b> Due to serious risk of bias<sup>16</sup></p>	<p>Interventions lasting 4 weeks probably decrease time taken to sit-to-stand or sit-to-walk</p>

<p><b>Time taken to sit-to-stand or sit-to-walk - 12 weeks of treatment</b> Post-intervention 7 Critical</p>	<p>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 60 patients in 1 studies.<sup>17</sup> (Randomized controlled) Follow up 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.36 lower</b> ( CI 95% 0.87 lower - 0.15 higher )</p>	<p><b>Low</b> Due to serious risk of bias, Due to serious imprecision<sup>18</sup> Interventions lasting 12 weeks may decrease time taken to stand or walk</p>
<p><b>Time taken to sit-to-stand or sit-to-walk - 3 sessions per week</b> Post-intervention 7 Critical</p>	<p>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 101 patients in 3 studies.<sup>19</sup> (Randomized controlled) Follow up 4 to 12 weeks of treatment</p>		<p><b>Moderate</b> Due to serious risk of bias<sup>20</sup> Interventions with 3 sessions per week probably decrease time taken to sit-to-stand or sit-to-walk</p>
<p><b>Time taken to sit-to-stand or sit-to-walk - 5 sessions per week</b> Post-intervention 7 Critical</p>	<p>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 102 patients in 3 studies.<sup>21</sup> (Randomized controlled) Follow up 2 to 4 weeks of treatment</p>		<p><b>Moderate</b> Due to serious risk of bias<sup>22</sup> Interventions with 5 sessions per week probably decrease time taken to sit-to-stand or sit-to-walk</p>
<p><b>Lateral symmetry - Repetitive sit-to-stand interventions</b> Post-intervention 7 Critical</p>	<p>Measured by: Symmetry of weight distribution, lateral movement of centre of pressure during sit-to-stand High better Based on data from: 84 patients in 3 studies.<sup>23</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>		<p><b>Low</b> Due to serious risk of bias and influence of a single low-quality study (Cheng 2001), Due to serious imprecision<sup>24</sup> Repetitive sit-to-stand interventions may improve lateral symmetry</p>
<p><b>Lateral symmetry - Exercise programme interventions</b> Post-intervention 7 Critical</p>	<p>Measured by: Symmetry of weight distribution High better Based on data from: 9 patients in 1 studies.<sup>25</sup> (Randomized controlled) Follow up 3 weeks of treatment</p>		<p><b>Very Low</b> Due to serious risk of bias, Due to very serious imprecision<sup>26</sup> We are uncertain whether exercise programme interventions improve or worsen lateral symmetry</p>

<p><b>Lateral symmetry - Sitting training interventions</b> Post-intervention  7 Critical</p>	<p>Measured by: Symmetry of weight distribution High better Based on data from: 12 patients in 1 studies.<sup>27</sup> (Randomized controlled) Follow up 2 weeks of treatment</p>	<p>Difference: <b>SMD 2.11 higher</b> ( CI 95% 0.58 higher - 3.64 higher )</p>	<p><b>Low</b> Due to very serious imprecision<sup>28</sup>  Sitting training interventions may improve lateral symmetry</p>
<p><b>Lateral symmetry - 2 to 3 weeks of treatment</b> Post-intervention  7 Critical</p>	<p>Measured by: Symmetry of weight distribution, lateral movement of centre of pressure during sit-to-stand High better Based on data from: 84 patients in 3 studies.<sup>29</sup> (Randomized controlled) Follow up 2 to 3 weeks of treatment</p>	<p>Difference: <b>SMD 1.02 higher</b> ( CI 95% 0.21 higher - 1.83 higher )</p>	<p><b>Low</b> Due to serious risk of bias, Due to serious imprecision<sup>30</sup>  Interventions lasting 2 to 3 weeks may improve lateral symmetry</p>
<p><b>Lateral symmetry - 4 weeks of treatment</b> Post-intervention  7 Critical</p>	<p>Measured by: Symmetry of weight distribution, lateral movement of centre of pressure during sit-to-stand High better Based on data from: 21 patients in 2 studies.<sup>31</sup> (Randomized controlled) Follow up 4 weeks of treatment</p>	<p>Difference: <b>SMD 0.86 higher</b> ( CI 95% 0.14 lower - 1.86 higher )</p>	<p><b>Very Low</b> Due to serious risk of bias, Due to very serious imprecision<sup>32</sup>  We are uncertain whether interventions lasting 4 weeks improve lateral symmetry</p>
<p><b>Lateral symmetry - 3 sessions per week</b> Post-intervention  7 Critical</p>	<p>Measured by: Symmetry of weight distribution, lateral movement of centre of pressure during sit-to-stand High better Based on data from: 21 patients in 2 studies.<sup>33</sup> (Randomized controlled) Follow up 4 weeks of treatment</p>	<p>Difference: <b>SMD 0.86 higher</b> ( CI 95% 0.14 lower - 1.86 higher )</p>	<p><b>Very Low</b> Due to serious risk of bias, Due to very serious imprecision<sup>34</sup>  We are uncertain whether interventions with 3 sessions per week improve lateral symmetry</p>
<p><b>Lateral symmetry - 5 sessions per week</b> Post-intervention</p>	<p>Measured by: Symmetry of weight distribution, lateral movement of centre of pressure during sit-to-stand High better Based on data from: 84</p>	<p>Difference: <b>SMD 1.02 higher</b> ( CI 95% 0.21 higher - 1.83 higher )</p>	<p><b>Low</b> Due to serious risk of bias, Due to serious imprecision<sup>36</sup>  Interventions with 5 sessions per week may improve lateral symmetry</p>

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7 Critical	patients in 3 studies. <sup>35</sup> (Randomized controlled) Follow up 2 to 3 weeks of treatment
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1. Systematic review [101] with included studies: Barreca 2004. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Only data from one study, Wide confidence intervals ; **Publication bias: No serious** .
3. Systematic review [101] with included studies: Barreca 2004, Mead 2007, Dean 2007, Cheng 2001, FLASSH 2012. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias possibly in 3 of 5 studies ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
5. Systematic review [101] . **Baseline/comparator::** Control arm of reference used for intervention .
6. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients, Wide confidence intervals, Only data from one study ; **Publication bias: No serious** .
7. Systematic review [101] . **Baseline/comparator::** Control arm of reference used for intervention .
8. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias in Cheng and Mead studies ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
9. Systematic review [101] . **Baseline/comparator::** Control arm of reference used for intervention .
10. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias in Cheng study, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
11. Systematic review [101] . **Baseline/comparator::** Control arm of reference used for intervention .
12. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias in two of four studies ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
13. Systematic review [101] . **Baseline/comparator::** Control arm of reference used for intervention .
14. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Data from a single low quality study significantly influences pooled data ; **Publication bias: No serious** .
15. Systematic review [101] . **Baseline/comparator::** Control arm of reference used for intervention .
16. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
17. Systematic review [101] . **Baseline/comparator::** Control arm of reference used for intervention .
18. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Only data from one study ; **Publication bias: No serious** .
19. Systematic review [101] . **Baseline/comparator::** Control arm of reference used for intervention .
20. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .



21. Systematic review [101]. **Baseline/comparator::** Control arm of reference used for intervention .
22. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
23. Systematic review [101]. **Baseline/comparator::** Control arm of reference used for intervention .
24. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias in Cheng study, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
25. Systematic review [101]. **Baseline/comparator::** Control arm of reference used for intervention .
26. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Wide confidence intervals, Only data from one study, Low number of patients ; **Publication bias: No serious** .
27. Systematic review [101]. **Baseline/comparator::** Control arm of reference used for intervention .
28. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients, Wide confidence intervals, Only data from one study ; **Publication bias: No serious** .
29. Systematic review [101]. **Baseline/comparator::** Control arm of reference used for intervention .
30. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
31. Systematic review [101]. **Baseline/comparator::** Control arm of reference used for intervention .
32. **Risk of bias: Serious** . Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients, Wide confidence intervals ; **Publication bias: No serious** .
33. Systematic review [101]. **Baseline/comparator::** Control arm of reference used for intervention .
34. **Risk of bias: Serious** . Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients, Wide confidence intervals ; **Publication bias: No serious** .
35. Systematic review [101]. **Baseline/comparator::** Control arm of reference used for intervention .
36. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

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## 10.5 - Standing balance

Standing balance is an important determinant of performance of activities of daily living, which is a strong predictor of functional recovery and walking capacity and an important risk factor for falls (van Duijnhoven et al. 2016 [115]). Often after stroke, patients regain their standing balance however not always to full capacity, and with ongoing difficulty with postural sway, weight transference, and maintaining their balance

in standing when influenced by external forces. These limitations can then impact on a person's ability to reach their goals in other areas of their physical rehabilitation (van Duijnhoven et al. 2016 [115]).

### Strong Recommendation

For stroke survivors who have difficulty standing, task-specific practice of standing balance should be provided (French et al. 2016 [173]). Strategies could include:

- practising functional tasks while standing (van Duijnhoven et al. 2016 [119]);
- walking training that includes challenge to standing balance (e.g. overground walking, obstacle courses) (van Duijnhoven et al. 2016 [119]);
- providing visual or auditory feedback (Veerbeek et al. 2014 [95]; Stanton et al. 2011 [109]).

### Practical Info

Standing balance training should include practice of functional tasks or weight-shifting in standing as well as over-ground walking training. A range of modalities to achieve this could be used, including virtual reality (Wii Fit) and Tai Chi as long as the exercises are active, conducted in standing and challenge the balance system. Activities should be performed without hand support where possible.

While few adverse events are reported in the literature, care should be taken to minimise the risk of falls during balance training.

### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

Modest benefits have been reported in a large meta-analysis (Veerbeek et al. 2014 [95]) for task-specific practice, and another meta-analysis showed modest benefits for interventions involving functional standing and weight-shifting activities or walking training (van Duijnhoven et al. 2016 [119]). It has been shown that balance training on an unstable surface may lead to greater improvements in balance as compared to training on a stable surface. In a randomised control trial (Miklitsch et al. 2013 [113]), training on a mini-trampoline led to 7 points greater improvement in Berg Balance Scale result as compared to training on the ground. Providing feedback has also been shown to be beneficial for measures of balance (Stanton et al. 2011 [109]; Veerbeek et al. 2014 [95]). There are no reported harms of balance training.

#### Quality of evidence

Moderate

The quality of the evidence for this recommendation is moderate.

#### Preference and values

No substantial variability expected

Practice balancing in standing would be expected by most patients who have difficulty with balance. It is also seen as usual clinical practice.

#### Resources and other considerations

Factors not considered

### Rationale

Several systematic reviews (van Duijnhoven et al. 2016 [119]; Verbeek et al. 2014 [95], English et al. 2010 [111]) have reported that exercise training that includes either practising functional tasks in standing, weight-shifting or walking training that includes a balance challenge (but not treadmill training with body-weight support or robotics) improves standing balance. Such training may also improve balance self-efficacy.

In a randomised control trial (Miklitsch et al. 2013 [113]), training on a mini-trampoline lead to 7 points greater improvement in Berg Balance Scale result as compared to training on the ground.

There is somewhat conflicting evidence for the use of biofeedback in standing balance training. A systematic review of randomised trials of biofeedback by Stanton et al. (2011) [131] included 22 trials. A meta-analysis that pooled various standing and balance measures showed that lower limb activities were significantly improved following biofeedback (SMD 0.49, 95% CI 0.22 to 0.75). Another systematic review with meta-analysis by Veerbeek et al. (2014) [95] found that biofeedback led to a significant improvement in postural sway but not functional measures of balance.

The review by van Duijnhoven et al (2016) [119] included two RCTs that included Tai Chi as an intervention, both of which found positive effects in balance measures. There is currently insufficient evidence (two RCTs with equivocal results) to support the use of yoga for balance training. (Schmid et al 2012 [114]; Youkhana et al 2016 [118])

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## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Biofeedback  
**Comparator:** Control

### Summary

A systematic review of randomised trials of biofeedback by Stanton et al (2011) [105] included 22 trials. Biofeedback interventions used in the trials included giving visual or auditory feedback on ground reaction force using a force platform, visual or auditory feedback on muscle activity using EMG, and joint position via an electrogoniometer. Control groups mostly received usual therapy, although in 3 trials they received no treatment. A meta-analysis that pooled various standing and balance measures showed that lower limb activities were significantly improved following biofeedback (SMD 0.49, 95% CI 0.22 to 0.75).

Another systematic review with meta-analysis by Veerbeek et al (2014) [95] also investigated the effects of the use of biofeedback in training standing balance. It was found that biofeedback leads to a significant improvement in postural sway in chronic stroke. It was found that biofeedback did not significantly improve balance, gait velocity or basic ADLs.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Biofeedback		
<b>Standing</b> Post-intervention (3 to 8 weeks treatment)	Measured by: Pooled data: Directional control during reaching in standing, Berg Balance Scale, Rivermead Mobility Index, gross motor subscale of Rivermead Motor Assessment & balance component of Fugal- Meyer-Lindmark High better Based on data from: 125 patients in 5 studies. <sup>1</sup> (Randomized controlled) Follow up 2-8 weeks		Difference: <b>SMD 0.42 higher</b> ( CI 95% 0.05 higher - 0.78 higher )	<b>Low</b> Due to serious inconsistency, Due to serious risk of bias <sup>2</sup>	Biofeedback may improve standing

1. Systematic review [109] . **Baseline/comparator::** Control arm of reference used for intervention . **Supporting references:** [131],
2. **Risk of bias: Serious** . Median PEDro score of included studies was 4.5. Concealment of allocation during randomization process only occurred in 9% of trials, blinding of assessors in 41% and only 9% had intention-to-treat analysis. ; **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with I2: 69%. ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** . The Systematic review used did not search for gray literature ;

## References

[109] Stanton R., Ada L., Dean CM, Preston E. : Biofeedback improves activities of the lower limb after stroke: a systematic review. Journal of Physiotherapy 2011;57(3):145-155 [Pubmed Journal](#)

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Exercise training  
**Comparator:** Control

## Summary

A systematic review and meta-analysis by van Duijnhoven et al (2016) [115] investigated the effects of exercise interventions (including functional standing and weight shifting activities, yoga, Tai Chi, walking training, virtual reality training and high-intensity aerobic training). There was an overall positive benefit of exercise therapy on improving functional measures of balance including the Berg Balance Scale, the Functional Reach Test and the Sensory Organisation Test, with both immediate (post-

intervention) and sustained effects (1 to 5 months follow-up) . There was a differential effect based on type of intervention with functional standing and weight shifting activities (including Tai Chi), virtual reality and walking training showing a positive effect, but not high-intensity aerobic training. Studies that included treadmill training with body-weight support or robotic training did not show improvements in balance.

A systematic review by Tang et al (2015) [115] included 9 RCTs of any balance intervention and that included a measure of balance self-efficacy. They found significant effects in favour of active exercise interventions improving balance self-efficacy immediately after intervention (SMD 0.44, 95% CI 0.11 to 0.77) but not at follow-up (SMD 0.32, 95% CI -0.17-0.80). The review included four studies that used mental imagery as the intervention, and these did not lead to an improvement in balance self-efficacy (SMD SMD 0.68, 95% CI -0.33-1.69).

An earlier review by Veerbeek et al (2014) [68] also found positive effects for balance training during functional activities. The summary effect size was significant for balance (0.355 (0.067-0.642), power= 0.863, I<sup>2</sup> = 51%) and for basic ADL performance (0.383 (0.113-0.653), power = 0.660 (inadequate). It was not significant for comfortable gait speed (0.313 (-0.100-0.726), power = 0.244 (inadequate)). The same review found standing balance training *without* biofeedback (standing on surfaces of different compliance with eyes open +/- closed, or standing in a frame) did not produce significant positive effects.

A Cochrane review by English et al (2010) [111] investigated the effect of circuit class therapy on walking speed and balance. Most of the subjects could walk 10m without assistance. Circuit class therapy was classified as group therapy involving functional task specific training with the aim of improving mobility. For the outcome balance, circuit class therapy was shown to significantly improve step test results (MD, fixed 3.00 steps, 95% CI 0.08 to 5.91, P = 0.04) but did not significantly improve Berg Balance (MD, fixed 0.86, 95% CI -1.02 to 2.74, P = 0.37).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Exercise training		
<p><b>Balance</b> Post intervention  7 Critical</p>	<p>Measured by: Berg Balance Scale High better Based on data from: 985 patients in 28 studies. (Randomized controlled)</p>		<p>Difference: <b>MD 2.22 higher</b> ( CI 95% 1.26 higher - 3.17 higher )</p>	<p><b>Moderate</b> Due to serious inconsistency (significant heterogeneity). Subgroup analyses showed significant improvements following balance, weight-shifting and gait training interventions but not high intensity aerobic training.<sup>1</sup></p>	<p>Exercise training probably improves balance</p>

1. **Risk of bias: No serious** . The included trials were of moderate to high quality (PEDro scores 4 to 9) ; **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with I<sup>2</sup>: 52% ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .

## References

[96] Sorinola IO, Powis I., White CM : Does additional exercise improve trunk function recovery in stroke patients? A meta-analysis. *Neurorehabilitation* 2014;35(2):205-213 [Journal Website](#)

[110] Veerbeek JM, Van Wegen E., Van Peppen R., Van Der Wees PJ, Hendriks E., Rietberg M., Kwakkel G. : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis. *PLoS ONE* 2014;9(2): [Pubmed Journal](#)

[111] English C, Hillier SL : Circuit class therapy for improving mobility after stroke. *Cochrane Database of Systematic Reviews* 2010;(7):CD007513 [Pubmed Journal](#)

[112] Cabanas-Valdes R., Cuchi GU, Bagur-Calafat C. : Trunk training exercises approaches for improving trunk performance and functional sitting balance in patients with stroke: A systematic review. *Neurorehabilitation* 2013;33(4):575-592 [Journal Website](#)

[119] van Duijnhoven HJR, Heeren A, Peters MAM, Veerbeek JM, Kwakkel G, Geurts ACH, Weerdesteyn V : Effects of Exercise Therapy on Balance Capacity in Chronic Stroke: Systematic Review and Meta-Analysis. *Stroke; a journal of cerebral circulation* 2016;47(10):2603-10 [Pubmed Journal](#)

## Clinical Question/ PICO

**Population:** Adults with Stroke  
**Intervention:** Balance training on dynamic surface  
**Comparator:** Control (Balance training on stable ground)

## Summary

A high-quality randomised controlled trial by Miklitsch et al (2013) [109] (PEDRo score =8) showed that Timed Up and Go performance did not significantly improve with balance training on a dynamic surface as compared to a stable surface. The dynamic surface group improved their Timed Up and Go performance by 10.12s (SD = 8) and the control group improved by a mean of 7.23s (SD = 11) with a between-group difference of 2.89s (P = 0.100)

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control (Balance training on stable ground)	Balance training on dynamic surface		
<b>Balance</b> <sup>1</sup> Post intervention  7 Critical	Measured by: Berg Improvement from baseline on Balance Scale: Scale: 0-56 High better Based on data from: 40 patients in 1 studies. <sup>2</sup> (Randomized controlled) Follow up 3 weeks of treatment	<b>5</b> points (Median)	<b>12</b> points (Median)	<b>Moderate</b> The difference between groups was significant. Due to serious imprecision- low sample size and single study only. <sup>3</sup>	Balance training on a dynamic surface (e.g. mini trampoline) probably leads to greater improvements in balance than training on a stable surface (e.g. ground).
		Difference: <b>7 higher</b> CI 95%			

<p><b>Mobility</b> Post intervention</p> <p>7 Critical</p>	<p>Measured by: Improvement from baseline in six minute walk test (6MWT) High better Based on data from: 40 patients in 1 studies.<sup>4</sup> (Randomized controlled) Follow up 3 weeks of treatment</p>	<p><b>75</b> metres (Mean)</p> <p><b>135</b> metres (Mean)</p> <p>Difference: <b>MD 60 higher</b> CI 95%</p>	<p><b>Moderate</b> The difference between-groups was not significant. Due to serious imprecision- low sample size and single study only.<sup>5</sup></p>	<p>Balance training on a dynamic surface probably has little or no difference on mobility</p>
<p><b>ADL</b> Post intervention</p> <p>7 Critical</p>	<p>Measured by: Improvement from baseline in Barthel Index Scale: 0-20 High better Based on data from: 40 patients in 1 studies.<sup>6</sup> (Randomized controlled) Follow up 3 weeks of treatment</p>	<p><b>13</b> points (Mean)</p> <p><b>20</b> points (Mean)</p> <p>Difference: <b>7 higher</b> CI 95%</p>	<p><b>Moderate</b> The difference between-groups was not significant. Due to serious imprecision- due to low sample size and single study only.<sup>7</sup></p>	<p>Balance training on a dynamic surface probably has little or no difference on ADLs</p>

1. Balance measured with Berg Balance Scale
2. Primary study [113]. **Baseline/comparator::** Control arm of reference used for intervention [113].
3. **Risk of bias: No serious** . Lack of blinding of participants and therapists providing the intervention resulting in potential for performance bias. (PEDro = 8/10) ; **Inconsistency: No serious** . **Indirectness: No serious** . Participants were very high functioning (independent standing ability for a minimum of 2 minutes, able to walk with or without walking aids) ?generalisability ; **Imprecision: Serious** . Only data from one study, Only data from one study, Low number of patients ; **Publication bias: No serious** .
4. Primary study [113]. **Baseline/comparator::** Control arm of reference used for intervention [113].
5. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and therapists, resulting in potential for performance bias (PEDro = 8/10) ; **Inconsistency: No serious** . **Indirectness: No serious** . Participants were very high functioning (independent standing ability for a minimum of 2 minutes, able to walk with or without walking aids) ?generalisability ; **Imprecision: Serious** . Only data from one study, Low number of patients ; **Publication bias: No serious** .
6. Primary study [113]. **Baseline/comparator::** Control arm of reference used for intervention . **Supporting references:** [113],
7. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and therapists, resulting in potential for performance bias (PEDro = 8/10). ; **Inconsistency: No serious** . **Indirectness: No serious** . Participants were very high functioning (independent standing ability for a minimum of 2 minutes, able to walk with or without walking aids) ?generalisability ; **Imprecision: Serious** . Only data from one study, Low number of patients ; **Publication bias: No serious** .

## References

[113] Miklitsch C, Krewer C, Freivogel S, Steube D : Effects of a predefined mini-trampoline training programme on balance, mobility and activities of daily living after stroke: a randomized controlled pilot study.. Clinical rehabilitation 2013;27 939-947  
[Journal](#)

### Weak Recommendation

For stroke survivors who have difficulty with standing balance, virtual reality including treadmill training with virtual reality or use of Wii Balance Boards may be used. (Corbetta et al. 2015 [103])

### Practical Info

Virtual reality is defined as "an advanced form of human-computer interface that allows the user to 'interact' with and become 'immersed' in a computer-generated environment in a naturalistic fashion" (Corbetta et al. 2015 [103]). Examples of interventions include treadmill training with virtual reality and training with Wii Balance Board.

### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

Virtual reality probably has a small benefit on balance (Berg Balance Scale increase of 2.1 points: 95% CI = 1.8–2.5 points) and may have a small benefit on mobility (Timed Up and Go test improvement of 2.3 seconds: 95% CI = 1.2–3.4 lower) (Corbetta et al. 2015 [103]).

Studies either reported no adverse events (Corbetta et al. 2015 [103]) or minor adverse events only (e.g. dizziness, headache, pain or increases in spasticity) (Laver et al. 2015 [108]; Cheek et al. 2015 [106]).

#### Quality of evidence

Moderate

In the systematic review with meta-analysis (Corbetta et al. 2015 [103]) there was some risk of bias due to unclear allocation procedure in half of the included studies and randomisation being unclear in 3/15 studies.

#### Preference and values

No substantial variability expected

People with stroke are unlikely to have strong preferences for use of virtual reality.

#### Resources and other considerations

Important issues, or potential issues not investigated

##### Resource considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

### Rationale

One meta-analysis (Corbetta et al. 2015 [103]) has reported that virtual reality training (including treadmill training with virtual reality and training with a Wii Balance Board) results in small improvements in standing balance.

### Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Virtual reality  
**Comparator:** Control

### Summary

The meta-analysis by Corbetta et al (2015) [76] found a positive effect of virtual reality training on the Berg Balance Scale (MD



2.1, 95% CI 1.8 to 2.5) and the Timed Up and Go (MD 2.3 seconds faster, 95% CI 1.2 to 3.4 seconds faster). Similarly, a systematic review by Cheek et al (2015) [79] examined the use of virtual reality provided through use of Wii balance board with Wii Fit software in addition to standard care (i.e. extra therapy time). This significantly improved mobility with TUG SMD 0.81 (0.29-1.33,  $p=0.002$ ,  $I^2=0\%$ ) but did not significantly improve balance ( $I^2=51\%$ ).

Two additional low quality randomised controlled trials (Lee et al (2015) [78]; Yatar et al (2015) [80]) reported significant improvements in balance after Wii balance board training. These results should be interpreted with caution as both included small sample sizes ( $n=24$  and  $n=33$ ) and had serious risk of bias including lack of blinding, lack of concealment and lack of intention to treat.

Despite one systematic review [76] reporting nil adverse effects, minor adverse effects (including transient dizziness, headache, pain, and increases in spasticity) were reported in 2 other reviews (LAVAR and CHEOK).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Virtual reality		
<b>Balance</b> Post-intervention (2-6 weeks of treatment)  7 Critical	Measured by: Berg Balance Scale Scale: 0-56 High better Based on data from: 130 patients in 5 studies. <sup>1</sup> (Randomized controlled) Follow up 2-6 weeks of treatment	Difference: <b>MD 2.1 higher</b> ( CI 95% 1.8 higher - 2.5 higher )		<b>Moderate</b> Due to serious risk of bias. <sup>2</sup>	Virtual reality based training probably improves balance.
<b>Mobility</b> Post-intervention (2-6 weeks of treatment)  7 Critical	Measured by: Timed Up and Go (seconds) Lower better Based on data from: 114 patients in 5 studies. <sup>3</sup> (Randomized controlled) Follow up 2-6 weeks of treatment	Difference: <b>MD 2.3 lower</b> ( CI 95% 1.2 lower - 3.4 lower )		<b>Low</b> Due to serious risk of bias, Due to serious inconsistency <sup>4</sup>	Virtual reality based training may improve mobility.
<b>Adverse Events</b> <sup>5</sup>  7 Critical	Based on data from 341 patients in 15 studies. <sup>6</sup>	Studies did not explicitly report adverse events, but some implied that they were monitored and would have been reported if they occurred.		<b>Moderate</b> Due to serious risk of bias <sup>7</sup>	There were no reported adverse events.

1. Systematic review [103]. **Baseline/comparator::** Control arm of reference used for intervention .

2. **Risk of bias: Serious** . Half of 15 the included trials in the systematic review did not report the allocation process. The randomisation procedure was not clear in 3/15. ; **Inconsistency: No serious** .  $I^2=0\%$  ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .

3. Systematic review [103]. **Baseline/comparator::** Control arm of reference used for intervention .

4. **Risk of bias: Serious** . Half of 15 the included trials in the systematic review did not report the allocation process. The

randomisation procedure was not clear in 3/15. ; **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with  $I^2=84\%$ . When 2 studies with large estimated effect were excluded heterogeneity reduced to  $I^2=0\%$ . ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .

5. There were no reported adverse events

6. Systematic review **Supporting references:** [133],

7. **Risk of bias: Serious** . Half of 15 the included trials in the systematic review did not report the allocation process. The randomisation procedure was not clear in 3/15. ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .

## References

[103] 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. J Physiother 2015;61 117-124 [Pubmed Journal](#)

[104] Ko Y, Ha H, Bae Y-H, Lee W : Effect of space balance 3D training using visual feedback on balance and mobility in acute stroke patients. Journal of Physical Therapy Science 2015;27(5):1593-1596 [Pubmed Journal](#)

[105] Lee HY, Kim YL, Lee SM : Effects of virtual reality-based training and task-oriented training on balance performance in stroke patients. Journal of Physical Therapy Science 2015;27(6):1883-1888 [Pubmed Journal](#)

[106] Cheok G, Tan D, Low A, Hewitt J : Is Nintendo Wii an Effective Intervention for Individuals With Stroke? A Systematic Review and Meta-Analysis. Journal of the American Medical Directors Association 2015;16(11):923-932 [Pubmed Journal](#)

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[108] Laver Kate E., George S, Thomas S, Deutsch Judith E., Crotty M : Virtual reality for stroke rehabilitation. Cochrane Database of Systematic Reviews 2015;(9): [Pubmed Journal](#)

## 10.6 - Walking

Walking difficulty is common after stroke, with 75% of patients reported as unable to mobilise independently on admission to hospital (Stroke Foundation 2015 [8]). Overall there is extensive evidence from many systematic reviews on interventions to improve walking. Reviews tend to focus on specific interventions such as task-specific overground training, cueing of cadence, joint position feedback, electrical stimulation, virtual training, mental practice and use of an orthosis. Alternatively, reviews focus on ways to deliver the interventions, such as circuit class training, treadmill training, electromechanically assisted training, and community-based ambulation training.

This section should be read in conjunction with Weakness and Cardiorespiratory fitness; see also Spasticity and Contracture in the [Managing complications](#) chapter.

### Strong Recommendation

Stroke survivors with difficulty walking should be given the opportunity to undertake tailored repetitive practice of walking (or components of walking) as much as possible. (French et al. 2016 [173])

The following modalities may be used:

- Circuit class therapy (with a focus on overground walking practice) (Veerbeek et al. 2014 [95]);
- Treadmill training with or without body weight support (Mehrholtz et al. 2014 [125]).

### Practical Info

Observational studies and secondary analyses of trial data suggest that stroke survivors spend as little as 10 minutes or less engaged in practice of walking during therapy sessions (Kaur et al. 2012 [140], English et al. 2014 [85]), and overestimation of time spent on activity in therapy is common (Kaur et al. 2013 [70]). Therefore, objective measurement of time spent practising walking using activity monitors, or auditing therapy sessions using video analysis can be useful.

### Key Info

#### Benefits and harms

Substantial net benefits of the recommended alternative

Circuit class therapy improves walking endurance and independence with mobility following stroke (Veerbeek et al. 2014 [60]; English et al. 2010 [111]; van de Port et al. 2012 [124]).

Treadmill training with or without body weight support improves walking endurance and walking speed by a small amount following stroke, without any significant risk of harm (Mehrholtz et al. 2014 [125]). The evidence for treadmill training should be considered as a whole given that both forms – with body weight support and without body weight support – offer similar benefits. The mixed evidence profiles support its use to improve walking when both types are pooled together. However, treadmill training appears beneficial only for people able to walk independently at onset of therapy (Mehrholtz et al. 2014 [125]).

#### Quality of evidence

High

The evidence profile for circuit class therapy and treadmill training was strong, and the certainty of effect estimates was high.

#### Preference and values

No substantial variability expected

#### Resources and other considerations

No important issues with the recommended alternative

##### Implementation considerations

A clinical indicator is collected in the National Stroke Audit to determine if a patient was mobilised during their admission and whether the method of mobilisation involved walking.

### Rationale

One previous high-quality review (French et al. 2007 [139]) found repetitive, task-specific training improved walking distance, speed and ADL. Circuit class therapy and treadmill training are interventions that are supported by systematic reviews, which had high certainty of effect estimates (high-quality evidence profiles) for improving walking ability, probably via providing greater opportunities for walking practice. For this reason, these interventions were grouped and classed as a strong recommendation.

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Virtual reality  
**Comparator:** Usual care

**Summary**

A systematic review by Corbetta et al (2015) [133] assessed the effects of virtual reality based rehabilitation as an addition to or substitute for standard rehabilitation. 15 trials with 341 total participants were included (7 trials and 138 participants for the outcome of walking speed). Virtual reality interventions that replaced some or all standard rehabilitation time led to significantly increased walking speed (MD 0.15 m/s, 95% CI 0.10 to 0.19). Only one small trial assessed virtual reality training as an addition to standard rehabilitation, meaning there was insufficient evidence to assess the benefits on walking speed.

Two other recent systematic reviews (Rodrigues-Baroni et al 2014 [134]; Laver et al 2015 [108]) of randomised controlled trials report conflicting results as to the effect of virtual reality based training on walking speed compared to non-virtual reality based walking interventions. One review (Rodrigues-Baroni et al 2014) which included 7 trials (N=154) of moderate quality, suggests that virtual reality based training improves gait speed among chronic stroke survivors MD 0.15 m/sec, 95% CI (0.05-0.24), a similar result to that found in the Corbetta et al review. In contrast, another review (Laver et al 2015) which included 3 trials (N=58) of low quality, suggests that virtual reality based training does not improve gait speed MD 0.07 m/sec, 95% CI (-0.09 to 0.23). When considering the quality and number of studies included in both reviews, current evidence suggests that virtual reality based training probably improves walking speed among stroke survivors.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Virtual reality		
<b>Walking speed</b> Immediately after intervention	Measured by: Walking speed (m) High better Based on data from: 138 patients in 7 studies. (Randomized controlled) Follow up 2-6 weeks		Difference: <b>MD 0.15 higher</b> ( CI 95% 0.1 higher - 0.19 higher )	<b>High</b>	Virtual reality based rehabilitation improves walking speed.

**References**

[108] Laver Kate E., George S, Thomas S, Deutsch Judith E., Crotty M : Virtual reality for stroke rehabilitation. Cochrane Database of Systematic Reviews 2015;(9): [Pubmed Journal](#)

[133] 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(3):117-24 [Pubmed Journal](#)

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physical therapy 18(6):502-12 [Pubmed Journal](#)

### Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Circuit class therapy  
**Comparator:** Usual care

### Summary

A systematic review by Veerbeek et al (2014) [60] included 8 randomised controlled trials assessing circuit class therapy with 359 total participants. The review covered a broad range of physical therapy interventions and limited detail was provided about the circuit class therapy trials specifically. Meta-analysis showed significant improvements in walking endurance and mobility but no significant difference in walking speed.

A systematic review by English et al (2010) [111] demonstrated that circuit class therapy improved walking distance and capacity on the 6-minute walk test, with a mean difference of 76.57m (95%CI 38.44-114.7), and walking speed mean difference of 0.12 m/s. (95%CI 0.00-0.24). An improvement in walking distance of 76m is a significant and clinically meaningful improvement. The improvement in walking speed of 0.12 is of minimal clinical importance.

A large multicentre randomised control trial by van de Port et al (2012) [124] analysed the effects of circuit training as an alternative to usual physiotherapy after stroke in 250 patients within the outpatient setting. The intervention group received 90-minute sessions, twice weekly for 12 weeks versus usual therapy in the control group. The RCT concluded that circuit training produced faster gait speed of 0.09 m/s (SE 0.02) and increased walking distance of 20 metres (SE 7.4) but this was not significant compared to the control group.

A large 3 armed randomised trial (English et al 2015 [59]) compared three models of physiotherapy service delivery- a 7-day physiotherapy service, 5-day circuit class therapy and usual care. There were no significant differences in walking ability between the groups.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Circuit therapy		
<b>Walking speed</b>	Measured by: 10 metre walk test, Walking speed gait analysis High better Based on data from: 181 patients in 8 studies. (Randomized controlled)	Difference: <b>SMD 0.48 higher</b> ( CI 95% 0.01 lower - 0.96 higher )		<b>High</b>	No statistically significant difference was found. Circuit training did not appear to improve walking speed.

<b>Walking endurance</b> Measured by: 6MWT - 6 minute walk test (walking distance) High better Based on data from: 208 patients in 8 studies. (Randomized controlled)	Difference: <b>SMD 0.57 higher</b> ( CI 95% 0.3 higher - 0.84 higher )	<b>High</b>	Pooling resulted in significant homogeneous positive SEs for walking distance.
<b>Mobility</b> Measured by: RMI, TUG Lower better Based on data from: 259 patients in 8 studies. (Randomized controlled)	Difference: <b>SMD 0.28 lower</b> ( CI 95% 0.04 lower - 0.52 lower )	<b>High</b>	Pooling resulted in significant homogeneous positive SEs for walking ability.

## References

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- [121] Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis.. PloS one 2014;9(2):e87987 [Pubmed Journal](#)
- [124] van de Port IGL, Wevers LEG, Lindeman E, Kwakkel G : Effects of circuit training as alternative to usual physiotherapy after stroke: randomised controlled trial.. BMJ (Clinical research ed.) 2012;344 e2672 [Pubmed Journal](#)

## Clinical Question/ PICO

- Population:** Adults with stroke
- Intervention:** Treadmill (with or without body weight support)
- Comparator:** Usual care (walking training without mechanical assistance)

## Summary

In a Cochrane review, Mehrholz et al (2014) [125] included 44 randomised and quasi-randomised trials (N = 2658) of treadmill training and body weight support, together or in combination. Walking velocity was significantly increased by 0.07 m/s following treadmill training (95% CI 0.01 to 0.12). and walking endurance (MD 26.35m, 95% CI 2.51 to 50.19), but did not significantly increase the chances of walking independently (risk difference 0.0, 95% CI -0.02 to 0.02). The review authors concluded that treadmill training may improve walking speed and walking endurance, with greater benefits for stroke patients who are able to walk already.

A further systematic review (Veerbeek et al 2014 [60]) of randomised controlled trials (RCTs) supports the use of treadmill training to improve multiple gait related functions following stroke. Overall the evidence reported supports the use of treadmill training with or without body weight support to improve walking speed and endurance following stroke.

The effect of treadmill training with body weight support on gait speed and endurance was investigated in 18 randomised controlled trials (N = 1158) with PEDro ratings between 4-8. Participants included in these trials were stroke survivors in either the early or chronic rehabilitation phases with restriction in their walking ability. Significant heterogeneous positive summary effect sizes (SES) were found for comfortable gait speed, SES 0.468, 95% CI 0.107 to 0.829, and for walking endurance, SES 0.606, 95% CI 0.173 to 1.039. Non-significant differences were found for other gait parameters including walking ability and maximum gait speed. The incidence of adverse events was non-significant. Evidence from this review supports the use of body weight supported treadmill training to improve walking speed and endurance following stroke.

The effect of speed-dependent treadmill training without body weight support on gait speed and endurance was investigated in 13 RCT's (N = 610) with PEDro ratings between 4-8. Trials included participants from early, late or chronic rehabilitation phases. Significant heterogeneous positive SESs were found for maximum gait speed, SES 0.236, 95% CI 0.009 to 0.331, whereas no significant differences were found for other gait parameters such as comfortable gait speed, walking endurance or walking ability. The review supports the use of speed-dependent treadmill training to improve walking speed following stroke.

Earlier systematic reviews included fewer trials but generally supported the benefits of treadmill training to improve walking speed or endurance, either in comparison to no treatment or non-walking interventions or overground walking training (Polese et al 2013 [126]; Charalambous et al 2013 [127]; Ada 2010 [128]).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Treadmill (with or without body weight support)		
<b>Walking Endurance</b>	Measured by: Six Minute Walk Test High better Based on data from: 1,388 patients in 20 studies. (Randomized controlled)	<b>203.7</b> meters (Mean)	<b>223.78</b> meters (Mean)	<b>Moderate</b>	Treadmill training (with or without body weight support) significantly improved walking endurance.
<b>Walking Speed</b>	Measured by: Walking speed High better Based on data from: 1,891 patients in 35 studies. (Randomized controlled)	<b>0.59</b> m/s (Mean)	<b>0.66</b> m/s (Mean)	<b>High</b>	Treadmill training (with or without body weight support) significantly improved walking speed by a small to moderate amount.

## References

[121] Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis.. PloS one 2014;9(2):e87987 [PubMed Journal](#)

[125] Merholz J, Pohl M, Elsner B : Treadmill training and body weight support for walking after stroke . The Cochrane Database of Systematic Reviews 2014; [Journal](#)

### Weak Recommendation

For stroke survivors with difficulty walking, one or more of the following interventions may be used in addition to those listed above:

- Virtual reality training. (Corbetta et al. 2015 [133])
- Electromechanically assisted gait training. (Mehrholtz et al. 2013 [129])
- Biofeedback. (Stanton et al. 2011 [131])
- Cueing of cadence. (Nascimento et al. 2015 [130])
- Electrical stimulation. (Howlett et al. 2015 [132])

## Key Info

### Benefits and harms

Substantial net benefits of the recommended alternative

Virtual reality training improves walking speed following stroke (Corbetta et al. 2015 [133]; Rodrigues-Baroni et al. 2014 [134]), although the certainty of effect varies with different reviews (Laver et al. 2015 [108]).

Various types of virtual reality training were included in the reviews that support its use for walking after stroke. The evidence does not support a single type of system, however it does support its use in general. This should be taken into account when considering the evidence.

Electromechanically assisted gait training when used in combination with usual physiotherapy improves independence with mobility after stroke and had low incidence of harm (Mehrholtz et al. 2013 [129]).

Various modes of biofeedback (when all data is pooled) may improve gait parameters after stroke (Stanton et al. 2011 [131]).

Cueing of cadence may improve walking speed after stroke (Nascimento et al. 2015 [130]).

Electrical stimulation when applied functionally may improve walking speed by a small amount (Howlett et al. 2015 [132]).

### Quality of evidence

Low

Electromechanically assisted gait training and electrical stimulation had moderate certainty in effect estimates, while cueing of cadence and biofeedback had low certainty in effect estimates.

### Preference and values

Substantial variability is expected or uncertain

Electromechanically assisted gait training should be used in combination with physiotherapy.

### Resources and other considerations

Important issues, or potential issues not investigated

#### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

#### Implementation considerations

There are clinical indicators collected in the National Stroke Audit on whether a patient's management for a mobility impairment included the cueing of cadence, joint position biofeedback or mechanically assisted gait (via mechanical or robotic device).

## Rationale

Virtual reality training, electromechanically assisted gait training, biofeedback, cueing of cadence and electrical stimulation may improve walking ability, however there is a lower certainty of effect estimates compared to circuit class therapy and treadmill training.



**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Joint position feedback  
**Comparator:** Placebo or usual therapy

**Summary**

A systematic review of biofeedback interventions for improving lower limb activities after stroke included 22 randomised trials (Stanton et al 2011 [127]). Initial analysis showed substantial statistical heterogeneity, so for the final analysis, only 11 higher-quality trials were included. Meta-analysis based on 4 trials with 76 participants showed significant short-term improvements in walking outcomes (SMD 0.57, 95% CI 0.01 to 1.03).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Placebo or usual therapy	Joint position feedback		
Walking ability - various gait parameters (pooled) <sup>1</sup> After intervention	High better Based on data from: 76 patients in 4 studies. (Randomized controlled) Follow up 10 days - 3 months	Difference: <b>SMD 0.57 higher</b> ( CI 95% 0.1 higher - 1.03 higher )		<b>Low</b> Due to serious risk of bias and due to serious inconsistency <sup>2</sup>	Biofeedback (various modes) may improve gait parameters during walking (stride length, base of support, step length etc) however this should be interpreted with caution.

1. Stanton (2011) assessed the effects on walking through a pooled analysis of various gait parameters: weight distribution, step length, stride length, base of support etc.
2. **Risk of bias: Serious**. Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Missing intention-to-treat analysis., Inadequate/lack of blinding of outcome assessors (41% studies had blinded assessors), resulting in potential for detection bias ; **Inconsistency: Serious**. The magnitude of statistical heterogeneity was high, with I<sup>2</sup>:... % ;

**References**

[131] Stanton R, Ada L, Dean CM, Preston E : Biofeedback improves activities of the lower limb after stroke: a systematic review.. Journal of physiotherapy 2011;57(3):145-55 [Pubmed Journal](#)

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Electrical stimulation  
**Comparator:** Control (walking training alone)

**Summary**

A systematic review by Howlett et al (2015) [128] included trials of functional electrical stimulation (FES) for improving upper or lower limb activity compared to placebo, no treatment or training alone. Eighteen trials were included with 485 total participants. Comparing FES to training alone using results from 203 participants in 8 trials showed a significant improvement in walking speed of 0.08 m/s (95% CI 0.02 to 0.15). However, there was a high risk of bias in many of the included trials, with a lack of blinding for outcome assessors and a lack of intention-to-treat analysis.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Control (walking training alone)    Electrical stimulation	Certainty in effect estimates (Quality of evidence)	Plain text summary
<b>Walking speed</b>	Measured by: Walking speed (m/s) High better Based on data from: 203 patients in 8 studies. (Randomized controlled) Follow up 0 months - 24 months	Difference: <b>MD 0.08 higher</b> ( CI 95% 0.02 higher - 0.15 higher )	<b>Moderate</b> 1	FES significantly improves walking speed by a small amount (MD 0.08m/s).

1. **Risk of bias: Serious** . Inadequate/lack of blinding of outcome assessors (only in 50% of trials), resulting in potential for detection bias. Missing intention-to-treat analysis in 84% of trials. ;

**References**

[132] Howlett OA, Lannin NA, Ada L, McKinstry C : Functional electrical stimulation improves activity after stroke: a systematic review with meta-analysis.. Archives of physical medicine and rehabilitation 2015;96(5):934-43 [Pubmed Journal](#)

**Clinical Question/ PICO**

**Population:** Electromechanical-assisted training for walking after stroke  
**Intervention:** Electromechanical assisted gait training in combination with physiotherapy  
**Comparator:** Physiotherapy (or usual care)

**Summary**

Mehrholtz et al (2013) [125] conducted a Cochrane review of electromechanical-assisted interventions for improving walking after stroke. Twenty three trials with 999 total participants were included. Intervention used in the trials used electromechanical or robot-assisted devices in addition to physiotherapy. Participants were significantly more likely to be independent in walking following electromechanical-assisted training (OR 2.39, 95% CI 1.67 to 3.43), with subgroup analyses suggesting that patients in

the acute phase of stroke were likely to benefit but showing no significant benefit for patients in the chronic phase. The review authors concluded that electromechanical-assisted training improved the ability to walk independently, but further research is required to determine the optimum frequency and duration of training.

A further systematic review and meta-analysis by Veerbeek et al (2014) [60] of 16 randomised trials identified a significant improvement in maximum gait speed with SES (summary effect size) 0.215, 95% CI 0.016 to 0.413, and a non-significant improvement in walking ability with SES 0.186, 95% CI -0.329 to 1.333. The subgroup analysis for comfortable gait speed identified that patients in the early rehabilitation phase who were dependent in walking benefited from electromechanical-assisted gait training. Subgroup analysis also found a positive SES in walking ability for patients within the early rehabilitation phase.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Physiotherapy (or usual care)	Electromechanical assisted gait training and physiotherapy		
<b>Ability to walk independently</b> <sup>1</sup> At end of intervention phase	Odds Ratio 2.39 (CI 95% 1.67 - 3.43) Based on data from 999 patients in 23 studies. <sup>2</sup> (Randomized controlled) Follow up Varied: 10 days to 8 weeks	<b>446</b> per 1000	<b>658</b> per 1000	<b>Moderate</b> Due to serious risk of bias <sup>3</sup>	Electromechanical assisted gait training probably improves the ability to walk independently following stroke.
<b>Adverse events - death (risk difference)</b> <sup>4</sup> End of intervention  9 Critical	0 (CI 95% -0.02 - 0.02) Based on data from 999 patients in 23 studies. <sup>5</sup> (Randomized controlled) Follow up Varied: 10 days to 8 weeks			<b>High</b>	Electromechanical assisted gait training does not increase the risk of adverse events following stroke.
<b>Walking speed</b> <sup>6</sup> End of followup	Measured by: Walking speed (m/s) High better Based on data from: 690 patients in 17 studies. <sup>7</sup> (Randomized controlled) Follow up Varied: 10 days to 8 weeks		Difference: <b>MD 0.04 higher</b> (CI 95% 0.03 lower - 0.11 higher)	<b>Moderate</b>	Electromechanical assisted gait training probably does not improve walking speed.

1. Independent walking at the end of intervention phase, all electromechanical devices used

2. Systematic review [129] with included studies: Hornby 2008, Brincks 2011, Noser 2012, Geroin 2011, Fisher 2008, Chang 2012, Morone 2011, Husemann 2007, Peurala 2009, Peurala 2005, Tong 2006, Kyung 2008, Hidler 2009, Pohl 2007, Mayr 2008, Tanaka 2012, Aschbacher 2006, Dias 2006, Werner 2002, Van Nunen 2012, Saltuari 2004, Westlake 2009, Schwartz 2006. **Baseline/comparator::** Control arm of reference used for intervention .

3. **Risk of bias: Serious** . due to 45% of participants could walk independently at start of trials. ;
4. Death from all causes until the end of intervention phase. Mehrholz (2013) reports this as a risk difference.
5. Systematic review [129] with included studies: Westlake 2009, Chang 2012, Saltuari 2004, Geroiin 2011, Tanaka 2012, Schwartz 2006, Husemann 2007, Van Nunen 2012, Pohl 2007, Morone 2011, Werner 2002, Mayr 2008, Aschbacher 2006, Brincks 2011, Fisher 2008, Hornby 2008, Hidler 2009, Tong 2006, Dias 2006, Peurala 2005, Kyung 2008, Noser 2012, Peurala 2009. **Baseline/comparator::** Control arm of reference used for intervention .
6. Walking velocity (metres per second) at the end of followup
7. Systematic review [129] with included studies: Fisher 2008, Brincks 2011, Husemann 2007, Hornby 2008, Tanaka 2012, Werner 2002, Van Nunen 2012, Hidler 2009, Westlake 2009, Morone 2011, Kyung 2008, Peurala 2005, Noser 2012, Saltuari 2004, Pohl 2007, Tong 2006, Geroiin 2011. **Baseline/comparator::** Control arm of reference used for intervention .

### References

[121] Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis.. PloS one 2014;9(2):e87987 [Pubmed](#) [Journal](#)

[129] Mehrholz J, Elsner B, Werner C, Kugler J, Pohl M : Electromechanical-assisted training for walking after stroke. The Cochrane Database of Systematic Reviews 2013; [Journal](#)

[156] Mehrholz J, Pohl M, Platz T, Kugler J, Elsner B : Electromechanical and robot-assisted arm training for improving activities of daily living, arm function, and arm muscle strength after stroke. Cochrane Database of Systematic Reviews 2015; [Pubmed](#) [Journal](#)

### Clinical Question/ PICO

- Population:** Adults with stroke  
**Intervention:** Cueing of cadence  
**Comparator:** Control (walking training alone)

### Summary

Nascimento et al (2015) [126] conducted a systematic review of walking training interventions with cueing of cadence, including 7 trials with 211 participants. Meta-analysis showed that the interventions with cueing of cadence significantly improved walking speed by 0.23 m/s (95% CI 0.18 to 0.27). However, there was substantial heterogeneity, and an analysis that excluded one trial with a much larger effect size showed a smaller but still significant improvement. There was also a high risk of bias in the majority of included trials.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Control (walking training alone)    Cueing of cadence	Certainty in effect estimates (Quality of evidence)	Plain text summary
Walking speed	Measured by: Gait speed m/s	Difference: <b>MD 0.23 higher</b>	<b>Low</b> Due to serious risk	Cueing of cadence does appear to significantly

High better Based on data from: 171 patients in 6 studies. (Randomized controlled) Follow up 2 weeks - 6 weeks	( CI 95% 0.18 higher - 0.27 higher )	of bias <sup>1</sup>	improve walking speed, however due to serious risk of bias in the majority of the trials this should be interpreted with caution.
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1. **Risk of bias: Serious** . Majority did not report concealed allocation and did not have blinded assessors resulting in potential for detection bias, Missing intention-to-treat analysis. Majority had more than a 15% drop out rate. ;

### References

[130] Nascimento LR, de Oliveira CQ, Ada L, Michaelsen SM, Teixeira-Salmela LF : Walking training with cueing of cadence improves walking speed and stride length after stroke more than walking training alone: a systematic review.. Journal of physiotherapy 2015;61(1):10-5 [Pubmed Journal](#)

### Weak Recommendation

For stroke survivors, individually fitted lower limb orthoses may be used to minimise limitations in walking ability. Improvement in walking will only occur while the orthosis is being worn. (Tyson et al. 2013 [136])

### Practical Info

The type of orthosis worn should be prescribed following a thorough analysis of a person's walking. They should be custom fitted to suit the patient and address the walking deficits identified during gait analysis.

### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

The evidence supports the wearing of an orthosis (KAFO or AFO pooled in data analysis) to improve walking ability and gait speed by a small amount after stroke (Tyson et al. 2013 [136]). No harms were reported (Tyson et al. 2013 [136]).

#### Quality of evidence

Moderate

The certainty of the effect estimates was moderate (Tyson et al. 2013 [136]).

#### Preference and values

Substantial variability is expected or uncertain

There may be some variation in patients' preferences due to the discomfort with orthosis and small scale of benefits.

#### Resources and other considerations

Important issues, or potential issues not investigated

**Resources considerations**

No literature to understand or describe the potential economic implications of this recommendation was identified.

**Rationale**

The evidence profile supports the wearing of lower limb orthoses to improve walking speed and walking ability. The data pooled studies which investigated the use of knee ankle foot orthoses (KAFO) and ankle foot orthoses (AFO), so when recommending their use, this should be reflected. In order to do this, the general term "orthoses" was used in place of "knee ankle foot orthoses" and "ankle foot orthoses". The evidence still supports them being custom fitted. Inclusion criteria in the 13 included trials was very broad, with only one trial specifying patients who had no ankle control and another two trials that specified marked ankle spasticity.

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Orthosis  
**Comparator:** No orthosis

**Summary**

A systematic review of randomised trials of ankle-foot orthosis included 13 randomised controlled trials with 334 total participants (Tyson et al 2013 [132]). Meta-analysis showed significant improvements in walking activity, walking speed and walking impairment, but a non-significant improvement on timed mobility measures. The small trials included in the study may have been underpowered and generally trials only assessed short-term effects of treatment, meaning long-term benefits are uncertain.

A further systematic review of randomised controlled trials by Veerbeek et al (2014) [60] suggests that orthoses have no effect on walking speed after stroke. Four studies were included in the review (N=111) which investigated the effects of wearing an ankle-foot orthosis (AFO) or knee ankle foot orthosis (KAFO) on the comfortable walking speed in stroke survivors during subacute and chronic rehabilitation phases. The PEDro scores of included studies ranged from 2 (1 study) to 7 (3 studies). No significant difference was found in the comfortable gait speed when comparing walking with an orthosis and walking without an orthosis, (summary effect size 0.596, 95% CI -0.550 to 1.742). Furthermore, subgroup analyses showed that the results did not differ by post-stroke phase. Current evidence does not support the use of orthoses to improve walking speed after stroke.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		No orthosis	Orthosis		
<b>Walking ability</b> Immediately after intervention	Measured by: Functional Ambulation Categories High better Based on data from: 65 patients in 3 studies. (Randomized controlled) Follow up 1 day		Difference: <b>SMD 1.34 higher</b> ( CI 95% 0.95 higher - 1.72 higher )	<b>Moderate</b> Only included studies with low risk of bias, but no data reported.	The use of an orthosis probably improves walking ability.
<b>Walking speed</b> Immediately after	Measured by: Walking speed (m/sec)		Difference: <b>MD 0.06 higher</b>	<b>Moderate</b> Only included	The use of an orthosis probably improves

intervention	High better Based on data from: 282 patients in 11 studies. (Randomized controlled) Follow up 1 day	( CI 95% 0.03 higher - 0.08 higher )	studies with low risk of bias, but no data reported.	walking speed by a small amount.
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## References

[121] Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis.. PloS one 2014;9(2):e87987 [Pubmed Journal](#)

[136] Tyson SF, Kent RM : Effects of an ankle-foot orthosis on balance and walking after stroke: a systematic review and pooled meta-analysis.. Archives of physical medicine and rehabilitation 2013;94(7):1377-85 [Pubmed Journal](#)

## 10.7 - Upper limb activity

Sixty-nine percent of acute stroke patients have upper limb impairment on admission (Stroke Foundation 2015 [8]). Recovery of upper limb function plays an important role in activities of daily living. The term 'arm' function describes proximal upper limb (UL) function (i.e. shoulder/elbow), whereas 'hand' function describes distal UL function and coordination (i.e. wrist, hand, and fingers).

Some interventions target people with weak arm function (e.g. external supports, taping, electrical stimulation). Other interventions target people with weak or absent hand function (e.g. orthotics, mirror therapy, electrical stimulation), or with some active wrist and finger movement (e.g. constraint-induced movement therapy). Some of the recommendations highlight interventions that are suitable for these subgroups.

Task-specific motor training forms the basis of the motor retraining that occurs as part of other interventions such as constraint-induced movement therapy. There is also direct evidence for task-specific training specifically (French et al. 2016 [169]).

Interventions which target activities of daily living such as eating, drinking and self-care and also involve the upper limb should also be considered here (see Activities of daily living). This section should also be read in conjunction with Weakness and Loss of sensation.

### Strong Recommendation

For stroke survivors with some active wrist and finger extension, intensive constraint-induced movement therapy (minimum 2 hours of active therapy per day for 2 weeks, plus restraint for at least 6 hours a day) should be provided to improve arm and hand use. (Corbetta et al. 2015 [177]) Trunk restraint may also be incorporated into the active therapy sessions at any stage post-stroke. (Wee et al. 2014 [164])

## Practical Info

In most studies, participants had some active wrist and finger extension, no significant pain, spasticity or reduced range of joint motion, no or minimal cognitive deficits, no difficulties balancing during walking and reduced use of the arm in everyday life. Most studies included at least 2 weeks of (a) intensive, supervised task practice with the affected hand for 2 to 5 hours per day, 5 days per week, (b) a transfer package and homework tasks, and (c) restraint of the *unaffected* hand in a mitt or sling for at least 6 hours a day. Trunk restraint during therapy sessions may provide additional benefits in terms of trunk control and shoulder flexion.

Many more trials included community-dwelling chronic stroke participants, with fewer trials conducted in the early acute inpatient phase.

Active, intensive task practice is the key component to constraint-induced movement therapy, although the optimal timing and amount of practice remains unclear (Kwakkel et al. 2015 [181]). There is no evidence for the use of restraint alone (Kwakkel et al. 2015 [181]).

## Key Info

### Benefits and harms

Substantial net benefits of the recommended alternative

There are no harms associated with constraint-induced movement therapy (CIMT). There is evidence that CIMT is effective in improving motor function and motor impairment, but no evidence that this reduces disability (Corbetta et al. 2015 [177]).

### Quality of evidence

Moderate

There is evidence from a large number of randomised controlled trials supporting use of CIMT for addressing motor impairment and motor function, with limited effect on disability.

### Preference and values

Substantial variability is expected or uncertain

The demands and expectation of patients during a CIMT program should be negotiated with stroke survivors and their family. Some people may not be willing or able to engage in 2 weeks of intensive practice, for up to 5 hours per day, plus doing daily homework tasks. Most people do not object to wearing the restraint during therapy sessions, but may object to wearing the restraint in the community.

### Resources and other considerations

No important issues with the recommended alternative

#### Implementation considerations

There is a clinical indicator collected in the National Stroke Audit on the type of management provided to those patients who have difficulty using their upper limbs, including the provision of constraint-induced movement therapy.

## Rationale

A Cochrane review of 42 trials (1453 participants) found that constraint-induced movement therapy (CIMT) was effective at improving arm function, dexterity (hand function), arm motor impairment and use of the arm in everyday life (Corbetta et al. 2015 [177]). However, there was no significant effect on disability (ability to perform activities of daily living) either immediately after treatment or at follow-up (Corbetta et al. 2015 [177]). One systematic review of studies comparing CIMT to dose-matched other interventions also demonstrated significant benefits in arm function, arm motor impairment, disability and everyday arm use. Most trials included community-dwelling chronic stroke participants. A recent RCT by Kwakkel et al. (2016) [182] found that for people with some active finger extension, 1 hour per day of CIMT, started within 2 weeks of stroke and provided for at least 3 weeks, improved hand function more than usual therapy.

## Clinical Question/ PICO

- Population:** Adults with stroke  
**Intervention:** Constraint-induced movement therapy for upper extremities  
**Comparator:** Control

### Summary

Corbetta et al (2015) [173] is the most recent meta-analysis of the effects of CIMT in stroke survivors with upper limb paresis. The participants had some residual motor power of the paretic arm and the potential for further motor recovery with limited pain and spasticity, but tended to use the affected limb little. The primary outcome was disability, in which there was a non-significant standard mean difference favouring CIMT over conventional treatment. A small but statistically significant improvement was seen in arm motor function. Data on the long-term effects of CIMT is scarce. A recent RCT (Kwakkel et al 2016 [178]) found for those people with active finger extension, 1 hour per day of CIMT, started within 2 weeks of stroke and provided for at least 3



weeks, improved hand function more than usual therapy, but did not improve impairment.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Constraint-induced movement therapy		
<p><b>Arm Motor Function - Constraint therapy versus usual care</b></p> <p>Post intervention</p> <p>8 Critical</p>	<p>Measured by: Various e.g. Wolf Motor Function Test, Action Research Arm Test, Motor Assessment Scale</p> <p>High better</p> <p>Based on data from: 816 patients in 25 studies.<sup>1</sup> (Randomized controlled)</p> <p>Follow up 2 to 10 weeks of treatment</p>	<p>Difference: <b>SMD 0.31 higher</b> ( CI 95% 0.09 higher - 0.52 higher )</p>		<p><b>Low</b></p> <p>Due to serious risk of bias, Due to serious inconsistency<sup>2</sup></p>	<p>Constraint induced movement therapy may improve arm motor function compared to usual care</p>
<p><b>Arm Motor Function - Constraint therapy versus no treatment</b></p> <p>Post intervention</p> <p>8 Critical</p>	<p>Measured by: Various e.g. Wolf Motor Function Test, Action Research Arm Test, Motor Assessment Scale</p> <p>High better</p> <p>Based on data from: 42 patients in 3 studies.<sup>3</sup> (Randomized controlled)</p> <p>Follow up 2 to 10 weeks of treatment</p>	<p>Difference: <b>SMD 1.04 higher</b> ( CI 95% 0.31 lower - 2.4 higher )</p>		<p><b>Moderate</b></p> <p>Due to serious risk of bias<sup>4</sup></p>	<p>Constraint induced movement therapy probably improves arm motor function compared to no treatment</p>
<p><b>Perceived Arm Motor Function (Quality of Use) - CIMT versus usual care</b></p> <p>Post intervention</p>	<p>Measured by: Motor Activity Log</p> <p>High better</p> <p>Based on data from: 865 patients in 22 studies.<sup>5</sup> (Randomized controlled)</p>	<p>Difference: <b>MD 0.65 higher</b> ( CI 95% 0.44 higher - 0.86 higher )</p>		<p><b>High</b><sup>6</sup></p>	<p>Constraint induced movement therapy improves perceived arm motor function (quality of use) compared to usual care</p>
<p><b>Perceived Arm Motor Function (Quality of Use) - CIMT versus no treatment</b></p> <p>Post intervention</p>	<p>Measured by: Motor Activity Log</p> <p>High better</p> <p>Based on data from: 26 patients in 2 studies.<sup>7</sup> (Randomized controlled)</p> <p>Follow up 2 to 10 weeks of treatment</p>	<p>Difference: <b>MD 0.94 higher</b> ( CI 95% 0.32 lower - 2.2 higher )</p>		<p><b>Very Low</b></p> <p>Due to serious risk of bias, Due to serious inconsistency, Due to serious imprecision<sup>8</sup></p>	<p>Constraint induced movement therapy may improve perceived arm motor function (quality of use) compared to no treatment</p>

8 Critical				
<p><b>Perceived Arm Motor Function (Amount of Use) - CIMT versus usual care</b></p> <p>Post intervention</p>	<p>Measured by: Motor Activity Log High better</p> <p>Based on data from: 818 patients in 21 studies.<sup>9</sup> (Randomized controlled)</p> <p>Follow up 2 to 10 weeks of treatment</p>	<p>Difference: <b>MD 0.75 higher</b> ( CI 95% 0.44 higher - 1.05 higher )</p>	<p><b>Moderate</b> Due to serious inconsistency<sup>10</sup></p>	<p>Constraint induced movement therapy probably improves perceived arm motor function (amount of use) compared to usual care</p>
8 Critical				
<p><b>Perceived Arm Motor Function (Amount of Use) - CIMT versus no treatment</b></p> <p>Post intervention</p>	<p>Measured by: Motor Activity Log High better</p> <p>Based on data from: 33 patients in 2 studies.<sup>11</sup> (Randomized controlled)</p> <p>Follow up 2 to 10 weeks of treatment</p>	<p>Difference: <b>MD 1.2 higher</b> ( CI 95% 0.78 higher - 1.62 higher )</p>	<p><b>Low</b> Due to serious risk of bias, Due to serious imprecision<sup>12</sup></p>	<p>Constraint induced movement therapy may improve perceived arm motor function (amount of use) compared to no treatment</p>
8 Critical				
<p><b>Arm Motor Impairment - Constraint therapy versus usual care</b></p> <p>Post intervention</p>	<p>Measured by: Various e.g. Fugl-Meyer Assessment, Chedoke McMaster Impairment Inventory High better</p> <p>Based on data from: 355 patients in 15 studies.<sup>13</sup> (Randomized controlled)</p> <p>Follow up 2 to 10 weeks of treatment</p>	<p>Difference: <b>SMD 0.88 higher</b> ( CI 95% 0.33 higher - 1.42 higher )</p>	<p><b>High</b> <sup>14</sup></p>	<p>Constraint induced movement therapy improves arm motor impairment compared to usual care</p>
8 Critical				
<p><b>Arm Motor Impairment - Constraint therapy versus no treatment</b></p> <p>Post intervention</p>	<p>Measured by: Various e.g. Fugl-Meyer Assessment, Chedoke McMaster Impairment Inventory High better</p> <p>Based on data from: 17 patients in 1 studies.<sup>15</sup> (Randomized controlled)</p> <p>Follow up 2 to 10 weeks of treatment</p>	<p>Difference: <b>SMD 0.25 higher</b> ( CI 95% 0.7 lower - 1.21 higher )</p>	<p><b>Low</b> Due to serious risk of bias, Due to serious imprecision<sup>16</sup></p>	<p>Constraint induced movement therapy may improve arm motor impairment compared to no treatment</p>
8 Critical				
<p><b>Quality of life - Constraint therapy versus usual care</b></p>	<p>Measured by: Stroke Impact Scale High better</p> <p>Based on data from: 96</p>	<p>Difference: <b>MD 6.54 higher</b> ( CI 95% 1.2 lower - 14.28 higher )</p>	<p><b>High</b></p>	<p>Constraint induced movement therapy has little or no difference on quality of life compared</p>

Post intervention 8 Critical	patients in 3 studies. <sup>17</sup> (Randomized controlled)			to usual care
<b>Dexterity - Constraint therapy versus usual care</b> Post intervention 8 Critical	Measured by: Various e.g. Grooved Pegboard Test, Nine-Hole Peg Test, Box and block test High better Based on data from: 113 patients in 4 studies. <sup>18</sup> (Randomized controlled) Follow up 2 to 10 weeks of treatment	Difference: <b>SMD 0.42 higher</b> ( CI 95% 0.04 higher - 0.79 higher )	<b>High</b>	Constraint induced movement therapy improves dexterity compared to usual care
<b>Disability</b> Post intervention 9 Critical	Measured by: Functional Independence Measure and Barthel Index High better Based on data from: 344 patients in 11 studies. (Randomized controlled) Follow up 2 to 10 weeks of treatment	Difference: <b>SMD 0.24 higher</b> ( CI 95% 0.05 lower - 0.52 higher )	<b>Moderate</b> Due to serious risk of bias <sup>19</sup>	Constraint-induced movement therapy probably has little or no difference on disability post-intervention
<b>Disability</b> 3 to 6 month follow-up 9 Critical	Measured by: Functional Independence Measure and Barthel Index High better Based on data from: 125 patients in 3 studies. (Randomized controlled) Follow up 3 to 6 months	Difference: <b>SMD 0.21 lower</b> ( CI 95% 0.57 lower - 0.16 higher )	<b>Moderate</b> Due to serious risk of bias <sup>20</sup>	Constraint-induced movement therapy probably has little or no difference on disability at 3 to 6 month follow-up

1. Systematic review [177] with included studies: Bergheim 2010, Ploughman 2004, Brogårdh 2009, Page 2008, Hammer 2009, Wu 2012a, Brunner 2012, Atteya 2004, Hayner 2010, Dromerick 2000, Dromerick 2009, Treger 2012, Myint 2008, Yoon 2014, Van Delden 2013, Page 2001, Smania 2012, Wolf 2006, Page 2005b, Wu 2011, Dahl 2008, Khan 2011, Wang 2011, Tariah 2010, Huseyinsinoglu 2012. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . There was serious risk of bias in 7 of the included studies ; **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies . ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
3. Systematic review [177] with included studies: Kim 2008, Wittenberg 2003, Taub 1993. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: Serious** . Missing intention-to-treat analysis in of included paper ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
5. Systematic review [177] with included studies: Wu 2007c, Smania 2012, Wu 2011, Khan 2011, Dahl 2008, Krawczyk 2012, Brunner 2012, Wu 2007a, Wolf 2006, Myint 2008, Lin 2010, Van Delden 2013, Page 2005b, Wu 2007b, Wu 2012a, Tariah 2010, Brogårdh 2009, Lin 2009a, Lin 2007, Boake 2007, Huseyinsinoglu 2012, Hammer 2009. **Baseline/comparator::** Control arm of

reference used for intervention .

6. **Risk of bias: No serious** . risk of bias high in 4 of the 22 studies ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
7. Systematic review [177] with included studies: Kim 2008, Taub 1993. **Baseline/comparator::** Control arm of reference used for intervention .
8. **Risk of bias: Serious** . Missing intention-to-treat analysis ; **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies. ; **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
9. Systematic review [177] with included studies: Page 2005b, Wu 2007b, Smania 2012, Dahl 2008, Brunner 2012, Boake 2007, Huseyinsinoglu 2012, Hammer 2009, Myint 2008, Tariah 2010, Wolf 2006, Van Delden 2013, Brogårdh 2009, Khan 2011, Wu 2011, Wu 2007c, Lin 2007, Wu 2007a, Wu 2012a, Lin 2010, Lin 2009a. **Baseline/comparator::** Control arm of reference used for intervention .
10. **Risk of bias: No serious** . 4 included studies had serious risk of bias ; **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies. ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
11. Systematic review [177] with included studies: Wittenberg 2003, Kim 2008. **Baseline/comparator::** Control arm of reference used for intervention .
12. **Risk of bias: Serious** . Missing intention-to-treat analysis ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
13. Systematic review [177] with included studies: Tariah 2010, Singh 2013, Wu 2007b, Van Delden 2013, Lin 2009a, Yoon 2014, Page 2008, Atteya 2004, Wu 2007c, Ploughman 2004, Hammer 2009, Page 2005b, Lin 2010, Boake 2007, Page 2001. **Baseline/comparator::** Control arm of reference used for intervention .
14. **Risk of bias: No serious** . 4 included studies had high risk of bias ; **Inconsistency: No serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies. ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
15. Systematic review [177] with included studies: Kim 2008. **Baseline/comparator::** Control arm of reference used for intervention .
16. **Risk of bias: Serious** . Missing intention-to-treat analysis ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Only data from one study ; **Publication bias: No serious** .
17. Systematic review [177] with included studies: Lin 2009a, Dahl 2008, Wu 2007c. **Baseline/comparator::** Control arm of reference used for intervention .
18. Systematic review [177] with included studies: Yoon 2014, Van Delden 2013, Hammer 2009, Brunner 2012. **Baseline/comparator::** Control arm of reference used for intervention .
19. **Risk of bias: Serious** . 3 of 11 included studies had high risk of bias ; **Inconsistency: No serious** . The magnitude of statistical heterogeneity was moderate, with  $I^2:47\%$  . ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
20. **Risk of bias: Serious** . high risk of bias in 1 of the 3 included studies ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .

## References

- [175] Stevenson T, Thalman L, Christie H, Poluha W : Constraint-Induced Movement Therapy Compared to Dose-Matched Interventions for Upper-Limb Dysfunction in Adult Survivors of Stroke: A Systematic Review with Meta-analysis.. *Physiotherapy Canada. Physiothérapie Canada* 2012;64(4):397-413 [Pubmed Journal](#)
- [177] Corbetta D, Sirtori V, Castellini G, Moja L, Gatti R : Constraint-induced movement therapy for upper extremities in people with stroke. *Cochrane Database of Systematic Reviews* 2015 2015; [Pubmed Journal](#)

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Practice with trunk restraint  
**Comparator:** Practice without trunk restraint

**Summary**

A systematic review of randomised controlled trials comparing upper limb outcomes with and without trunk restraint was conducted by Wee et al (2014) [160]. 6 randomised trials with a total of 187 subjects were included, all of which were rated 6 or higher on the PEDro scale. 3 trials used trunk restraint as part of a constraint-induced movement therapy (CIMT) approach. Meta-analysis showed significant improvements in Fugl-Meyer Upper Extremity scores (SMD 0.54, 95% CI 0.06 to 1.01) and shoulder flexion (SMD 0.45, 95% CI 0.11 to 0.79), with non-significant effects for elbow flexion and hand function. The trials appeared to be at high risk of bias, with a lack of clear sequence generation and allocation concealment. CIMT interventions also involved substantially more treatment hours than the other approaches, which may have contributed to the improved outcomes, rather than the trunk restraint approach alone.

A systematic review of physical therapies for stroke rehabilitation by Veerbeek et al (2014) [60] included 4 trials of trunk restraint with 86 subjects. Meta-analysis showed non-significant differences in active range of motion and arm-hand activities. Limited detail was available regarding individual interventions and trials, so it is unclear how the included trials differed from those included in the Wee et al review.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Practice without trunk restraint	Practice with trunk restraint		
<b>Fugl Meyer Assessment (UE)</b>  Post intervention	Measured by: Fugl-Meyer Upper Extremity High better Based on data from: 71 patients in 3 studies. (Randomized controlled) Follow up 1 day to 5 weeks of treatment	Difference: <b>SMD 0.54 higher</b> ( CI 95% 0.06 higher - 1.01 higher )		<b>Very Low</b> Due to serious risk of bias, Due to very serious risk of bias, Due to serious imprecision <sup>1</sup>	We are uncertain whether practice with trunk restraint improves or worsens arm impairment
<b>Range of motion</b>	Measured by: Kinematics High better Based on data from: 70 patients in 5 studies. (Randomized controlled)	Difference: <b>SMD 0.45 higher</b> ( CI 95% 0.11 higher - 0.79 higher )		<b>Very Low</b> Due to serious risk of bias, Due to very serious risk of bias, Due to serious inconsistency, Due to serious imprecision <sup>2</sup>	We are uncertain whether practice with trunk restraint improves or worsens shoulder flexion active range of motion
<b>Self reported use (MAL)</b>	Measured by: Motor Activity Log - Amount of	Difference: <b>SMD 0.12 lower</b>		<b>Very Low</b> Due to very	We are uncertain whether practice with

Post intervention	<p style="text-align: center;">use High better</p> <p>Based on data from: 80 patients in 2 studies. (Randomized controlled) Follow up 1 day to 5 weeks of treatment</p>	<p style="text-align: center;">( CI 95% 0.56 lower - 0.32 higher )</p>	<p>serious risk of bias, Due to serious imprecision, Due to serious inconsistency<sup>3</sup></p> <p style="text-align: right;">trunk restraint increases or decreases self reported use of the arm</p>
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- Risk of bias: Very Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals, Low number of patients ; **Publication bias: No serious** .
- Risk of bias: Very Serious** . Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: Serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients, Wide confidence intervals ; **Publication bias: No serious** .
- Risk of bias: Very Serious** . Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: Serious** . Point estimates vary widely ; **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients, Wide confidence intervals ; **Publication bias: No serious** .

### References

- [144] Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis.. PloS one 2014;9(2):e87987 [Pubmed Journal](#)
- [164] Wee SK, Hughes A-M, Warner M, Burridge JH : Trunk restraint to promote upper extremity recovery in stroke patients: a systematic review and meta-analysis.. Neurorehabilitation and neural repair 2014;28(7):660-77 [Pubmed Journal](#)

### Weak Recommendation

For stroke survivors with mild to severe arm weakness, mechanically assisted arm training (e.g. robotics) may be used to improve upper limb function. (Mehrholz et al. 2015 [156])

### Practical Info

The Cochrane review included studies using a range of different robotic devices (Mehrholz et al. 2015 [156]), therefore there is no evidence for one device being superior to another.

### Key Info

#### Benefits and harms

Mechanically assisted arm training at distal and proximal joints improves arm function and activities of daily living (Mehrholz et al. 2015 [156]). There are no reported harms associated with the interventions.

Substantial net benefits of the recommended alternative

**Quality of evidence** Low  
 Quality of the evidence is low due to inconsistency between trials, and wide confidence intervals.

**Preference and values** No substantial variability expected  
 Patients are unlikely to have strong preferences for the use of mechanically assisted arm training.

**Resources and other considerations** Important issues, or potential issues not investigated

**Resources considerations**  
 Robotic devices may be expensive, although more services in Australia are purchasing a device for patient use. Private clinics exist in some states of Australia and offer a range of robotic devices for a fee. No economic evaluation has been identified, therefore the cost-effectiveness of mechanically assisted arm training is unclear.

**Implementation considerations**  
 There is a clinical indicator collected in the National Stroke Audit on the type of management provided to those patients who have difficulty using their upper limbs, including the provision of mechanically assisted training.

**Rationale**

A Cochrane review including 34 trials (Mehrholtz et al. 2015 [156]) found evidence that mechanically assisted arm training modestly improves arm function and activities of daily living, particularly when provided earlier (less than 3 months) after stroke. The strength of the evidence is moderate to low and a range (total 19) of different devices were used. Most studies matched the amount of scheduled therapy time in the control groups, but few matched for repetitions. Thus, it is likely that the benefits of mechanically assisted arm training come from more efficient use of therapy time to deliver a great number of repetitions of active practice.

**Clinical Question/ PICO**

- Population:** Adults with stroke
- Intervention:** Electromechanical and robot-assisted arm training
- Comparator:** All other interventions

**Summary**

A Cochrane review of electromechanical and robot-assisted arm training interventions included 34 trials with 1160 total participants (Mehrholtz et al 2015 [152]). Meta-analysis showed significant improvements in activities of daily living (ADL) scores (SMD 0.37, 95% CI 0.11 to 0.64) as well as arm function and arm muscle strength. The review authors rated the quality of the evidence as low to very low, although subgroup analyses restricting analysis to trials with clearly described randomisation procedures, adequate concealed allocation or blinded assessors also showed significant ADL improvements. Subgroup analysis comparing different treatment approaches showed significant ADL improvements from distal (e.g. finger, hand) training, with a non-significant difference for proximal (shoulder, elbow) training, although there was no significant difference between the subgroups.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		All other interventions	Electromechanical and robot-assisted training		

<p><b>Acceptability: drop-outs during intervention period (risk difference)</b> During intervention</p>	<p>Relative risk 1 (CI 95% 0.98 - 1.03) Based on data from 1,160 patients in 34 studies.<sup>1</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p><b>42</b> per 1000</p> <p><b>45</b> per 1000</p> <p>Difference: <b>3 more</b> per 1000 ( CI 95% 20 fewer - 30 more )</p>	<p><b>Moderate</b> Due to serious risk of bias<sup>2</sup></p>	<p>electromechanical and robotic assisted training has little or no difference on acceptability: drop-outs during intervention period</p>
<p><b>Activities of daily living</b> End of intervention phase</p>	<p>Measured by: Various, e.g. Barthel Index, Functional Independence Measure High better Based on data from: 717 patients in 18 studies.<sup>3</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.37 higher</b> ( CI 95% 0.11 higher - 0.64 higher )</p>	<p><b>Very Low</b> Due to serious inconsistency, Due to serious risk of bias, Due to serious imprecision<sup>4</sup></p>	<p>We are uncertain whether electromechanical and robot-assisted training improves or worsen activities of daily living at the end of intervention phase</p>
<p><b>Activities of daily living - Treatment within 3 months of stroke</b> End of intervention phase</p>	<p>Measured by: Various, e.g. Barthel Index, Functional Independence Measure High better Based on data from: 320 patients in 8 studies.<sup>5</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.53 higher</b> ( CI 95% 0.09 higher - 0.96 higher )</p>	<p><b>Low</b> Due to serious imprecision, Due to serious inconsistency<sup>6</sup></p>	<p>For patients in the acute and subacute phase of stroke, (within 3 months), electromechanical and robotic assisted training may improve activities of daily living at the end of intervention phase</p>
<p><b>Activities of daily living - Treatment more than 3 months after stroke</b> End of intervention phase</p>	<p>Measured by: Various, e.g. Barthel Index, Functional Independence Measure High better Based on data from: 397 patients in 10 studies.<sup>7</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.66 higher</b> ( CI 95% 0.17 lower - 1.49 higher )</p>	<p><b>Moderate</b> Due to serious inconsistency<sup>8</sup></p>	<p>For patients in the chronic phase of stroke, (more than 3 months after), electromechanical and robotic assisted training probably improves activities of daily living at the end of intervention phase slightly</p>
<p><b>Activities of daily living - distal training (finger, hand and radio-ulnar joints)</b> End of intervention phase</p>	<p>Measured by: Various, e.g. Barthel Index, Functional Independence Measure High better Based on data from: 195 patients in 6 studies.<sup>9</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.49 higher</b> ( CI 95% 0.2 higher - 0.78 higher )</p>	<p><b>Low</b> Due to serious imprecision, Due to serious risk of bias<sup>10</sup></p>	<p>Providing robotics to the finger, hand and radioulnar joints may improve activities of daily living at the end of intervention phase</p>



<p><b>Activities of daily living - proximal training (shoulder and elbow joints)</b> End of intervention phase</p>	<p>Measured by: Various, e.g. Barthel Index, Functional Independence Measure High better Based on data from: 522 patients in 12 studies.<sup>11</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.32 higher</b> ( CI 95% 0.05 lower - 0.68 higher )</p>	<p><b>Very Low</b> Due to serious imprecision, Due to serious inconsistency, Due to serious risk of bias<sup>12</sup></p>	<p>We are uncertain whether proximal electromechanical and robot-assisted training improves or worsen activities of daily living</p>
<p><b>Arm function</b> End of intervention phase</p>	<p>Measured by: Various e.g. Fugl-Meyer score, Chedoke-McMaster Stroke Assessment, Wolf Motor Function Test High better Based on data from: 1,078 patients in 31 studies.<sup>13</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.35 higher</b> ( CI 95% 0.18 higher - 0.51 higher )</p>	<p><b>Low</b> Due to serious imprecision, Due to serious risk of bias<sup>14</sup></p>	<p>Electromechanical and robotic assisted training may improve arm function at the end of intervention phase slightly</p>
<p><b>Arm function - distal training (finger, hand and radio-ulnar joints)</b> End of intervention phase</p>	<p>Measured by: Various e.g. Fugl-Meyer score, Chedoke-McMaster Stroke Assessment, Wolf Motor Function Test High better Based on data from: 299 patients in 10 studies.<sup>15</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.39 higher</b> ( CI 95% 0.06 higher - 0.72 higher )</p>	<p><b>Low</b> Due to serious inconsistency, Due to serious imprecision<sup>16</sup></p>	<p>Distal training (finger, hand and radio-ulnar joints) may improve arm function at the end of intervention phase</p>
<p><b>Arm function - proximal training (shoulder and elbow joints)</b> End of intervention phase</p>	<p>Measured by: Various e.g. Fugl-Meyer score, Chedoke-McMaster Stroke Assessment, Wolf Motor Function Test High better Based on data from: 779 patients in 21 studies.<sup>17</sup> (Randomized controlled) Follow up 2 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.33 higher</b> ( CI 95% 0.14 higher - 0.52 higher )</p>	<p><b>Low</b> Due to serious inconsistency, Due to serious imprecision<sup>18</sup></p>	<p>Proximal training (shoulder and elbow joints) may improve arm function at the end of intervention phase</p>

<b>Arm muscle strength</b> End of intervention phase	Measured by: Various e.g. Motricity Index score or Medical Research Council score, grip force High better Based on data from: 568 patients in 16 studies. <sup>19</sup> (Randomized controlled)	Difference: <b>SMD 0.36 higher</b> (CI 95% 0.01 higher - 0.7 higher)	<b>Very Low</b> Due to serious inconsistency, Due to serious imprecision, Due to serious risk of bias <sup>20</sup>	Electromechanical and robotic assisted training may improve arm muscle strength at the end of intervention phase
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1. Systematic review [156] with included studies: Volpe 2000, Housman 2009, Lum 2002, Klamroth-Marganska 2014, Hsieh 2014, Kahn 2006, Sale 2014, Amirabdollahian 2007, Lum 2006, Yoo 2013, Abdullah 2011, Kutner 2010, Mayr 2008, Daly 2005, Wu 2012, Hesse 2005, Hesse 2014, Ang 2014, Hwang 2012, Susanto 2015, Lo 2010, Hsieh 2011, Conroy 2011, McCabe 2015, Brokaw 2014, Fazekas 2007, Liao 2011, Masiero 2011, Rabadi 2008, Timmermans 2014, Masiero 2007, Volpe 2008, Hollenstein 2011, Burgar 2011. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . A number of ratings with high risk of bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
3. Systematic review [156] with included studies: Rabadi 2008, Masiero 2011, Volpe 2008, Fazekas 2007, Burgar 2011, Housman 2009, Hesse 2014, Lo 2010, Liao 2011, Conroy 2011, Hesse 2005, Kutner 2010, Volpe 2000, Yoo 2013, Wu 2012, Hsieh 2011, Masiero 2007, Lum 2006. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: Serious** . A number of ratings with high risk of bias ; **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies., The magnitude of statistical heterogeneity was high, with  $I^2:62%$  . ; **Indirectness: No serious** . **Imprecision: Serious** . Upper or lower confidence limit crosses an effect size of 0.5 in either direction . ; **Publication bias: No serious** .
5. Systematic review [156] with included studies: Rabadi 2008, Hesse 2005, Burgar 2011, Lum 2006, Hesse 2014, Masiero 2011, Masiero 2007, Volpe 2000. **Baseline/comparator::** Control arm of reference used for intervention .
6. **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies . ; **Indirectness: No serious** . **Imprecision: Serious** . Upper or lower confidence limit crosses an effect size of 0.5 in either direction . ; **Publication bias: No serious** .
7. Systematic review [156] with included studies: Wu 2012, Hsieh 2011, Fazekas 2007, Conroy 2011, Housman 2009, Liao 2011, Kutner 2010, Lo 2010, Yoo 2013, Volpe 2008. **Baseline/comparator::** Control arm of reference used for intervention .
8. **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies . ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
9. Systematic review [156] . **Baseline/comparator::** Control arm of reference used for intervention .
10. **Risk of bias: Serious** . A number of ratings with high risk of bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Upper or lower confidence limit crosses an effect size of 0.5 in either direction . ; **Publication bias: No serious** .
11. Systematic review [156] . **Baseline/comparator::** Control arm of reference used for intervention .
12. **Risk of bias: Serious** . A number of ratings with high risk of bias ; **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies., The magnitude of statistical heterogeneity was high, with  $I^2:73%$  . ; **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
13. Systematic review [156] with included studies: Susanto 2015, Abdullah 2011, Lo 2010, Kutner 2010, Volpe 2008, Liao 2011, Masiero 2011, Burgar 2011, McCabe 2015, Volpe 2000, Hsieh 2014, Mayr 2008, Hollenstein 2011, Hsieh 2011, Conroy 2011, Rabadi 2008, Hesse 2005, Timmermans 2014, Wu 2012, Housman 2009, Klamroth-Marganska 2014, Lum 2006, Ang 2014, Brokaw 2014, Hesse 2014, Sale 2014, Masiero 2007, Daly 2005, Fazekas 2007, Hwang 2012, Yoo 2013. **Baseline/comparator::** Control arm of reference used for intervention .
14. **Risk of bias: Serious** . A number of ratings with high risk of bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Upper or lower confidence limit crosses an effect size of 0.5 in either direction . ; **Publication bias: No serious** .

15. Systematic review [156] with included studies: Fazekas 2007, Burgar 2011, Abdullah 2011, Rabadi 2008, Wu 2012, Hsieh 2014, Timmermans 2014, Masiero 2011, Hollenstein 2011, Hesse 2014, Brokaw 2014, Volpe 2000, Liao 2011, Lum 2006, Masiero 2007, Daly 2005, Hwang 2012, Hesse 2005, Conroy 2011, Susanto 2015, Housman 2009, Klamroth-Marganska 2014, Volpe 2008, McCabe 2015, Hsieh 2011, Ang 2014, Sale 2014, Yoo 2013, Kutner 2010, Lo 2010, Mayr 2008. **Baseline/comparator::** Control arm of reference used for intervention .
16. **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies. ; **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
17. Systematic review [156] with included studies: Rabadi 2008, Kutner 2010, Abdullah 2011, Susanto 2015, Hollenstein 2011, Sale 2014, Volpe 2008, Lum 2006, Hsieh 2011, Hesse 2014, Ang 2014, Brokaw 2014, Volpe 2000, Liao 2011, Lo 2010, Mayr 2008, Fazekas 2007, Hesse 2005, Conroy 2011, Daly 2005, Hsieh 2014, Timmermans 2014, McCabe 2015, Masiero 2011, Hwang 2012, Housman 2009, Burgar 2011, Klamroth-Marganska 2014, Yoo 2013, Wu 2012, Masiero 2007. **Baseline/comparator::** Control arm of reference used for intervention .
18. **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies. ; **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
19. Systematic review [156] with included studies: Burgar 2011, Housman 2009, Rabadi 2008, Volpe 2008, Yoo 2013, Hesse 2005, Hsieh 2011, Volpe 2000, Lum 2006, Masiero 2011, Hesse 2014, Klamroth-Marganska 2014, Hwang 2012, Masiero 2007, Sale 2014, Mayr 2008. **Baseline/comparator::** Control arm of reference used for intervention .
20. **Risk of bias: Serious** . A number of ratings with high risk of bias ; **Inconsistency: Serious** . The confidence interval of some of the studies do not overlap with those of most included studies/ the point estimate of some of the included studies., The magnitude of statistical heterogeneity was high, with  $I^2:72\%$ . ; **Indirectness: No serious** . **Imprecision: Serious** . Upper or lower confidence limit crosses an effect size of 0.5 in either direction. ; **Publication bias: No serious** .

## References

[156] Mehrholz J, Pohl M, Platz T, Kugler J, Elsner B : Electromechanical and robot-assisted arm training for improving activities of daily living, arm function, and arm muscle strength after stroke. Cochrane Database of Systematic Reviews 2015; [Pubmed Journal](#)

Strong Recommendation

AGAINST

Hand and wrist orthoses (splints) should not be used as part of routine practice as they have no effect on function, pain or range of movement. (Tyson et al. 2011 [163])

## Practical Info

Routine use of hand and wrist orthoses is not recommended for patients with no active wrist or finger extension. Alternative interventions which can be used include electrical stimulation and motor training for paralysed or weak muscles, and mirror therapy. Where therapists choose to prescribe a hand or wrist orthosis for individual patients on a case-by-case basis, objective measurements should be obtained before and after splinting to evaluate outcomes.

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

Use of wrist and hand orthoses have no effect on either range of motion of the wrist, or hand function (Tyson et al. 2011 [136]). Few adverse events were reported in the literature and tolerance was generally high.

### Quality of evidence

High

Only four randomised controlled trials, two by the same research group, but all were of high quality. Statistical heterogeneity was very low in the analyses, indicating consistency of findings.

### Preference and values

Substantial variability is expected or uncertain

Splints can be uncomfortable to wear and carry a risk of pressure areas and other skin issues. Compliance may vary.

### Resources and other considerations

Factors not considered

## Rationale

Given the consistent evidence of no effect from a small number of randomised controlled trials involving people within 6 months of stroke, routine use of hand and wrist orthoses is not recommended. While there are a limited number of trials involving small sample sizes, all trials included power calculations and the size of the effect (0.04 to 1 degree of joint range) and the narrow confidence intervals indicate that statistical power was not a concern in these trials. There is little evidence to guide practice of use of orthoses later after stroke. See also the [Managing complications](#) chapter.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Orthosis  
**Comparator:** Usual care

### Summary

A systematic review by Tyson et al (2011) [159] included 4 trials (total N = 126) of upper limb orthotics in stroke survivors. Pooling data from 2 included trials showed non-significant differences in upper limb function, range of movement and pain. Although confidence intervals were wide due to the low sample sizes involved, the plausible range of effects appeared to be clinically insignificant. Based on this review, use of wrist and hand orthoses do not improve either arm function or improve range of motion.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Usual care      Orthosis	Certainty in effect estimates (Quality of evidence)	Plain text summary
<b>Arm function</b> Post intervention	Measured by: Motor Assessment Scale Scale: 0-18 High better	Difference: <b>MD 0.37 higher</b> ( CI 95% 0.19 lower - 0.93 higher )	<b>Moderate</b> Due to serious imprecision <sup>2</sup>	Use of hand and wrist orthosis probably has little or no difference on

<p>8 Critical</p>	<p>Based on data from: 91 patients in 2 studies.<sup>1</sup> (Randomized controlled) Follow up 4 weeks of treatment</p>	<p>degrees (n/a)      degrees (n/a)</p> <p>Difference: <b>MD 0.04 higher</b> ( CI 95% 5.21 lower - 5.3 higher )</p>		<p>arm function</p>
<p><b>Range of motion of the wrist</b> Post intervention</p> <p>7 Critical</p>	<p>Measured by: Joint range of motion at the wrist Scale: 0-70 High better Based on data from: 121 patients in 3 studies.<sup>3</sup> (Randomized controlled) Follow up 4 to 13 weeks of treatment</p>			<p><b>High</b> While sample sizes are small results are consistent in finding no effect<sup>4</sup></p> <p>Use of hand and wrist orthosis has no effect on range of motion of the wrist</p>

1. Systematic review [163] . **Baseline/comparator::** Control arm of reference used for intervention .
2. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ; **Publication bias: No serious** .
3. Systematic review [163] . **Baseline/comparator::** Control arm of reference used for intervention .
4. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients, but consistent results ; **Publication bias: No serious .** Unlikely to see larger studies as evidence of no effect currently ;

**References**

[163] Tyson SF, Kent RM : The effect of upper limb orthotics after stroke: a systematic review.. NeuroRehabilitation 2011;28(1):29-36 [Pubmed Journal](#)

**Weak Recommendation**

For stroke survivors with mild to moderate arm impairment, virtual reality and interactive games may be used to improve upper limb function. Virtual reality therapy should be provided for at least 15 hours total therapy time and is most effective when used in the first six months after stroke. (Laver et al. 2015 [108])

**Practical Info**

There appears to be no difference in outcome between trials that have used commercially available equipment compared to more expensive custom-made systems. Virtual reality may not be appropriate for people with cognitive or visual deficits. The benefits of virtual reality training appear to be related to the 'dosage' (amount) of active therapy delivered.

**Key Info**

**Benefits and harms**

**Substantial net benefits of the recommended alternative**

There is a clear signal of benefit for virtual reality and interactive video gaming to improve arm function and activities of daily living when used as an adjunct to usual care (to increase overall therapy time) or when compared with the same dose of conventional

therapy (Laver et al. 2015 [108]). There were few reported adverse events and those that were reported were mild (Laver et al. 2015 [108]).

**Quality of evidence**

Low

Studies were small and had between 5 and 40 participants in each arm, but were generally of high quality.

**Preference and values**

Substantial variability is expected or uncertain

Patients are unlikely to have strong preferences for the use of virtual reality.

**Resources and other considerations**

Factors not considered

**Rationale**

A Cochrane review (Laver et al. 2015 [108]) found small but significant favourable effects for virtual reality and interactive video gaming to improve arm function and activities of daily living when used as an adjunct to usual care (to increase overall therapy time), or when compared with the same dose of conventional therapy. The subgroup analyses suggest that virtual reality is effective only when provided for at least 15 hours of total therapy time and only for participants with mild to moderate arm impairment. The effectiveness of virtual reality appears limited to the early post-stroke period (less than 6 months), with benefits less clear for people later after stroke.

**Clinical Question/ PICO**

- Population:** Adults with stroke
- Intervention:** Virtual reality
- Comparator:** Conventional therapy

**Summary**

An updated Cochrane Review by Laver et al (2015) [108] captured an additional 19 (n=37) randomised and quasi-randomised trials from the previous review. All 37 studies recruited 1019 participants, with upper limb function as the primary outcome. Based on findings from 8 studies (N = 253) that investigated its effect on ADL, virtual reality-based intervention in conjunction with standard care resulted in improved ADL outcomes. However, there was no evidence that effects were sustained long-term. This intervention is relatively safe, but studies were only able to recruit 25% of participants screened. Interventions based on virtual reality technology were found to have a potential benefit in ADL outcomes in patients with chronic stroke only, and most participants were relatively young (mean age 46-75).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Conventional therapy	Virtual reality		
<p><b>ADL<sup>1</sup></b> Post intervention  8 Critical</p>	<p>Measured by: Various e.g. Functional Independence Measure, Barthel Index High better Based on data from: 253</p>	<p>Difference: <b>SMD 0.43 higher</b> ( CI 95% 0.18 higher - 0.69 higher )</p>		<p><b>Very Low</b> Due to serious risk of bias, serious inconsistency, and serious</p>	<p>We are uncertain whether virtual reality improves or worsens ADL</p>

patients in 8 studies.  
(Randomized controlled)

imprecision<sup>2</sup>

1. Measures of ADL, such as Barthel Index, Functional Independence Measure, and modified Rankin Scale
2. **Risk of bias: Serious** . Risk of bias was unclear in a number of studies. ; **Inconsistency: Serious** . **Indirectness: No serious** . **Imprecision: Serious** . small total population size ; **Publication bias: No serious** .

### References

[108] Laver Kate E., George S, Thomas S, Deutsch Judith E., Crotty M : Virtual reality for stroke rehabilitation. Cochrane Database of Systematic Reviews 2015;(9): [Pubmed Journal](#)

### Weak Recommendation

For stroke survivors with mild to severe arm or hand weakness, electrical stimulation in conjunction with motor training may be used to improve upper limb function. (Howlett et al. 2015 [132])

### Practical Info

Electrical stimulation should be provided in conjunction with motor training, ensuring enough dosage (amount) of practice is achieved. It is unclear whether electrical stimulation is more or less effective in people with different degrees of arm weakness.

### Key Info

#### Benefits and harms

Substantial net benefits of the recommended alternative

There does not appear to be harm associated with electrical stimulation, and stimulation may be beneficial to upper limb activity recovery (Howlett et al. 2015 [132]).

#### Quality of evidence

Moderate

The quality of the evidence is reasonable, although most studies had small sample sizes and did not include intention-to-treat analyses.

#### Preference and values

Substantial variability is expected or uncertain

Patients are unlikely to have strong preferences in relation to electrical stimulation. Some patients may dislike or refuse the stimulation.

#### Resources and other considerations

Factors not considered

## Rationale

When electrical stimulation is provided with the purpose of improving arm function and in conjunction with motor training, there is strong evidence that it improves arm function when compared to either motor training alone or no/placebo therapy. Of the 12 papers included in the Howlett et al. (2015) [132] systematic review that focussed on arm re-training, 5 included participants with moderate to severe arm weakness, 4 included participants with mild weakness and 3 had either mixed or unspecified samples. A recent RCT (Kwakkel et al. 2016 [182]) found for people with no active finger extension, twice daily electrical stimulation in addition to usual care, commenced within 2 weeks of stroke onset was not effective. Therefore, while the effects of electrical stimulation on people with different degrees of arm weakness remains somewhat unclear, it may be less beneficial for those with no active motor function, and should always be provided in conjunction with active motor training.

There is currently a lack of evidence as to the effect of electrical stimulation for improving motor function on disability or quality of life.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Electrical stimulation  
**Comparator:** Usual care without stimulation

### Summary

Electrical stimulation can be used passively (i.e. patients do not do any active exercises during therapy) or actively (combined with motor training). Passive electrical stimulation is more often used to treat or prevent shoulder subluxation or pain. (See the Subluxation and Shoulder pain topics in the Managing complications chapter). This section considers evidence for the use of electrical stimulation combined with active motor training with the intention of improving arm or hand function.

A systematic review by Howlett et al (2015) [128] included 18 trials in total (10 involving upper limb training), all of which included electrical stimulation with the intent to produce muscle contraction and in combination with motor training. Meta-analysis of upper-limb activity measures showed a large and significant benefit of electrical stimulation in addition to motor training when compared to either no therapy or motor training alone (SMD 0.69, 95% CI 0.33 to 1.05). When all 18 trials were considered together, there was a significant effect in favour of electrical stimulation plus motor training improving activity (walking speed or arm activity) when compared to either motor training alone (SMD 0.56, 95% CI 0.21 to 0.92) or no therapy (SMD 0.40, 95% CI 0.08 to 0.72).

A recent RCT (Kwakkel et al 2016 [178]) found that, in people with no active finger extension, twice daily 30-minute sessions of electrical stimulation commenced within 2 weeks of stroke onset was not superior to usual care therapy in improving either hand function or impairment.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Usual care without stimulation    Electrical stimulation	Certainty in effect estimates (Quality of evidence)	Plain text summary
<b>Upper limb activity</b> Post intervention  8 Critical	Measured by: Various motor function scales e.g. Motor Assessment Scale, Arm Motor Ability Test, nine hole peg test, Action Research Arm Test, Box and Block test, Upper Extremity Function Test and Wolf Motor Function	Difference: <b>SMD 0.69 higher</b> ( CI 95% 0.33 higher - 1.05 higher )	<b>Low</b> Due to serious inconsistency, Due to serious imprecision, Due to serious risk of bias, Due to serious	Electrical stimulation provided with motor training may improve upper limb activity



Test High better Based on data from: 192 patients in 8 studies. (Randomized controlled) Follow up 2 to 12 weeks of treatment		imprecision <sup>1</sup>
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1. **Risk of bias: Serious** . 7 out of the 8 included studies missing intention-to-treat analysis, 3 out of 8 studies had Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . The point estimate of some of the included studies vary widely but, magnitude of statistical heterogeneity was low, with  $I^2$ : 27% . ; **Indirectness: No serious** . Unable to differentiate effect for upper limb electrical stimulation plus motor training compared to either motor training alone or no training . ; **Imprecision: Serious** . Low number of patients in included trials ; **Publication bias: No serious** .

### References

[132] Howlett OA, Lannin NA, Ada L, McKinstry C : Functional electrical stimulation improves activity after stroke: a systematic review with meta-analysis.. Archives of physical medicine and rehabilitation 2015;96(5):934-43 [Pubmed Journal](#)

[174] Vafadar AK, Côté JN, Archambault PS : Effectiveness of functional electrical stimulation in improving clinical outcomes in the upper arm following stroke: a systematic review and meta-analysis.. BioMed research international 2015;2015 729768 [Pubmed Journal](#)

### Weak Recommendation

For stroke survivors with mild to moderate weakness of their arm, mental practice in conjunction with active motor training may be used to improve arm function. (Kho et al. 2014 [157])

### Practical Info

Communication and cognitive abilities, including attention and working memory, are likely to impact on the feasibility and outcomes of mental practice. Different mental practice strategies were used in the literature, but all involved visualisation of specific movements. The optimal 'dosage' (amount) of therapy and therapy schedule remains unclear, with the literature reporting a range of 10–60 minute therapy sessions performed between once a week to daily for between 3 and 12 weeks. For patients to use mental practice correctly, therapists will need to spend time teaching them 'how to do' the practice. Like meditation and mindfulness, mental practice requires focused attention, a quiet location and assistance from others to maintain the habit.

### Key Info

#### Benefits and harms

There is some suggestion that mental practice may be beneficial in improving arm function (Kho et al. 2014 [157]; Barclay-Goddard et al. 2011 [158]; Braun et al. 2014 [135]). There are no reported harms.

Small net benefit, or little difference between alternatives

<p><b>Quality of evidence</b></p> <p>The included trials involve small sample sizes and one research group has conducted the majority of trials in this area.</p>	Low
<p><b>Preference and values</b></p> <p>Some patients will not be able or willing to learn how to do mental practice.</p>	Substantial variability is expected or uncertain
<p><b>Resources and other considerations</b></p> <p><u>Resources considerations</u></p> <p>No literature to understand or describe the potential economic implications of this recommendation was identified.</p>	Important issues, or potential issues not investigated

### Rationale

Several systematic reviews have shown small, favourable effect sizes for the use of mental imagery to improve arm function, the most recent being Kho et al. (2014) [157], which included 6 trials (5 randomised controlled trials). However, all primary studies have small sample sizes and many are from the same research group, reducing the certainty of results. Most studies have included participants with at least some voluntary arm movement, so the effect of mental practice on those with very severe weakness or very mild weakness is not known. Most studies used mental practice in conjunction with motor training and compared the intervention to no therapy, therefore the additional benefit of mental practice alone is unclear.

### Clinical Question/ PICO

- Population:** Adults with hemiparesis after stroke  
**Intervention:** Mental practice in addition to other treatment  
**Comparator:** Other treatment

### Summary

The most recent meta-analysis of mental practice interventions (Kho et al 2014 [153]) found mental practice in addition to other therapy lead to improvement in arm function. The magnitude of improvement based on the Action Research Arm Test of 6.8 points is larger than the minimal clinically important difference on this test (5.7 points, van der Lee 2001). However, the trials included in this meta-analysis all had very small sample sizes, and three of the four trials were conducted by the same research group. As small trials tend to overestimate effect, there is only a low level of certainty with this results. It is also important to note that the majority of participants in the trials had some voluntary movement of the arm at baseline and were in the chronic phase of stroke. These findings are consistent with an earlier Cochrane review (Barclay-Goddard et al 2011 [153]) which included two trials not in the Kho 2014 review. Another meta-analysis published in 2013 (Braun et al 2013 [131]) included 7 trials (197 participants) and found a favourable estimate of effect as measured by the Action Research Arm Test (SMD 0.62, 95% CI 0.05 to 1.19). Finally, Verbeek et al (2014) [60] included 14 randomised controlled trials (424 participants) and found a positive effect in favour of mental practice for improving arm function (Hedge's g 0.55, 95% CI 0.11 to 0.997).

A 2015 systematic review of a related intervention, action observation, included 5 randomised controlled trials (Kim 2015 [154]). No meta-analysis was conducted due to the variety of outcome measurements, although 4 out 5 included trials reported significant motor recovery effects.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Other treatment	Mental practice in addition to other treatment		

<b>Activity: upper extremity function</b> End of treatment  7 Critical	Measured by: Action Research Arm Test or Arm Functional Test High better Based on data from: 102 patients in 5 studies. <sup>1</sup> (Randomized controlled) Follow up 3 to 12 weeks of treatment	Difference: <b>SMD 1.37 higher</b> ( CI 95% 0.6 higher - 2.15 higher )	<b>Low</b> Small sample sizes in the trials leads to serious imprecision in results <sup>2</sup>	Mental practice in addition to other treatment may improve arm function
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1. Systematic review [159] with included studies: Page 2009, Page 2001, Page 2007, Page 2005, Riccio 2010. **Baseline/comparator:** Control arm of reference used for intervention .
2. **Risk of bias: No serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients (sample sizes ranged from 11 to 32 participants per trial) ; **Publication bias: No serious** .

## References

- [144] Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G : What is the evidence for physical therapy poststroke? A systematic review and meta-analysis.. PloS one 2014;9(2):e87987 [Pubmed Journal](#)
- [156] Mehrholz J, Pohl M, Platz T, Kugler J, Elsner B : Electromechanical and robot-assisted arm training for improving activities of daily living, arm function, and arm muscle strength after stroke. Cochrane Database of Systematic Reviews 2015; [Pubmed Journal](#)
- [157] Kho AY, Liu KPY, Chung RCK : Meta-analysis on the effect of mental imagery on motor recovery of the hemiplegic upper extremity function.. Australian occupational therapy journal 2014;61(2):38-48 [Pubmed Journal](#)
- [158] Barclay-Goddard RE, Stevenson TJ, Poluha W, Thalman L : Mental practice for treating upper extremity deficits in individuals with hemiparesis after stroke.. The Cochrane database of systematic reviews 2011;(5):CD005950 [Pubmed Journal](#)
- [159] Mental practice for treating upper extremity deficits in individuals with hemiparesis after stroke [Data only. When citing this record quote "Cochrane Database of Systematic Reviews 2011, Issue 5"].
- [160] Kim K : Action observation for upper limb function after stroke: evidence-based review of randomized controlled trials.. Journal of physical therapy science 2015;27(10):3315-7 [Pubmed Journal](#)
- [161] Braun S, Kleynen M, van Heel T, Kruithof N, Wade D, Beurskens A : The effects of mental practice in neurological rehabilitation; a systematic review and meta-analysis.. Frontiers in human neuroscience 2013;7 390 [Pubmed Journal](#)

## Weak Recommendation

For stroke survivors with mild to moderate weakness, complex regional pain syndrome and/or neglect, mirror therapy may be used as an adjunct to routine therapy to improve arm function after stroke. (Thieme et al. 2012 [162])

## Practical Info

Mirror therapy can be used as an intervention to improve pain or motor function. When the intention is to improve motor function,

therapy should incorporate bilateral active movements. The optimal 'dosage' (amount) of therapy and therapy schedule remains unclear, with the literature reporting a range of 10–60 minute therapy sessions performed between once a week to daily for between 2 and 6 weeks. Some stroke patients may find it difficult to focus their attention on the mirror and their practice. Other stroke patients and/or their carers may construct a mirror box at home and need instruction from therapists about which exercises to do.

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

There are no reported adverse events associated with mirror therapy (Thieme et al. 2012 [162]). There is some evidence for a small effect of mirror therapy on improving arm function and abilities in activities of daily living (Thieme et al. 2012 [162]).

### Quality of evidence

High

Most trials included in the meta-analysis were of high quality.

### Preference and values

Substantial variability is expected or uncertain

Some stroke patients may find it difficult to focus their attention on the mirror and their practice.

Other stroke patients and/or their carers may construct a mirror box at home and need instruction from therapists about which exercises to do.

### Resources and other considerations

Important issues, or potential issues not investigated

#### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

## Rationale

A Cochrane review of 14 trials (Thieme et al. 2012 [162]) found small favourable positive effects for mirror therapy to improve arm function, pain and to a lesser extent activities of daily living after stroke. While the quality of the included studies varied, the positive effects of mirror therapy remained in subgroup analyses based on trial quality, suggesting the findings are robust. However, the arm function outcome in this review was based on pooling both impairment-based measures (e.g. Fugl-Meyer) and activity-based measures (e.g. Action Research Arm Test). Another review in which only arm activity measures were pooled (Veerbeek et al. 2014 [60]) showed no significant benefit. Two studies only included people with complex regional pain syndrome and found positive effects on pain reduction. Studies either did not specify inclusion criteria related to motor ability at baseline, or included only people with at least some voluntary movement. Therefore the effectiveness of mirror therapy for people with no active movement is unclear.

## Clinical Question/ PICO

- Population:** Adults with stroke  
**Intervention:** Mirror therapy for improving motor function after stroke  
**Comparator:** All other interventions

### Summary

A Cochrane review (Thieme et al 2012 [?]) found that mirror therapy significantly improved arm motor function (SMD 0.61, 95% CI 0.22 to 1.0). However, this was based on pooling data from a range of outcome measures including both impairment measures (Fugyl-Meyer) and activity measures (Action Research Arm Test, Wolf Motor Function Test, Motor Assessment Scale). The review and meta-analysis by Veerbeek et al (2014) [60] found a non-significant effect of mirror therapy on arm function when only activity based measures (Action Research Arm Test, Wolf Motor Function Test) were included. There is some suggestion that

mirror therapy may have beneficial effects on pain and neglect when used with people with complex regional pain syndrome or unilateral spatial neglect respectively.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		All other interventions	Mirror therapy		
<b>Arm motor function</b> End of intervention  7 Critical	Measured by: Fugyl- Meyer (upper extremity), Action Research Arm Test, Wolf Motor Function Test and Motor Assessment Scale item 7 High better Based on data from: 481 patients in 11 studies. <sup>1</sup> (Randomized controlled) Follow up 2 to 6 weeks of treatment		Difference: <b>SMD 0.61 higher</b> ( CI 95% 0.22 higher - 1 higher )	<b>Moderate</b> Due to serious inconsistency <sup>2</sup>	Mirror therapy probably improves arm motor function immediately after the intervention
<b>Arm motor function</b> Follow up after 6 months  7 Critical	Measured by: Fugyl- Meyer (upper extremity), Action Research Arm Test, Wolf Motor Function Test and Motor Assessment Scale item 7 High better Based on data from: 157 patients in 4 studies. <sup>3</sup> (Randomized controlled) Follow up 6 months post- intervention		Difference: <b>SMD 1.09 higher</b> ( CI 95% 0.3 higher - 1.87 higher )	<b>Low</b> Due to serious inconsistency, due to serious imprecision <sup>4</sup>	Mirror therapy may improve arm motor function 6 months after treatment finishes
<b>Activities of Daily Living</b> End of intervention  8 Critical	Measured by: Functional Independence Measure, Barthel Index High better Based on data from: 217 patients in 4 studies. (Randomized controlled) Follow up 2 to 6 weeks of treatment		Difference: <b>SMD 0.33 higher</b> ( CI 95% 0.05 higher - 0.6 higher )	<b>Moderate</b> Due to serious imprecision <sup>5</sup>	Mirror therapy probably improves activities of daily living
<b>Arm motor function - upper extremity treatment only</b> End of	Measured by: Fugyl- Meyer (upper extremity), Action Research Arm Test, Wolf Motor Function Test and Motor Assessment Scale		Difference: <b>SMD 0.53 higher</b> ( CI 95% 0.04 higher - 1.01 higher )	<b>Moderate</b> Due to serious inconsistency <sup>7</sup>	Mirror therapy probably improves arm motor function immediately after the intervention

intervention	item 7 High better Based on data from: 421 patients in 10 studies. <sup>6</sup> (Randomized controlled) Follow up 2 to 6 weeks of treatment	
7 Critical		

1. Systematic review [162] with included studies: Seok 2010, Yavuzer 2008, Tezuka 2006, Cacchio 2009b, Cacchio 2009a, Acerra 2007, Yun 2010, Dohle 2009, Michielsen 2011, Sütbeyaz 2007, Ietswaart 2011. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: No serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias in two of the 11 trials included in the meta-analysis ; **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with  $I^2 = 75\%$  . ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
3. Systematic review [162] with included studies: Michielsen 2011, Yavuzer 2008, Cacchio 2009a, Sütbeyaz 2007. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with  $I^2 = 81\%$  . ; **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
5. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
6. Systematic review [162] with included studies: Acerra 2007, Cacchio 2009b, Seok 2010, Cacchio 2009a, Ietswaart 2011, Dohle 2009, Michielsen 2011, Yavuzer 2008, Tezuka 2006, Yun 2010. **Baseline/comparator::** Control arm of reference used for intervention .
7. **Risk of bias: No serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias in two of the 11 trials included in the meta-analysis ; **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with  $I^2 = 75\%$  . ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .

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## Weak Recommendation

For stroke survivors with at least some voluntary movement of the arm and hand, repetitive task-specific training may be used to improve arm and hand function. (French et al. 2016 [173])

## Practical Info

The optimal delivery methods and intensity (numbers of repetitions) for task-specific training remains unclear.

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

A recent Cochrane review (French et al. 2016 [173]) found small but consistent benefits for repetitive task-specific training for improving arm and hand function. Few adverse events have been reported.

### Quality of evidence

Low

Overall the quality of the evidence in the primary studies was low to moderate.

### Preference and values

No substantial variability expected

People with stroke are likely to want to engage in active therapy to improve motor function.

### Resources and other considerations

No important issues with the recommended alternative

#### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

## Rationale

A recent Cochrane review (French et al. 2016 [173]) included between 8 and 11 studies (n = 619 to 749) that investigated the effectiveness of repetitive task-specific training on hand and arm function respectively. There were small but statistically significant positive effects for up to 6 months post-intervention.

Weak Recommendation

AGAINST

Brain stimulation (transcranial direct stimulation or repetitive transcranial magnetic stimulation) should not be used in routine practice for improving arm function, and only used as part of a research framework. (Elsner et al. 2016 [195]; Hao et al. 2013 [149])

## Practical Info

Specialist equipment is required for brain stimulation. Optimal dosages are unknown, as is the optimal timing of conjunctive motor training.

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

Both repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS) are safe interventions (Elsner et al. 2016 [195]; Hao et al. 2013 [149]). Adverse events are rare and transient. There is little evidence of the beneficial effects of brain stimulation on motor function of the arm.

### Quality of evidence

Low

The quality of the individual studies varies, and many have small sample sizes.

### Preference and values

No substantial variability expected

People with stroke are unlikely to have strong preferences for brain stimulation.

Resources and other considerations

Factors not considered

## Rationale

There is currently insufficient evidence to support the use of brain stimulation (transcranial direct current stimulation [tDCS] or repetitive transcranial magnetic stimulation [rTMS]) on improving arm motor function. Two Cochrane reviews found no significant benefit of either tDCS (Elsner et al. 2016 [195]) or rTMS (Hao et al. 2013 [149]) on arm motor function. There are conflicting results arising from both primary studies and other systematic reviews (Marquez et al. 2015 [147]; Butler et al. 2012 [146]; Tedesco et al. 2016 [145]; Tang et al. 2012 [151]; Le et al. 2014 [150]; Hsu et al. 2012 [152]).

There is some suggestion that both tDCS (Marquez et al. 2015 [147]; Butler et al. 2012 [146]) and rTMS (Tang et al. 2012 [151]; Le et al. 2014 [150], Hsu et al. 2012 [152]) may have a small positive effect on arm motor function, particularly in people with subcortical lesions. However, there is considerable uncertainty around the optimal dosage parameters for both tDCS and rTMS. Furthermore, there is significant variability in effect on individual people and the individual characteristics of those more or less likely to respond are largely unknown.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Transcranial direct current stimulation  
**Comparator:** Placebo or passive control

### Summary

A Cochrane review of transcranial direct current stimulation (tDCS) trials included 32 trials with 748 total participants (Elsner et al 2016 [138]). 9 studies compared tDCS to sham stimulation and reported activities of daily living (ADL) outcomes at the end of treatment, showing a small significant improvement for the tDCS groups (SMD 0.24, 95% CI 0.03 to 0.44). Meta-analysis of 6 studies also showed improved ADL scores at the end of follow-up (SMD 0.31, 95% CI 0.01 to 0.62). However, neither of these effects remained significant when analysis was restricted to studies with adequate allocation concealment, suggesting a high risk of bias.

Marquez et al (2015) [143] conducted a systematic review of 15 moderate/high quality studies, pooling data according to different stimulation and patient characteristics. There was no benefit of any particular type of tDCS compared to sham (anodal: SMD = 0.05, CI = -0.25 - 0.31; cathodal: SMD = 0.39, CI = -0.05 - 0.82; bihemispheric: SMD = 0.24, CI = -0.3 - 0.77). When data was pooled according to time since stroke, tDCS produced a significant improvement in function for those with chronic stroke (SMD = 0.41, CI = 0.09 - 0.80, p = 0.001) but not those with subacute stroke (SMD = 0.01, CI = -0.39 - 0.4). Similarly there appears to be a differential finding according to stroke severity whereby when the data for those with mild/moderate impairment was pooled there was significant improvement (SMD = 0.37, CI = 0.05 - 0.70, p = 0.02) but not those with severe impairments (SMD = -0.05, CI = -0.38 - 0.28). The size of the treatment effect is variable and at best modest with a maximum effect size of 35% improvement when measured directly following the stimulation.

Another systematic review with meta-analysis (Butler et al 2012 [142]) reported small to moderate effects on function in favour of anodal stimulation. (SMD = 0.49, CI = 0.18 - 0.81, p = 0.005). This is in conflict with Tedesco et al (2016) [141] who analysed the effects of multiple sessions of tDCS in combination with therapy. The pooled results of 9 studies revealed no significant benefit of tDCS.

Sattler et al (2015) [143] combined anodal tDCS with PNS in 20 acute stroke patients and reported significant improvement compared to sham following 10 days and 25 days post 5 consecutive sessions of therapy (F[2.36] = 4.42, p = 0.01). This equated to a mean improvement of 23 secs 10 secs post intervention on the Jebsen Taylor Hand Function Test. No significant benefit was recorded for other measures of upper limb function.



Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Placebo or passive control	tDCS		
<p><b>Dropouts, adverse events and deaths (risk difference)</b> During intervention period (3 months)</p> <p>7 Critical</p>	<p>0.01 (CI 95% -0.02 - 0.03) Based on data from 664 patients in 23 studies.<sup>1</sup> (Randomized controlled) Follow up Intervention completion, 3 months</p>	<p><b>20</b> per 1000</p>	<p><b>30</b> per 1000</p>	<p><b>High</b> Adverse events are rare and minor and transient in nature<sup>2</sup></p>	<p>tDCS poses low risk to people with stroke</p>
<p><b>Upper extremity function at the end of the intervention period</b><sup>3</sup> Up to 6 weeks of treatment</p> <p>7 Critical</p>	<p>Measured by: Various - JTT, FM-UE, Box and Block, reaction time tasks, sequence tasks High better Based on data from: 431 patients in 12 studies.<sup>4</sup> (Randomized controlled) Follow up Up to 6 weeks of treatment</p>	<p>Difference: <b>SMD 0.11 higher</b> ( CI 95% 0.17 lower - 0.39 higher )</p>		<p><b>Low</b> Due to serious inconsistency, Due to serious imprecision<sup>5</sup></p>	<p>tDCS may have little or no difference on upper extremity function at the end of the intervention period</p>
<p><b>Upper extremity function to the end of follow-up</b><sup>6</sup> At least 3 months post intervention</p> <p>6 Important</p>	<p>Measured by: Various: FM-UE, Box and Block, JTT reaction time High better Based on data from: 187 patients in 4 studies.<sup>7</sup> (Randomized controlled) Follow up at least 3 months</p>	<p>Difference: <b>SMD 0.01 higher</b> ( CI 95% 0.48 lower - 0.5 higher )</p>		<p><b>Low</b> Due to serious inconsistency, Due to serious imprecision<sup>8</sup></p>	<p>tDCS may have little or no difference on upper extremity function by the end of follow-up</p>

1. Systematic review [143] with included studies: Ang 2012, Park 2013, Di Lazzaro 2014a, Bolognini 2011, Lee 2014, Geroi 2011, Kim 2010, Wu 2013a, Cha 2014, Rossi 2013, Di Lazzaro 2014b, Lindenberg 2010, Tahtis 2012, Tedesco Triccas 2015b, Nair 2011, Khedr 2013, Hesse 2011, Wang 2014, Viana 2014, Fusco 2013a, Qu 2009, Fusco 2014, Boggio 2007a. **Baseline/comparator::** Control arm of reference used for intervention .

2. **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious .** Wide confidence intervals ; **Publication bias: No serious .**

3. Data for this outcome comes from 12 studies reporting absolute upper extremity scores at the end of intervention. 4 studies reported only change scores were not pooled with these results.

4. Systematic review [143] with included studies: Lindenberg 2010, Lee 2014, Kim 2010, Rossi 2013, Di Lazzaro 2014b, Viana 2014, Tedesco Triccas 2015b, Wu 2013a, Fusco 2013a, Hesse 2011, Di Lazzaro 2014a, Bolognini 2011. **Baseline/comparator::** Control arm of reference used for intervention .

5. **Inconsistency: Serious .** The direction of the effect is not consistent between the included studies ; **Indirectness: No serious .**

**Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .

6. Data for this outcome comes from 4 studies reporting absolute upper extremity scores at the end of follow-up. 1 study which only reported change scores was not pooled with these studies.

7. Systematic review [143] with included studies: Di Lazzaro 2014b, Rossi 2013, Hesse 2011, Tedesco Triccas 2015b. **Baseline/comparator::** Control arm of reference used for intervention .

8. **Inconsistency: Serious** . The direction of the effect is not consistent between the included studies ; **Indirectness: No serious** .

**Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .

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## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Repetitive transcranial magnetic stimulation  
**Comparator:** Usual care

## Summary

A Cochrane review of trials of repetitive transcranial magnetic stimulation (rTMS) for improving function in people with stroke included 19 trials with a total of 588 participants (Hao et al 2013 [149]). The rTMS interventions included low-frequency stimulation of the contralesional cortex and high-frequency stimulation of the damaged cortex. Meta-analysis of 2 trials (N = 183) reporting Barthel Index scores showed a non-significant increase following rTMS treatment (MD 15.92, 95% CI -2.11 to 33.95). Pooled analysis of 4 trials (N = 73) showed a non-significant increase in motor function (SMD 0.51, 95% CI -0.99 to 2.01). Depression and cognitive function also showed non-significant changes. Subgroup analyses showed no significant differences between low and high-frequency stimulation. The low numbers of trials and patients included in the review mean there is low certainty about the range of possible benefits and harms of rTMS treatment.

In addition to the Cochrane review, there have been 3 other systematic reviews conducted investigating TMS and motor function. These report findings in favour of rTMS.

Tang et al (2012) [151] pooled data from 9 studies and found significant positive effects of TMS on function compared to control (Hedge's  $g = 0.59$ ,  $CI = 0.13$  to  $1.05$ ,  $p = 0.01$ ) and the benefit seemed to be greatest for low frequency TMS (Hedge's  $g = 0.81$ ,  $CI = 0.05$  to  $1.56$ ,  $p = 0.04$ ).

This was confirmed by Le et al (2014) [150] who pooled data from 8 articles ( $n=273$ ). A larger analysis by Hsu et al (2012) [152] of 17 studies (362 subjects) also reported a significant effect for upper limb function (mean effect size =  $0.55$ ,  $CI = 0.37-0.72$ ,  $p < 0.01$ ) Subgroup analysis demonstrated the benefit was greatest for those with subcortical stroke (mean effect size =  $0.73$ ,  $CI = 0.44-1.02$ ) and low-frequency TMS (mean effect size =  $0.69$ ,  $CI = 0.42-0.95$ ).

These reviews included studies from a wide range of time since stroke (5 days to over 10 years), range of TMS frequencies and sites (1Hz to 25Hz) and treatment protocols (1 session to 10 sessions). This makes it difficult to determine which protocols are most beneficial.

A recent randomised controlled trial (RCT) investigated the effects of combining low frequency TMS and VR training (Zheng et al 2015 [153]). They report positive effects compared to VR training and sham TMS following training for 6 days/week for 4 weeks on FM ( $MD = 13.2$ ,  $CI = 3.6$  to  $22.7$ ,  $p < 0.01$ ); WMFT ( $MD = 2.9$ ,  $CI = 2.7$  to  $12.3$ ,  $p < 0.01$ ) and the modified BI ( $MD = 16.1$ ,  $CI = 3.8$  to  $9.4$ ,  $p < 0.05$ ).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	rTMS		
<b>Motor function</b> Up to six weeks of treatment  6 Important	Measured by: MAS, action research arm test, 9HPT, rivermead , gait parameters High better Based on data from: 73 patients in 4 studies. <sup>1</sup> (Randomized controlled) Follow up Up to 6 weeks of treatment	Difference: <b>SMD 0.51 higher</b> ( CI 95% 0.99 lower - 2.01 higher )		<b>Low</b> Due to serious inconsistency, Due to serious imprecision <sup>2</sup>	rTMS may have little or no difference on motor function

1. Systematic review [149] with included studies: Fregni 2006. **Baseline/comparator::** Control arm of reference used for intervention .

2. **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with  $I^2:87.6\%$ ., The direction of the effect is not consistent between the included studies ; **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .

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## 11 - Activities of daily living

Assessment and management of activities of daily living (ADL) fall into two areas:

- Personal ADL, including basic self-maintenance tasks such as showering, toileting, dressing, and eating.
- Extended ADL, including domestic and community tasks such as home maintenance, management of financial affairs and community access, including driving.

Interventions targeting areas such as sensorimotor impairments and physical activities, cognition, communication, leisure and driving, all impact on ADLs. Please refer to other sections of these Clinical Guidelines for interventions targeting these specific impairments. This topic focusses on interventions to improve function and independence in personal and extended ADLs, including occupationally focussed and pharmacological therapies. See also other chapter sections on driving and community ambulation. No recommendation has been made regarding cognitive rehabilitation to improve ADL performance due to inconsistency in the literature, and further trials are recommended (Hoffmann et al. 2010 [186]).

Around 87% of stroke survivors in Australia were considered to have difficulties with ADL (Stroke Foundation 2016 [9]). The majority of stroke survivors receive some intervention and ADL training in hospitals, including task-specific practice (91%) and training in use of appropriate aids and equipment (62%) (Stroke Foundation 2016 [9]).

### Strong Recommendation

- Community-dwelling stroke survivors who have difficulties performing daily activities should be assessed by a trained clinician. (Legg et al. 2006 [184])
- Community-dwelling stroke survivors with confirmed difficulties in personal or extended ADL should have specific therapy from a trained clinician (e.g. task-specific practice and training in the use of appropriate aids) to address these issues. (Legg et al. 2006 [184])

### Practical Info

Tailored ADL training should be provided at home to stroke survivors with ADL difficulties, as part of routine therapy. Intervention and therapy sessions may focus on personal ADL (dressing, bathing) or extended ADL (cooking, laundry tasks).

### Key Info

#### Benefits and harms

Based on the 2006 Cochrane review (Legg et al. 2006 [184]), ADL performance was improved, and the odds of a poor outcome were reduced (26 fewer death or dependency per 1000 patients treated) when occupational therapy intervention was provided to stroke survivors living in the community.

Substantial net benefits of the recommended alternative

#### Quality of evidence

The methodological quality of evidence (9 trials) in the 2006 Cochrane review was moderate to high.

Moderate

#### Preference and values

All stroke survivors with difficulties in ADL would want to receive assessments and tailored therapies.

No substantial variability expected

#### Resources and other considerations

##### Implementation considerations

There are no clinical indicators collected in the National Stroke Audit on occupational therapy interventions for stroke survivors living in the community, but there are clinical indicators collected on whether an assessment by an occupational therapist took place within the inpatient setting and the median time between a patient's admission and this assessment. For patients, in acute care or

No important issues with the recommended alternative

rehabilitation, who have difficulties with activities of daily living, clinical indicators are collected on the management for these difficulties. These include task-specific practice and trained use of appropriate aids. There is also an organisational indicator collected on whether or not hospitals have locally agreed assessment protocols for ADL.

## Rationale

The 2006 Cochrane review included 9 trials of moderate to high quality, which demonstrated improvements in ADL performance when ADL training was provided at home (Legg et al. 2006 [184]). A number of trials have been published since 2006, mostly underpowered pilot or feasibility trials with a focus on occupation or activities tailored to individual stroke survivors and no intervention was proven to be particularly superior. Therefore, performance of daily activities should be assessed and managed by a trained clinician, but the optimal approach is yet to be determined.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Occupational therapy  
**Comparator:** Control

## Summary

Legg et al (2006) [180] assessed the effectiveness of occupational therapy-led interventions in a Cochrane review, specifically focussing on personal activities of daily living. 9 randomised controlled trials (RCTs) were included, with most using concealed randomisation and blinding of outcome assessors. Control groups generally received usual care or no intervention. Odds of a poor outcome (death, dependency or deterioration on ADL measures) were reduced in patients receiving occupational therapy interventions (OR 0.67, 95% CI 0.51 to 0.87), and personal activities of daily living were improved (SMD 0.18, 95% CI 0.04 to 0.32). Sensitivity analyses showed that excluding trials with risk of bias reduced these effects somewhat, but treatment effects were generally still significant after these exclusions. However, the best form of occupational therapy could not be determined. The authors also suggested that the results might only be applicable to people living at home after stroke as the included studies largely involved patients living at home. Another individual data meta-analysis of community occupational therapy pooled data from 8 RCTs (N = 1143) and found significant improvement in personal and extended activities of daily living, which is in line with the findings from the Cochrane review.

Since that 2006 systematic review, a few underpowered pilot RCTs and feasibility studies have been published (Tomori et al 2015 [179]; Rotenberg-Shpigelman et al 2012 [182]; Shinohara et al 2012 [183]; Liu et al 2014 [184]; Walker et al 2012 [185]). Some of these RCTs involved stroke inpatients (Lui et al, 2014 [184]; Walker et al 2012 [185]). However, none were powered to show a between-group difference (sample sizes range from 23-70) and no intervention has shown superiority over others. A multi-centre RCT of high methodological quality and adequate sample size (N=280) (Giudetti et al 2015 [180]) compared a client-centred ADL intervention to usual ADL treatment. The client-centred intervention involved collaboration between the client and the occupational therapist in identifying goals and developing strategies for meeting them. The primary outcomes were changes in the participation domain of the Stroke Impact Scale over 12 months. Odds of positive meaningful change favoured the client-centred intervention group but were non-significant (OR 1.53, 95% CI 0.93 to 2.51), and similarly the odds of negative meaningful change were non-significant (OR 0.67, 95% CI 0.38 to 1.19).

Overall, the current evidence supports the provision of occupational therapy to improve personal ADL in the community, with less evidence of benefit to inpatients. There is insufficient evidence about which approach or content is most effective, or how much ADL training is needed to improve performance.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Occupational therapy		

<p><b>Death or dependency</b> End of follow-up</p> <p>9 Critical</p>	<p>Odds Ratio 0.9 (CI 95% 0.67 - 1.23) Based on data from 788 patients in 4 studies.<sup>1</sup> (Randomized controlled) Follow up 3-12 months</p>	<p><b>438</b> per 1000</p> <p><b>412</b> per 1000</p> <p>Difference: <b>26 fewer</b> per 1000 ( CI 95% 95 fewer - 51 more )</p>	<p><b>Moderate</b> Due to serious imprecision<sup>2</sup></p>	<p>Occupational therapy probably has little or no difference on death or dependency</p>
<p><b>Activities of daily living</b> End of follow-up</p> <p>8 Critical</p>	<p>Measured by: Various e.g. Barthel Index, Rivermead ADL scale High better Based on data from: 961 patients in 8 studies.<sup>3</sup> (Randomized controlled) Follow up 3-12 months</p>	<p>Difference: <b>SMD 0.18 higher</b> ( CI 95% 0.04 higher - 0.32 higher )</p>	<p><b>High</b> 4</p>	<p>Occupational therapy increases activities of daily living, particularly for patients living at home</p>
<p><b>Extended activities of daily living</b> End of follow-up</p> <p>8 Critical</p>	<p>Measured by: Various e.g. Nottingham Extended Activities of Daily Living High better Based on data from: 847 patients in 6 studies.<sup>5</sup> (Randomized controlled) Follow up 3-12 months</p>	<p>Difference: <b>SMD 0.21 higher</b> ( CI 95% 0.03 higher - 0.39 higher )</p>	<p><b>High</b> 6</p>	<p>Occupational therapy increases extended activities of daily living, particularly for patients living at home</p>

1. Systematic review [184]. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Inconsistency: No serious . Indirectness: No serious .** Differences between the population of interest and those studied: studies all focussed on patients living at home after stroke ; **Imprecision: Serious .** Wide confidence intervals ; **Publication bias: No serious .**
3. Systematic review [184]. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: No serious .** A minority of trials had issues with allocation or blinding but restricting analysis to higher quality trials gave similar results, Blinding of participants and personnel not possible ; **Inconsistency: No serious . Indirectness: No serious .** Differences between the population of interest and those studied: studies all focussed on patients living at home after stroke ; **Imprecision: No serious . Publication bias: No serious .**
5. Systematic review [184]. **Baseline/comparator::** Control arm of reference used for intervention .
6. **Risk of bias: No serious .** A minority of trials had issues with allocation or blinding but restricting analysis to higher quality trials gave similar results, Blinding of participants and personnel not possible ; **Inconsistency: No serious . Indirectness: No serious .** Differences between the population of interest and those studied: studies all focussed on patients living at home after stroke ; **Imprecision: No serious . Publication bias: No serious .**

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Weak Recommendation

AGAINST

For older stroke survivors living in a nursing home, routine occupational therapy is not recommended to improve ADL function. (Sackley et al. 2015 [183])

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

There was little benefit in ADL function but also no harms (Sackley et al. 2015 [183]). There was a suggestion of increased odds of at least one fall in the intervention group, from additional occupational therapy provided in the nursing home, compared to usual care (odds ratio 1.55, 95% CI, 0.96 to 2.53,  $p = 0.07$ ) (Legg et al. 2006 [184]). However, the authors note that the fall rate over 3 months was within the normal range based on recently published data (1.49 to 2.5 falls per year) (Sackley et al. 2015 [183]).

### Quality of evidence

Low

Although the study was well-designed, this is the only trial on this topic and the participants had a high level of disability (Sackley et al. 2015 [183]).

### Preference and values

Substantial variability is expected or uncertain

Although no study to date has reported on the preferences and values of stroke survivors in nursing homes, stroke survivors and their carers are likely to want therapy to maintain or improve function. Therefore it is important to highlight what this study intervention involved, the dose of intervention and the sub-group of stroke participants. See Rationale.

## Resources and other considerations

Factors not considered

## Rationale

To date, only one large trial by Sackley and colleagues (2015) [183] has evaluated the outcomes of occupational therapy in nursing homes. No benefit was found on ADL performance at any time (3, 6 or 12 months) despite providing a relatively expensive intervention vs usual care (mean of 5 visits x 30 minutes vs no occupational therapy).

## Clinical Question/ PICO

**Population:** Older adults with stroke in nursing homes  
**Intervention:** Occupational therapy  
**Comparator:** Control

## Summary

A high-quality cluster randomised controlled trial (RCT) by Sackley et al (2015) [179] showed no effect or benefit on ADL (Barthel Index) outcome at any time (3, 6 or 12 months) from a somewhat expensive occupational therapy (OT) intervention (mean 5 visits x 30 mins) compared to no intervention/usual care (no OT). No other comparable RCTs were found involving stroke participants for comparison. However, the authors point to 2 other RCTs in nursing homes involving older residents (non-stroke) which produced negative results, i.e. evidence of no effect or difference from the active intervention – (a) exercise for depression in older residents, and (b) a functional activity program to improve function in nursing home residents. Overall, the research suggests that an occupational therapy-led program provided to older stroke participants in a nursing home is unlikely to improve function, compared to no therapy or usual care.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Occupational therapy		
ADL (3 months) <sup>1</sup> 3 months  8 Critical	Measured by: Barthel Index (reported difference is covariate-adjusted) Scale: 0-20 High better Based on data from: 976 patients in 1 studies. <sup>2</sup> (Randomized controlled) Follow up 3 months	<b>5.29</b> points (Mean)	<b>5.47</b> points (Mean)	<b>Low</b> Due to serious indirectness, Due to serious imprecision <sup>3</sup>	occupational therapy may have little or no difference on adl (3 months)
ADL (6 months) <sup>4</sup> 6 months  8 Critical	Measured by: Barthel Index (reported difference is covariate-adjusted) Scale: 0-20 High better Based on data from: 973 patients in 1 studies. <sup>5</sup> (Randomized controlled) Follow up 3 months	<b>4.78</b> (Mean)	<b>4.78</b> (Mean)	<b>Low</b> Due to serious indirectness, Due to serious imprecision <sup>6</sup>	occupational therapy may have little or no difference on adl (6 months)



<b>ADL (12 months)</b>	Measured by: Barthel Index (reported difference is covariate adjusted) Scale: 0-10 High better Based on data from: 942 patients in 1 studies. <sup>8</sup> (Randomized controlled) Follow up 3 months	<b>3.77</b> (Mean)	<b>3.93</b> (Mean)	<b>Low</b> Due to serious indirectness, Due to serious imprecision <sup>9</sup>	occupational therapy may have little or no difference on adl (12 months)
12 months		Difference: <b>MD 0.16 higher</b> ( CI 95% 0.4 lower - 0.72 higher )			
8 Critical					

- ADL measured by Barthel index. Participants who died were given a BI score of 0.
- Primary study [183]. **Baseline/comparator::** Control arm of reference used for intervention .
- Inconsistency: No serious . Indirectness: Serious .** Differences between the population of interest and those studied: nearly half of the residents with stroke (47%) had a BI in the 'very severe range' (ie BI score 0 to 4).The mean BI was 6.5 and 6.3, compared to their pilot study where the mean BI score was in the moderate range (score 10-14). The level of baseline disability may partly account for the lack of effect (compared to pilot study). ; **Imprecision: Serious .** Only data from one study ; **Publication bias: No serious .**
- ADL measured by Barthel index. Participants who died were given a BI score of 0.
- Primary study [183]. **Baseline/comparator::** Control arm of reference used for intervention .
- Inconsistency: No serious . Indirectness: Serious .** Differences between the population of interest and those studied: nearly half of the residents with stroke (47%) had a BI in the 'very severe range' (ie BI score 0 to 4).The mean BI was 6.5 and 6.3, compared to their pilot study where the mean BI score was in the moderate range (score 10-14). The level of baseline disability may partly account for the lack of effect (compared to pilot study). ; **Imprecision: Serious .** Only data from one study ; **Publication bias: No serious .**
- ADL measured by Barthel index. Participants who died were given a BI score of 0.
- Primary study [183]. **Baseline/comparator::** Control arm of reference used for intervention .
- Inconsistency: No serious . Indirectness: Serious .** Differences between the population of interest and those studied: nearly half of the residents with stroke (47%) had a BI in the 'very severe range' (ie BI score 0 to 4).The mean BI was 6.5 and 6.3, compared to their pilot study where the mean BI score was in the moderate range (score 10-14). The level of baseline disability may partly account for the lack of effect (compared to pilot study). ; **Imprecision: Serious .** Only data from one study ; **Publication bias: No serious .**

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- [190] Liu KPY, Chan CCH : Pilot randomized controlled trial of self-regulation in promoting function in acute poststroke patients. *Archives of Physical Medicine and Rehabilitation* 2014;95(7):1262-1267 [Journal Website](#)
- [191] Walker MF, Sunderland A., Fletcher-Smith J., Drummond A., Logan P., Edmans JA, Garvey K., Dineen RA, Ince P., Horne J., Fisher RJ, Taylor JL : The DRESS trial: a feasibility randomized controlled trial of a neuropsychological approach to dressing therapy for stroke inpatients. *Clinical Rehabilitation* 2012;26(8):675-685 [Journal Website](#)

Strong Recommendation

AGAINST

For stroke survivors in the acute, sub-acute or chronic phase post-stroke, acupuncture should not be used to improve ADL. (Kong et al. 2010 [196])

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

There were no benefits for ADL performance or known harms (Kong et al. 2010 [196]).

### Quality of evidence

High

The quality of evidence is high, based on trials in the 2010 systematic review that had good methodological quality.

### Preference and values

No substantial variability expected

Patients are unlikely to want to receive acupuncture to improve ADL as it has not shown benefits.

### Resources and other considerations

Factors not considered

## Rationale

There is now good quality evidence showing that acupuncture makes little or no difference to ADL performance, irrespective of time post-stroke compared to a sham treatment (i.e. a treatment that looks and feels like acupuncture) (Kong et al. 2010 [196]). Therefore a strong recommendation against this practice is made.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Acupuncture  
**Comparator:** Control

### Summary

One systematic review of 10 studies (Kong et al 2010 [192]) has investigated the efficacy of acupuncture in patients with stroke, irrespective of time post-event. Of the five studies that investigated the impact of acupuncture on activities of daily living (ADL) outcomes in the acute and sub-acute phase, only three used quality methods that have low levels of bias. The combined findings of these three studies indicate that acupuncture does not influence ADL outcomes after stroke in the first few days and weeks post event. Three studies also investigated outcomes in patients with chronic stroke and the combined findings indicated that, as with the acute and sub-acute phase, acupuncture does not influence ADL outcomes after stroke.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Control          Acupuncture	Certainty in effect estimates (Quality of evidence)	Plain text summary
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<p><b>ADL</b> End of treatment (1 day to 10 weeks of treatment)</p> <p>8 Critical</p>	<p>Measured by: Various: Barthel Index, modified BI, Sunaas Index of ADL High better Based on data from: 244 patients in 3 studies. (Randomized controlled) Follow up 6 to 12 months</p>	<p>Difference: <b>SMD 0.07 higher</b> ( CI 95% 0.18 lower - 0.32 higher )</p>	<p><b>High</b> 1</p>	<p>acupuncture has little or no difference on ADL</p>
<p><b>ADL</b> End of follow-up: 6 to 12 months</p> <p>8 Critical</p>	<p>Measured by: Various: Barthel Index, modified BI, Sunaas Index of ADL High better Based on data from: 244 patients in 3 studies. (Randomized controlled) Follow up 6 to 12 months</p>	<p>Difference: <b>SMD 0.1 higher</b> ( CI 95% 0.15 lower - 0.35 higher )</p>	<p><b>High</b> 2</p>	<p>acupuncture has little or no difference on ADL</p>

1. **Inconsistency: No serious** . Reviewers took this into account by excluding studies with high risk of bias ; **Indirectness: No serious** . The cohorts are all patients with stroke, and there is a bias in studies towards acute and sub-acute. There are two studies based in China, and both studies have been identified in the SR as potentially biased. Therefore, this reviewer has based the final outcome on the basis of the less biased SR outcomes. ; **Imprecision: No serious** . Accounted for in the review methods ; **Publication bias: No serious** . Studies in other languages included ;
2. **Inconsistency: No serious** . Reviewers took this into account by excluding studies with high risk of bias ; **Indirectness: No serious** . The cohorts are all patients with stroke, and there is a bias in studies towards acute and sub-acute. There are two studies based in China, and both studies have been identified in the SR as potentially biased. Therefore, this reviewer has based the final outcome on the basis of the less biased SR outcomes. ; **Imprecision: No serious** . Accounted for in the review methods ; **Publication bias: No serious** . Studies in other languages included ;

## References

[196] Kong JC, Lee MS, Shin BC, Song YS, Ernst E. : Acupuncture for functional recovery after stroke: a systematic review of sham-controlled randomized clinical trials. CMAJ Canadian Medical Association Journal 2010;182(16):1723-9 [Journal Website](#)

Strong Recommendation

AGAINST

Administration of amphetamines to improve ADL is not recommended. (Martinsson et al. 2007 [199])

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

The Cochrane review by Martinsson et al. (2007) [199] and colleagues which included four small RCTs suggested potential harms from amphetamines – a non-significant trend towards increased mortality. This Cochrane review found no benefit in activities of daily living and a non-significant effect in favour of placebo. The more recent RCT by Lokk et al. (2011) [200] and colleagues suggested modest benefits in ADL following amphetamine intervention combined with usual physiotherapy, but it has high risk of bias.

<b>Quality of evidence</b>	Low
The Cochrane review provided low quality of evidence due to small sample size and imbalances in baseline prognostic factors [199]. A more recent RCT by Lökk et al. (2011) had high risk of bias due to lack of assessor blinding [200].	
<b>Preference and values</b>	No substantial variability expected
Given the lack of benefits and potential harms, stroke survivors are unlikely to want to receive it for the purpose of improving ADL.	
<b>Resources and other considerations</b>	Factors not considered

## Rationale

Given the potential risk of death and lack of clear benefits, a strong recommendation has been made against administration of amphetamines.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Amphetamine  
**Comparator:** Placebo

## Summary

Martinsonn et al (2007) [195] conducted a Cochrane review of amphetamine treatments for patients with stroke, restricting inclusion to randomised trials comparing amphetamine to placebo. 10 RCTs with 287 patients were included, 8 using dexamphetamine and the remaining 2 using methamphetamine or d,l-amphetamine. There were non-significant increases in death or dependency (OR 1.5, 95% CI 0.6 to 3.3) and all-cause mortality (OR 2.8, 95% CI 0.9 to 8.6) in patients treated with amphetamine. The review authors suggested that these apparent differences may have been from imbalances in baseline prognostic factors that were seen in some included studies, e.g. higher age and lower levels of consciousness in the amphetamine groups. There was no indication of an improvement in ADL following amphetamine administration, with meta-analysis of 4 studies finding a non-significant effect in favour of placebo. However, the included trials were small and had issues with baseline equivalence, meaning further research may change these conclusions.

In a more recent trial of an amphetamine-like drug, Lökk et al (2011) [196] conducted a double-blind RCT (N = 100) comparing levodopa (LD), methylphenidate (MPH) or their combination to placebo. Outcomes were assessed at 3 and 6 months and included the Barthel Index, Fugl-Meyer assessment and National Institute of Health Stroke Scale (NIHSS). Mean changes from baseline to 6 months showed significant between-group differences for the Barthel Index (total as well as self-care and mobility scales) and NIHSS, with no significant differences on the Fugl-Meyer assessment. Specific comparisons were not reported in the trial but the combined methylphenidate and levodopa group appeared to show the greatest benefit. Outcome assessors were not blinded in this trial, creating a risk of bias, however the patients and the treating doctors were blinded. The results of this trial suggest modest benefits in ADL following amphetamine treatment. This apparent conflict with the results of the Cochrane review may reflect differences in methodology (e.g. the timing of exercise therapy following drug administration) or the baseline differences that were present in the Cochrane review studies.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Placebo	Amphetamine		

<p><b>Death or dependency</b><sup>1</sup> End of follow-up</p> <p>9 Critical</p>	<p>Odds Ratio 1.45 (CI 95% 0.64 - 3.27) Based on data from 106 patients in 3 studies.<sup>2</sup> (Randomized controlled) Follow up 3-12 months post stroke</p>	<p><b>311</b> per 1000</p> <p><b>396</b> per 1000</p> <p>Difference: <b>85 more</b> per 1000 ( CI 95% 87 fewer - 285 more )</p>	<p><b>Low</b> Due to serious imprecision, Due to serious indirectness (baseline differences in included studies)<sup>3</sup></p>	<p>Amphetamine may increase death or dependency</p>
<p><b>Death (all causes)</b> End of follow-up</p> <p>9 Critical</p>	<p>Odds Ratio 2.82 (CI 95% 0.92 - 8.6) Based on data from 287 patients in 10 studies.<sup>4</sup> (Randomized controlled) Follow up 1 day to 12 months</p>	<p><b>22</b> per 1000</p> <p><b>60</b> per 1000</p> <p>Difference: <b>38 more</b> per 1000 ( CI 95% 2 fewer - 140 more )</p>	<p><b>Low</b> Due to serious indirectness (baseline differences in included studies), Due to serious imprecision<sup>5</sup></p>	<p>Amphetamines may increase death from all causes</p>
<p><b>Activities of daily living</b> End of follow-up</p> <p>8 Critical</p>	<p>Measured by: Barthel Index High better Based on data from: 113 patients in 4 studies.<sup>6</sup> (Randomized controlled) Follow up 10 days to 12 months</p>	<p>Difference: <b>MD 3.87 lower</b> ( CI 95% 13.49 lower - 5.75 higher )</p>	<p><b>Low</b> Due to serious risk of bias (intention to treat analysis showed almost significant effect in favour of placebo), Due to serious imprecision<sup>7</sup></p>	<p>Amphetamines may have little or no difference on activities of daily living</p>

1. Dependency classified as scores < 60 on the Barthel Index or score of 3-6 on the Oxford Handicap scale.
2. Systematic review [199]. **Baseline/comparator::** Control arm of reference used for intervention .
3. **Inconsistency: No serious . Indirectness: Serious .** Differences between the intervention/comparator of interest and those studied: multiple statistically significant baseline differences in included studies ; **Imprecision: Serious .** Low number of patients, Wide confidence intervals ; **Publication bias: No serious .**
4. Systematic review [199]. **Baseline/comparator::** Control arm of reference used for intervention .
5. **Inconsistency: No serious . Indirectness: Serious .** Differences between the intervention/comparator of interest and those studied: multiple significant baseline differences in included studies ; **Imprecision: Serious .** Wide confidence intervals, few events ; **Publication bias: No serious .**
6. Systematic review [199]. **Baseline/comparator::** Control arm of reference used for intervention .
7. **Risk of bias: Serious .** In the Cochrane review, an intention to treat analysis showed an almost significant benefit of placebo compared to amphetamine treatment ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ; **Publication bias: No serious .**

## References

[199] Martinsson L, Hårdemark H, Eksborg S : Amphetamines for improving recovery after stroke.. The Cochrane database of systematic reviews 2007;(1):CD002090 [Pubmed Journal](#)

[200] Lokk J., Roghani RS, Delbari A. : Effect of methylphenidate and/or levodopa coupled with physiotherapy on functional and motor recovery after stroke - a randomized, double-blind, placebo-controlled trial. Acta Neurologica Scandinavica 2011;123(4):266-273 [Journal Website](#)

Weak Recommendation

For stroke survivors, selective serotonin reuptake inhibitors may be used to improve performance of ADL. (Mead et al. 2012 [209])

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

Selective serotonin reuptake inhibitors showed statistically significant benefit for decreased dependency and improved activities of daily living. However, there were also non-significant increases in side-effects (seizures and bleeding) (Mead et al. 2012 [209]).

### Quality of evidence

Moderate

Quality of evidence from a meta-analysis of 22 RCTs is moderate due to some inconsistency across studies.

### Preference and values

Substantial variability is expected or uncertain

Given the potential harms, stroke survivors would have varied preferences and should be assisted to make informed decisions.

### Resources and other considerations

Important issues, or potential issues not investigated

#### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

## Rationale

Selective serotonin reuptake inhibitors (SSRIs) have been mainly used for the treatment of mood disorders such as depression, not specifically with the aim of improving ADL performance. Moderate quality of evidence from a Cochrane review (Mead et al. 2012 [209]) has shown benefits in dependency and disability in stroke patients. The meta-analysis of 22 studies showed significant improvements in ADL. However, there was also non-significant increases in side-effects such as seizure and bleeding. Therefore, patients need to be assessed for their eligibility and necessity of receiving SSRIs to avoid unnecessary harms.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Selective serotonin reuptake inhibitor  
**Comparator:** Control

### Summary

Mead et al (2012) [205] have conducted a Cochrane review on the effects of selective serotonin reuptake inhibitor in stroke patients. The pooled data of two studies involving 223 patients found significantly lower dependency (modified Rankin Score 3-5). However, only one of these two studies (with Fluoxetine) contributed to this effect estimate while the other one (with Sertraline) had zero cases with dependency in both intervention and control groups. The meta-analysis of 22 studies (N = 1310) showed significant improvement in activities of daily living. A number of studies had unclear risk of bias but subgroup analysis of studies with low risk of bias still showed significantly better results. In terms of side effects, there was a non-significant excess of seizures (RR 2.67; 95% CI 0.61 to 11.63) (seven trials involving 444 participants), a non-significant excess of gastrointestinal side effects (RR 1.90; 95% CI 0.94 to 3.85) (14 trials involving 902 participants) and a non-significant excess of bleeding (RR 1.63; 95% CI 0.20 to 13.05) (two trials involving 249 participants) in those allocated SSRIs.

Overall, the evidence suggests a possible benefit in decreased dependency and improved activities of daily living but large trials

will be needed to confirm or refute that the benefits outweigh the harms.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Selective serotonin reuptake inhibitor		
<b>Dependency</b> <sup>1</sup>  8 Critical	Relative risk 0.81 (CI 95% 0.68 - 0.97) Based on data from 223 patients in 2 studies. (Randomized controlled)	<b>450</b> per 1000	<b>365</b> per 1000	<b>Moderate</b> Due to serious inconsistency <sup>2</sup>	Selective serotonin reuptake inhibitor probably decreases dependency
<b>Activities of daily living</b> <sup>3</sup>  8 Critical	Measured by: Adjusted mean from a range of ADL measures High better Based on data from: 1,310 patients in 22 studies. (Randomized controlled)	Difference: <b>85 fewer</b> per 1000 ( CI 95% 13 fewer - 144 fewer )		<b>Moderate</b> Due to serious inconsistency <sup>4</sup>	selective serotonin reuptake inhibitor probably improves activities of daily living

1. modified Rankin Scale 3-5
2. **Inconsistency: Serious** . All cases with the outcome dependency came from one trial with Fluoxetine, whereas the trial with sertraline had no patients with the outcome ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
3. Measured by a range of tools including Barthel Index, Functional Independence Measure, and
4. **Risk of bias: No serious** . A lot of them have "unclear risk of bias" but subgroup analysis of studies with low risk of bias still showed statistically significant benefit ; **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with I<sup>2</sup>:85 % . ; **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .

## References

[209] Mead GE, Hsieh C-F, Lee R, Kutlubayev MA, Claxton A, Hankey GJ, Hackett ML : Selective serotonin reuptake inhibitors (SSRIs) for stroke recovery.. The Cochrane database of systematic reviews 2012;11 CD009286 [PubMed Journal](#)

Weak Recommendation

AGAINST

Brain stimulation (transcranial direct stimulation or repetitive transcranial magnetic stimulation) should not be used in routine practice to improve ADL and only used as part of a research framework. (Elsner et al. 2016 [195]; Hao et al. 2013 [149])

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

In the 2016 Cochrane review of tDCS, ADL outcomes improved immediately following intervention, and at follow-up 3 months later. However, these outcomes following tDCS did not persist when trials with low methodological quality were excluded from analysis (Elsner et al. 2016 [195]).

In the 2013 Cochrane review of rTMS, no significant benefits in ADL performance were observed, using the Barthel Index as a measure of change. There was no difference in outcomes when different stimulation frequencies were compared (Hao et al. 2013 [149]).

### Quality of evidence

Low

The quality of evidence is moderate for tDCS but low for rTMS, mostly due the risk of bias and small sample size of included studies.

### Preference and values

Substantial variability is expected or uncertain

Patients' preferences are likely to vary due to the uncertainty in long-term benefits.

### Resources and other considerations

Factors not considered

## Rationale

The quality of evidence is low to moderate, and therefore a stronger recommendation cannot be made at this time.

In the 2016 Cochrane review of tDCS, ADL outcomes improved immediately following the intervention and at follow-up 3 months later. However, these outcomes following tDCS did not persist when trials with low methodological quality were excluded from analysis (Elsner et al. 2016 [195]). In the 2013 Cochrane review of rTMS, no significant benefits in ADL performance were observed, using the Barthel Index as a measure of change. There was no difference in outcomes when different stimulation frequencies were compared (Hao et al. 2013 [149]).

Brain stimulation has only been used in research environments to date, but has involved stroke survivors early and later post-stroke.

## Clinical Question/ PICO

- Population:** Adults with stroke  
**Intervention:** Transcranial direct-current stimulation  
**Comparator:** Placebo or passive control

### Summary

Transcranial direct current stimulation (tDCS), anodal, cathodal and/or dual, was systematically reviewed in a Cochrane review of 32 studies that recruited 748 adult participants with ischaemic and haemorrhagic stroke, across all phases of care (Elsner et al 2016 [191]). Nine studies assessed the outcome of activities of daily living (ADL) immediately following intervention and at follow-up. There was some evidence of improvement in ADL performance, but these results did not persist when those with poor methodology were excluded.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Placebo or passive    Transcranial direct-	Certainty in effect	Plain text summary
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			estimates (Quality of evidence)	
<p><b>ADL<sup>1</sup></b> Until end of follow-up: mean 3 months</p> <p>8 Critical</p>	<p>Measured by: Various: e.g. Barthel Index, modified Rankin Score, Functional Independence Measure High better</p> <p>Based on data from: 269 patients in 6 studies. (Randomized controlled) Follow up mean 3 months</p>	<p>Difference: <b>SMD 0.31 higher</b> ( CI 95% 0.01 higher - 0.62 higher )</p>	<p><b>Moderate</b> Due to serious risk of bias<sup>2</sup></p>	<p>Transcranial direct-current stimulation probably improves ADL until the end of follow-up</p>
<p><b>ADL<sup>3</sup></b> End of intervention</p> <p>8 Critical</p>	<p>Measured by: Various: e.g. Barthel Index, modified Rankin Score, Functional Independence Measure High better</p> <p>Based on data from: 396 patients in 9 studies. (Randomized controlled)</p>	<p>Difference: <b>SMD 0.24 higher</b> ( CI 95% 0.03 higher - 0.44 higher )</p>	<p><b>Moderate</b> Due to serious risk of bias<sup>4</sup></p>	<p>Transcranial direct-current stimulation probably improves ADL at the end of intervention</p>

1. A range of ADL measures were included, e.g. Barthel Index, modified Rankin Score, Functional Independence Measure
2. **Risk of bias: Serious** . The benefit of tDCS did not persist when only studies of high methodological quality were included ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
3. A range of ADL measures were included, e.g. Barthel Index, modified Rankin Score, Functional Independence Measure
4. **Risk of bias: Serious** . some studies has unclear risk for selective outcome reporting ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .

### References

[195] Elsner B, Kugler J, Pohl M, Mehrholz J : Transcranial direct current stimulation (tDCS) for improving activities of daily living, and physical and cognitive functioning, in people after stroke. Cochrane Database of Systematic Reviews 2016;(3): [Journal Website](#)

### Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Repetitive transcranial magnetic stimulation  
**Comparator:** Control

### Summary

A Cochrane review showed no significant increase in the Barthel Index score from two heterogeneous trials with a total of 183 participants comparing repetitive transcranial magnetic stimulation (rTMS) treatment and control (Hao et al 2013)

[149]). Subgroup analyses of different stimulation frequencies or duration of illness also did not show a significant difference, and a few mild adverse events were observed in the rTMS groups. Further trials with larger sample sizes and long-term outcomes are needed to inform clinical practice.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Repetitive transcranial magnetic stimulation		
<b>ADL</b> <sup>1</sup> Post intervention  8 Critical	Measured by: Barthel Index Scale: 0-100 High better Based on data from: 183 patients in 2 studies. (Randomized controlled)	Difference: <b>MD 15.92 higher</b> ( CI 95% 2.11 lower - 33.95 higher )		<b>Very Low</b> Due to moderate risk of bias, potential publication bias, and serious inconsistency, and serious imprecision (wide confidence interval) <sup>2</sup>	We are uncertain whether repetitive transcranial magnetic stimulation improves or worsens ADL

1. Measures of ADL, such as Barthel Index, Functional Independence Measure, and modified Rankin Scale
2. **Risk of bias: Serious** . Some studies have selective outcome reporting ; **Inconsistency: Serious** . The magnitude of statistical heterogeneity was high, with I<sup>2</sup>:97% . ; **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: Serious** . Asymmetrical funnel plot ;

## References

[149] Hao Z, Wang D, Zeng Y, Liu M : Repetitive transcranial magnetic stimulation for improving function after stroke. Cochrane Database of Systematic Reviews 2013; [Pubmed Journal](#)

### Weak Recommendation

For stroke survivors, virtual reality technology may be used to improve ADL outcomes in addition to usual therapy. (Laver et al. 2015 [108])

## Practical Info

Clinicians may consider purchasing, learning to use, and embedding some virtual reality technologies into their practice. It may be more appropriate to offer this therapy to selected stroke survivors (i.e. younger people, aged up to 75 years, and people living in the community) in addition to usual therapy.

## Key Info

<p><b>Benefits and harms</b></p> <p>A Cochrane review showed that the use of virtual reality in conjunction with usual care improved activities of daily living (Laver et al. 2015 [108]). There were no reported harms or adverse events such as increased incidence of falls.</p>	<p>Substantial net benefits of the recommended alternative</p>
<p><b>Quality of evidence</b></p> <p>The quality of evidence was very low, with potential high risk of bias and small sample size in included studies, and inconsistency in results.</p>	<p>Very Low</p>
<p><b>Preference and values</b></p> <p>Some stroke survivors will want to use, and agree to use virtual reality technology, while others will prefer traditional or standard therapies. Younger stroke survivors and those living in the community are more likely to accept and participate in these therapies.</p>	<p>Substantial variability is expected or uncertain</p>
<p><b>Resources and other considerations</b></p> <p><u>Resources considerations</u></p> <p>No literature to understand or describe the potential economic implications of this recommendation was identified.</p>	<p>Important issues, or potential issues not investigated</p>

## Rationale

The 2015 Cochrane review included eight trials that investigated the effect of virtual reality technology on ADL (Laver et al. 2015 [108]). Virtual reality technology in conjunction with standard care improved ADL outcomes when measured using the Functional Independence Measure and Barthel Index. However, the quality of evidence in this review was very low.

## Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Virtual reality  
**Comparator:** Conventional therapy

## Summary

An updated Cochrane Review by Laver et al (2015) [108] captured an additional 19 (n=37) randomised and quasi-randomised trials from the previous review. All 37 studies recruited 1019 participants, with upper limb function as the primary outcome. Based on findings from 8 studies (N = 253) that investigated its effect on ADL, virtual reality-based intervention in conjunction with standard care resulted in improved ADL outcomes. However, there was no evidence that effects were sustained long-term. This intervention is relatively safe, but studies were only able to recruit 25% of participants screened. Interventions based on virtual reality technology were found to have a potential benefit in ADL outcomes in patients with chronic stroke only, and most participants were relatively young (mean age 46-75).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Conventional therapy	Virtual reality		
ADL <sup>1</sup>	Measured by: Various e.g. Functional Independence			Very Low Due to serious risk	We are uncertain whether virtual reality

Post intervention 8 Critical	Measure, Barthel Index High better Based on data from: 253 patients in 8 studies. (Randomized controlled)	Difference: <b>SMD 0.43 higher</b> ( CI 95% 0.18 higher - 0.69 higher )	of bias, serious inconsistency, and serious imprecision <sup>2</sup>	improves or worsens ADL
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1. Measures of ADL, such as Barthel Index, Functional Independence Measure, and modified Rankin Scale
2. **Risk of bias: Serious** . Risk of bias was unclear in a number of studies . ; **Inconsistency: Serious** . **Indirectness: No serious** . **Imprecision: Serious** . small total population size ; **Publication bias: No serious** .

### References

[108] Laver Kate E., George S, Thomas S, Deutsch Judith E., Crotty M : Virtual reality for stroke rehabilitation. Cochrane Database of Systematic Reviews 2015;(9): [Pubmed Journal](#)

## 12 - Communication

In Australia, communication and speech problems occur in approximately 60% of stroke patients on admission (Stroke Foundation 2015 [8]). UK data suggest that one-third of people are left with communication disability after stroke (Bowen et al. 2012 [221]). Considering its impacts on stroke survivors' functional performance and psychological wellbeing, appropriate assessments and treatments should be provided.

### 12.1 - Assessment of communication deficits

Info Box

#### **Practice point**

- All stroke survivors should be screened for communication deficits using a screening tool that is valid and reliable.
- Those stroke survivors with suspected communication difficulties should receive formal, comprehensive assessment by a specialist clinician to determine the nature and type of the communication impairment.

#### **Key Info**

##### **Resources and other considerations**

##### **Implementation considerations**

There are clinical indicators collected in the National Stroke Audit to determine whether patients were assessed by a speech pathologist during their inpatient admission and whether this assessment took place within 48 hours of admission. Additionally, there is an organisational indicator collected in the National Stroke Audit to ascertain whether or not hospitals have locally agreed assessment protocols for communication.

#### **Rationale**

Screening is an important step because patients may otherwise be at risk of “falling through the cracks” in the health system. Patients may appear more able in general conversations than they really are, drawing on non-verbal and contextually situated cues. Aphasia is complex, is on a continuum of very severe to very mild, may affect language modalities to different degrees, and may also evolve rapidly in the early period. A formal screen is required to determine whether more detailed assessment is appropriate. A formal comprehensive assessment has multiple functions, including establishing a baseline, determining communication strengths and weaknesses, contributing information towards education and goal setting for patients and families, monitoring change, and determining rehabilitation planning.

### 12.2 - Aphasia

The term aphasia is used to describe an acquired loss or impairment of the language system following brain damage. It differentiates from other communication difficulties attributed to sensory loss, confusion, dementia or speech difficulties due to muscular weakness or dysfunction, such as dysarthria (Brady et al. 2016 [206]). The most common cause of aphasia is a stroke to the left hemisphere, where the language function of the brain is usually situated for right-handed people (Brady et al. 2016 [206]). The National Stroke Audit showed that around a third of stroke patients had aphasia on admission (Stroke Foundation 2015 [8]).

There is no universally accepted treatment that can be applied to every person with aphasia, and typically therapists select from a variety of theoretical approaches, delivery models, and intervention regimens to manage and facilitate rehabilitation (Brady et al. 2016 [206]).

Practice Statement

#### **Practice point**

Treatment for aphasia should be offered as early as tolerated.

**Strong Recommendation**

For stroke survivors with aphasia, speech and language therapy should be provided to improve functional communication. (Brady et al. 2016 [210])

**Practical Info**

The evidence suggests that benefits of speech and language therapy are aimed towards both impairment and functional goals. There is a range of options addressing all modalities and opportunities to transfer this work into meaningful contexts as negotiated with patients and families. Therapy options are varied, but include targeting specific underlying deficits or optimising preserved abilities through, for example, phonological or semantic therapies, sentence or discourse level therapies, reading and writing. Benefits have been shown for constraint-induced language therapy, multi-modal therapy, computer-based therapies, conversation therapies, partner-training and group-based communication and psychosocial therapies.

The Australian Aphasia Rehabilitation Pathway (AARP) is a set of care standards for aphasia management. It has been designed for speech pathologists to help guide person-centered, evidence-based aphasia services. It aims to optimise the overall rehabilitation journey for people with aphasia and their families/friends. The AARP is available at [www.aphasiapathway.com.au](http://www.aphasiapathway.com.au).

**Key Info**

**Benefits and harms**

**Substantial net benefits of the recommended alternative**

Overall, there appears to be a benefit of speech and language therapy (SLT) over no SLT according to a Cochrane review (Brady et al. 2016 [210]) based on 27 randomised controlled trial comparisons, including 1620 participants. More specifically, benefits were found on functional communication, reading, general expressive language and written language.

There were no harms associated with SLT. No evidence of benefit or harm was found for naming or auditory comprehension. There was no evidence of SLT and a change in mood.

**Quality of evidence**

**Moderate**

While the evidence for the benefits of functional communication was graded as moderate, it was low for general expression. The trials reviewed in this study were heterogeneous, for example in their sample sizes, when people were recruited to the trial post stroke, the frequency of therapy, the choice of outcome measure and the times chosen for follow-up assessment. There was little evidence at follow-up that benefits were long-lasting.

**Preference and values**

**No substantial variability expected**

**Resources and other considerations**

**No important issues with the recommended alternative**

**Resources considerations**

Our literature search identified three economic evaluations of various speech and language therapies using clinical trial data (Humphreys et al. 2015 [221]; Bowen et al. 2012 [213]; Latimer et al. 2013 [222]). However, the results of these evaluations were uncertain either due to risk of bias, indirectness of evidence and variability shown in sensitivity analyses. Overall, there was no conclusive evidence that these therapies were cost-effective compared to usual care.

**Implementation considerations**

There are clinical indicators collected on the types of management that patients with identified aphasia received. These types of management include alternative means of communication, phonological and semantic interventions, constraint-induced language therapy, supported conversation techniques, delivery of therapy programs via computer, and group therapy.

**Rationale**

The Cochrane review (Brady et al. 2016 [210]) included studies investigating a range of speech and language intervention types (e.g.

constraint-induced therapy, group therapy, computer volunteer assisted training) with a range of dosages, intensity and timing of interventions. The estimates of effect are based on pooled results from all studies. There is no evidence that one form of speech and language therapy is superior to another.

While several studies in Brady et al. (2016) [210] compared early versus delayed interventions, there were no significant between group differences. Therefore there is currently a lack of evidence to guide optimal timing of interventions.

There is evidence of benefit of speech and language therapy for improving impairment as well as functional communication. In addition to treating these aspects of language, aphasia therapy is a broad term incorporating a range of other potential benefits for addressing activity, participation, personal and environmental factors which have not been fully evaluated through RCT studies. Other methodological approaches, such as single case study designs, have demonstrated benefits for a range of aspects of aphasia therapy. Individually tailored interventions contribute to the strength of speech and language therapy for aphasia.

### Clinical Question/ PICO

**Population:** Adults with stroke with aphasia  
**Intervention:** Speech and language therapy  
**Comparator:** Control

#### Summary

A Cochrane review by Brady et al (2016) [206] included 57 randomised controlled trials (N = 3002) investigating the effects of speech and language therapy (SLT) for aphasia following stroke. Results from 27 comparisons of SLT against no SLT with 1620 participants showed that SLT significantly increased functional communication scores with a clinically significant effect size (SMD 0.28, 95% CI 0.06 to 0.49). Results from 7 trials also showed significant improvements in expressive language (SMD 1.28, 95% CI 0.38 to 2.19). The review authors rated the quality of evidence as moderate to low due to unclear randomisation and allocation concealment procedures in some trials and wide confidence intervals in some comparisons.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Speech and language therapy		
<b>Functional communication</b> Post intervention  8 Critical	Measured by: Various, e.g. WAB, ANELT, AAT, FCP High better Based on data from: 376 patients in 10 studies. <sup>1</sup> (Randomized controlled) Follow up various - 1 session to 12 months of treatment	Difference: <b>SMD 0.28 higher</b> ( CI 95% 0.06 higher - 0.49 higher )		<b>Moderate</b> Due to serious risk of bias <sup>2</sup>	Speech and language therapy (SLT) probably provides more benefit than no SLT for functional communication outcomes in aphasia.
<b>General expressive language</b> Post intervention  7 Critical	Measured by: PICA (verbal subtest), Chinese Language Impairment Examination High better Based on data from: 248 patients in 7 studies. <sup>3</sup>	Difference: <b>SMD 1.28 higher</b> ( CI 95% 0.38 higher - 2.19 higher )		<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>4</sup>	Speech and language therapy may improve general expressive language

<p><b>Mood</b> Post intervention 7 Critical</p>	<p>(Randomized controlled) Follow up various - 1 session to 12 months of treatment</p> <p>Based on data from 137 patients in 1 studies.<sup>5</sup></p>	<p>An RCT compared SLT to no SLT using the MAACL to assess mood. No significant differences were seen on the anxiety (MD: 0.40, 95% CI: -0.57 - 1.37), depression (MD: 0.70, 95% CI: -1.38, 2.78), or hostility scales (MD: -0.10, 95% CI: -0.90, 0.70).</p>	<p><b>Low</b> Due to serious imprecision, Due to serious risk of bias<sup>6</sup></p> <p>speech and language therapy may have little or no difference on mood (anxiety, depression or hostility)</p>
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1. Systematic review [210]. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
3. Systematic review [210]. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals ; **Publication bias: No serious** .
5. Systematic review [210].
6. **Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Wide confidence intervals, Only data from one study ; **Publication bias: No serious** .

## References

[210] Brady MC, Kelly H, Godwin J, Enderby P, Campbell P : Speech and language therapy for aphasia following stroke. Cochrane Database of Systematic Reviews 2016; [Pubmed Journal](#)

### Weak Recommendation

For stroke survivors with aphasia, intensive aphasia therapy (at least 45 minutes of direct language therapy for five days a week) may be used in the first few months after stroke. (Brady et al. 2016 [210])

## Practical Info

Putting this recommendation into practice depends on an awareness of the findings of higher dropout rates for those patients receiving high-intensity delivery and, therefore, requires clinicians to be sensitive to the tolerance level of each patient and the choice/fit of the therapy adopted. Intensive therapy has been found to work in both individual and group contexts and the latter may provide the benefits of social and peer support, as well as efficient use of therapist time.



## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

Speech and language therapy (SLT) offered at high intensity may have benefits for functional communication and for reducing the severity of the language impairment as compared to low-intensity SLT. This evidence is based on 2 key studies including 84 patients for functional communication and 5 studies involving 187 patients in relation to severity of impairment (Brady et al. 2016 [210]).

There were no effects on mood when comparing high-intensity SLT and low-intensity SLT in one study including 25 patients.

No harms were found in relation to intensity, but there were higher dropout rates for those patients receiving high-intensity therapy. In addition, high intensity delivery of SLT was found to be more beneficial for patients in the early months post-stroke as compared to those who were chronic (up to several years post-stroke).

### Quality of evidence

Low

While individual studies were of high methodological quality, the numbers were relatively small and trials were heterogeneous.

### Preference and values

Substantial variability is expected or uncertain

It is possible that not all patients would want to receive high-intensity SLT due to uncertain benefits and potential burden with longer treatment period.

### Resources and other considerations

Important issues, or potential issues not investigated

#### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

## Rationale

There is evidence for the benefits of intensive aphasia therapies, however the quality of the evidence is insufficient to warrant a strong recommendation. This recommendation also fits with theories of neuroplasticity and recovery, building on the principle of intensity along with increased opportunities for intensive practice and feedback.

## Clinical Question/ PICO

- Population:** Adults with stroke with aphasia  
**Intervention:** High intensity speech and language therapy  
**Comparator:** Low intensity language and speech therapy

### Summary

A Cochrane review by Brady et al (2016) [206] included 57 randomised controlled trials (N = 3002) investigating the effects of speech and language therapy (SLT) for aphasia following stroke. The review included 38 comparisons of different forms of SLT. Meta-analysis showed significantly better functional communication when therapy was delivered at a higher dose, higher intensity or for a longer duration. The quality of evidence was rated as moderate to low due to a high risk of bias in some included trials due to unclear randomisation procedures and unclear allocation concealment, and due to a lack of precision in some comparisons. In a trial assessing the benefits of early and intensive aphasia therapy, Godecke et al (2012) [61] compared daily aphasia therapy for acute stroke patients to usual care, including 59 participants. Participants in the intervention group received a total mean of 331 minutes of therapy, while in the usual care group 4 patients (15%) received therapy, receiving 295 minutes total. The daily therapy group showed significant improvements in aphasia quotient and functional communication profile scores.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Low intensity High intensity speech language and speech and language therapy therapy	Certainty in effect estimates (Quality of evidence)	Plain text summary
<b>Functional communication</b> Post intervention	Measured by: Functional Communication Profile High better Based on data from: 84 patients in 2 studies. (Randomized controlled) Follow up High intensity - 4 weeks of treatment, Low intensity - 4 to 50 weeks	Difference: <b>MD 11.75 higher</b> ( CI 95% 4.09 higher - 19.4 higher )	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>1</sup>	high intensity speech and language therapy may improve functional communication
<b>Severity of language impairment</b> <sup>2</sup> Post intervention	Measured by: Various - WAB Aphasia Quotient, AAT, BDAE High better Based on data from: 187 patients in 5 studies. (Randomized controlled)	Difference: <b>SMD 0.38 higher</b> ( CI 95% 0.07 higher - 0.69 higher )	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>3</sup>	high intensity speech and language therapy may reduce severity of language impairment but the benefit is only in those who were earlier post onset (up to 3 months post stroke).
<b>Mood</b> <sup>4</sup> Post intervention	Measured by: Stroke Aphasia Depression Questionnaire High better Based on data from: 25 patients in 1 studies. <sup>5</sup> (Randomized controlled) Follow up 12 months	<b>22</b> points (Mean) <b>29</b> points (Mean) Difference: <b>MD 7 higher</b> ( CI 95% 2.61 lower - 16.61 higher )	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>6</sup>	high intensity language and speech therapy may have little or no difference on mood

- Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
- Looked at in 7 trials using a range of measures such as the WAB, AAT or the BDAE. Groups that received high intensity SLT did better on measures of severity of aphasia than those who received low intensity SLT (P = 0.02, SMD0.38, 95%CI 0.07 to 0.69). The evidence for this is better in those who were earlier post onset (up to 3 months post stroke) and was not found in those who were several years post stroke.
- Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ;
- No evidence of a difference between high and low intensity SLT on mood (Smith, 1981 using GHQ and SPIRIT using SAD-Q).
- Systematic review [210] . **Baseline/comparator::** Control arm of reference used for intervention .
- Risk of bias: Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

## References

[210] Brady MC, Kelly H, Godwin J, Enderby P, Campbell P : Speech and language therapy for aphasia following stroke. Cochrane Database of Systematic Reviews 2016; [Pubmed Journal](#)

Weak Recommendation

AGAINST

Brain stimulation (transcranial direct current stimulation or repetitive transcranial magnetic stimulation), with or without traditional aphasia therapy, should not be used in routine practice for improving speech and language function and only used as part of a research framework. (Ren et al. 2014 [211]; Elsner et al. 2015 [212])

## Practical Info

For those clinicians currently researching the application of tDCS or rTMS with or without traditional aphasia therapy, a focus on both formal outcome measures of functional communication or language impairment is important, as well as follow-up measures to assess for maintenance of any gains.

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

Transcranial direct current stimulation (tDCS) plus speech language therapy does not improve accuracy in picture naming when compared to sham tDCS plus speech language therapy (Elsner et al. 2015 [212]). No adverse events were reported and the rate of dropouts was comparable between those receiving tDCS and those receiving sham tDCS (Elsner et al. 2015 [212]).

Low-frequency rTMS may reduce the overall severity of the language impairment and may improve naming and repetition when compared to sham rTMS with or without speech language therapy in the short term (Ren et al. 2014 [211]). There is insufficient evidence to determine if low-frequency rTMS improves or worsens written expression and auditory comprehension (Ren et al. 2014 [211]). No severe adverse effects were reported in these seven studies and no patient reported that language impairment worsened after treatment (Ren et al. 2014 [211]).

### Quality of evidence

Low

No studies on tDCS used formal measures of functional communication or language impairment, which are more critical outcomes. Included studies also had small sample sizes and high risk of bias.

All seven trials of rTMS were randomised, prospective placebo-controlled studies but used impairment outcome measures only. Six of the seven studies did not investigate treatment effects beyond 15 weeks.

### Preference and values

Substantial variability is expected or uncertain

There is inadequate evidence demonstrating the benefit or the harm of brain stimulation. Therefore, some variation in patients' preferences may exist.

### Resources and other considerations

Factors not considered

## Rationale

Low-quality evidence showed little difference between tDCS plus speech language therapy compared to speech language therapy alone (Ren et al. 2014 [211]; Elsner et al. 2015 [212]). Further high-quality research with longer follow-up and functional communication outcomes is required in this area before application to a clinical setting should be considered.

## Clinical Question/ PICO

<b>Population:</b>	Adults with stroke with aphasia
<b>Intervention:</b>	Repetitive Transcranial Magnetic Stimulation
<b>Comparator:</b>	Sham

### Summary

A systematic review of low-frequency rTMS for improving language recovery in stroke patients with aphasia included 7 trials with a total of 160 participants (Ren et al 2014 [207]). All trials included patients with left hemisphere damage and targeted stimulation at the triangular part of the right inferior frontal gyrus, using 1 Hz rTMS at 90% of the resting motor threshold. In 6 trials patients also received speech and language therapy following rTMS. Control participants received sham stimulation. Meta-analysis showed significant improvements in the severity of language impairment (SMD 1.26, 95% CI 0.80 to 1.71). Naming, repetition, writing and comprehension scales also showed significant improvements. The overall quality of evidence ranged from moderate to very low, as the number of included participants was small and some trials had high risk of bias.

There are a number of small individual rTMS trials identified in the literature search but not included in Ren et al (2014). However, the interventions used in these trials are heterogeneous and none of them was of sufficient quality to recommend a particular practice.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Sham	Repetitive Transcranial Magnetic Stimulation		
<b>Severity of language impairment</b> <sup>1</sup> Post intervention  8 Critical	Measured by: Various - Aachen Aphasia Test (AAT), Boston Diagnostic Aphasia Examination (BDAE) High better Based on data from: 96 patients in 5 studies. <sup>2</sup> (Randomized controlled) Follow up 0-15 weeks	Difference: <b>SMD 1.26 higher</b> ( CI 95% 0.8 higher - 1.71 higher )		<b>Moderate</b> Due to serious imprecision <sup>3</sup>	rTMS probably decreases severity of language impairment
<b>Naming</b> <sup>4</sup> 0 - 12 months  7 Critical	Measured by: Various: Boston Naming Test, BDAE naming subtests, AAT naming subtests, Computerized Picture Naming Test High better Based on data from: 139	Difference: <b>SMD 0.52 higher</b> ( CI 95% 0.18 higher - 0.87 higher )		<b>Low</b> Due to serious inconsistency, Due to serious imprecision <sup>6</sup>	rTMS may improve naming

<p><b>Writing</b> Post intervention</p> <p>7 Critical</p>	<p>patients in 6 studies.<sup>5</sup> (Randomized controlled) Follow up 0-12 months</p> <p>Measured by: AAT and BDAE writing subtests High better Based on data from: 63 patients in 3 studies. (Randomized controlled) Follow up Post intervention</p>	<p>Difference: <b>SMD 0.7 higher</b> ( CI 95% 0.19 higher - 1.22 higher )</p>	<p><b>Very Low</b> Due to serious risk of bias, Due to serious indirectness, Due to serious imprecision<sup>7</sup></p>	<p>We are uncertain whether rTMS improves written expression</p>
<p><b>Comprehension</b> 8 0-15 weeks</p> <p>7 Critical</p>	<p>Measured by: AAT and BDAE comprehension subtests High better Based on data from: 101 patients in 4 studies.<sup>9</sup> (Randomized controlled) Follow up 0-15 weeks</p>	<p>Difference: <b>SMD 0.32 higher</b> ( CI 95% 0.08 lower - 0.72 higher )</p>	<p><b>Very Low</b> Due to serious inconsistency, Due to serious indirectness, Due to serious imprecision<sup>10</sup></p>	<p>We are uncertain if rTMS improves or worsens receptive language/auditory comprehension</p>

- Only three trials reported the effect of rTMS on follow up after treatment. Two trials followed up with patients 15 weeks after treatment. The other trial followed up with patients 2,8 and 12 months after treatment. One study showed improvement in overall severity at 15 weeks.
- Systematic review [211]. **Baseline/comparator::** Control arm of reference used for intervention . Primary studies included: Barwood, 2013, Thiel, 2013, Seniow, 2013, Hartmann, 2013, Heiss, 2013, Weiduschat, 2011.
- Risk of bias: No serious** . Allocation concealment explicitly reported in 2/7 studies. Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Two studies (Heiss, 2013 and Weiduschat, 2011) were reported to be at high risk of bias for incomplete outcomes. Incomplete data and/or large loss to follow up Selective outcome reporting suggestive of high risk of bias in 1/7 studies (Waldowski, 2012), Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Incomplete data and/or large loss to follow up, Selective outcome reporting, due to [reason] ; **Inconsistency: No serious** . "Pooling the available data using SMDs we observed no heterogeneity, (I<sup>2</sup> = 0%, p=0.44)", The direction of the effect is not consistent between the included studies ; **Indirectness: No serious** . due to [reason] ; **Imprecision: Serious** . Low number of patients (160), due to outcome measures used. stronger effects shown when AAT used as measure of severity than when BDAE used as measure of severity. 4 studies in German, 2 in Polish, 1 in English. I am not familiar with the psychometric properties of the AAT. I am also unsure of the psychometric properties of the translated BDAE (into Polish) and the CPNT., Low number of patients ; **Publication bias: No serious** . A funnel plot, rank correlation and a regression test were used to describe possible publication bias, ;
- Outcomes include: AAT naming test, Boston naming Test, BDAE naming subtest, CPNT accuracy of naming test
- Systematic review [211]. **Baseline/comparator::** Control arm of reference used for intervention . Primary studies included: Barwood, 2013, Thiel, 2013, Seniow, 2013, Heiss, 2013, Waldowski, 2012, Weiduschat, 2011.
- Risk of bias: No serious** . Incomplete data and/or large loss to follow up, Selective outcome reporting, due to [reason] Allocation concealment explicitly reported in 2/7 studies. Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Two studies (Heiss, 2013 and Weiduschat, 2011) were reported to be at high risk of bias for incomplete outcomes. Selective outcome reporting suggestive of high risk of bias in 1/7 studies (Waldowski, 2012) 3/6 studies reported low risk of other bias, and remaining 3/6 studies were reported as risk of other bias unclear ; **Inconsistency: Serious** . The direction of the effect is not consistent between the included studies. The only study to use CPNT as the outcome measure did not show an effect, either positively or negatively for the intervention. The remaining 5 naming studies showed a positive effect. ; **Indirectness: No**

**serious** . 3 German, 2 Polish and 1 English study reviewed ; **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

7. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias in 2/3 studies , Incomplete data and/or large loss to follow up in 2/3 studies, Unclear risk of other bias in 2/3 studies ; **Inconsistency: No serious** . **Indirectness: Serious** . Differences between the population of interest and those studied. All 3 studies on German written language., The outcome time frame in studies were insufficient. No follow up in any of 3 studies. ; **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

8. Multiple measures

9. Systematic review [211] . Primary studies included: Thiel, 2013, Seniow, 2013, Heiss, 2013, Weiduschat, 2011. **Baseline/comparator::** Systematic review .

10. **Risk of bias: No serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias in 2/4 studies , Incomplete data and/or large loss to follow up in 2/4 studies, Unclear if risk of bias in 2/4 studies ; **Inconsistency: Serious** . The direction of the effect is not consistent between the included studies ; **Indirectness: Serious** . Differences between the population of interest and those studied. 3 studies in German and one in Polish ; **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

### Clinical Question/ PICO

**Population:** Adults with stroke with aphasia  
**Intervention:** tDCS plus speech and language therapy (SLT)  
**Comparator:** Sham tDCS plus SLT for improving aphasia

#### Summary

A Cochrane review by Elsner et al (2015) [208] included 12 trials (N = 136) of transcranial direct current stimulation (tDCS) for improving aphasia. The included trials used both anodal and cathodal tDCS and a variety of stimulation sites, e.g. left frontal cortex, Wernicke's area or Broca's area. All trials compared active tDCS to sham stimulation. The primary outcome in the review protocol was functional communication but this was not reported in any of the included trials. 6 trials (N = 66) reported results from picture naming tasks, and meta-analysis showed non-significant improvement in tDCS groups (SMD 0.37, 95% CI -0.18 to 0.92). Due to the low numbers of participants and the high risk of bias in included trials, there is insufficient evidence to determine the benefits of tDCS for aphasia.

There are a number of small individual tDCS trials identified in the literature search but not included in Elsner et al (2015). However, the interventions used in these trials are heterogeneous and none of them was of sufficient quality to recommend a particular practice.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Sham tDCS plus SLT tDCS plus speech and language therapy (SLT)	Certainty in effect estimates (Quality of evidence)	Plain text summary
Accuracy of naming At end of	Measured by: Picture naming accuracy Based on data from: 66	Difference: <b>SMD 0.37 higher</b> ( CI 95% 0.18 lower - 0.92 higher )	<b>Very Low</b> Due to serious indirectness, Due	We are uncertain whether tDCS plus speech and language therapy (SLT) improves or

intervention phase 7 Critical	patients in 6 studies. <sup>1</sup> (Randomized controlled) Follow up 1-4 weeks post intervention		to serious imprecision, Due to serious risk of bias <sup>2</sup>	worsens accuracy of naming
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1. Systematic review [212] with included studies: Fiori 2013, Marangolo 2013b, Kang 2011, You 2011, Monti 2008a, Floel 2011.

**Baseline/comparator::** Systematic review .

2. **Risk of bias: Serious** . overall high risk of bias ; **Inconsistency: No serious** . **Indirectness: Serious** . Differences between the outcomes of interest and those reported - functional communication and language impairment would be more patient-critical outcomes ; **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

### References

[212] Elsner B, Kugler J, Pohl M, Mehrholz J : Transcranial direct current stimulation (tDCS) for improving aphasia in patients with aphasia after stroke. Cochrane Database of Systematic Reviews 2015; [Pubmed Journal](#)

### Info Box

#### Practice points

Where a stroke patient is found to have aphasia, the clinician should:

- Document the provisional diagnosis.
- Explain and discuss the nature of the impairment with the patient, family/carers and treating team, and discuss and teach strategies or techniques which may enhance communication.
- Identify goals for therapy, and develop and initiate a tailored intervention plan, in collaboration with the patient and family/carer.
- Reassess the goals and plans at appropriate intervals over time.
- Use alternative means of communication (such as gesture, drawing, writing, use of augmentative and alternative communication devices) as appropriate.

All written information on health, aphasia, social and community supports (such as that available from the [Australian Aphasia Association](#) or local agencies) should be available in an aphasia-friendly format.

#### Info Box

##### **Practice point**

- Stroke survivors with chronic and persisting aphasia should have their mood monitored.
- Environmental barriers facing people with aphasia should be addressed through training communication partners, raising awareness of and educating about aphasia to reduce negative attitudes, and promoting access and inclusion by providing aphasia-friendly formats or other environmental adaptations. People with aphasia from culturally and linguistically diverse backgrounds may need special attention from trained healthcare interpreters.
- The impact of aphasia on functional activities, participation and quality of life, including the impact upon relationships, vocation and leisure, should be assessed and addressed as appropriate from early post-onset and over time for those chronically affected.

## 12.3 - Dysarthria

Dysarthria is an output problem, resulting from impaired movements of the speech musculature including lips, tongue, palate, larynx and respiration (Bowen et al. 2012 [221]). This limits intelligibility for the listener and may cause frustration and distress for the person with stroke, and often causes restricted activity and social participation (Bowen et al. 2012 [221]). It is unclear how prevalent dysarthria is in stroke patients, but it often co-occurs with other communication deficits that require attention from healthcare professionals (Bowen et al. 2012 [221]).

#### Weak Recommendation

For stroke survivors with dysarthria, individually tailored interventions provided by a speech and language pathologist or a trained communication partner may be provided. (Bowen et al. 2012 [213])

#### Practical Info

Patients with unclear or unintelligible speech should be assessed to determine the nature and cause of the speech impairment.

In the population of stroke patients affected by dysarthria, early and sustained contact targeted to individual needs is vital for enhancing patient confidence and functional communication improvements. Patients with identified dysarthria should commence individually targeted treatment as early as possible and within the first 32 days (Bowen et al. 2012 [225]), for at least three sessions per week for up to 16 weeks following stroke. Interventions should include speech practice of words, sentences and conversation, using strategies that include slowed speaking rate, emphasis on key syllables and articulatory placement.

Dysarthria treatment should focus on functional communication use, e.g. speech production tasks used in context. Interventions for the treatment of dysarthria can include:

- biofeedback or a voice amplifier to change intensity and increase loudness
- intensive therapy aiming to increase loudness (e.g. Lee Silverman Voice Treatment)
- the use of strategies such as decreased rate, emphasis on key syllables and deliberate articulation (Mackenzie et al 2014 [162]).

People with severe dysarthria can benefit from using augmentative and alternative communication devices in everyday activities.

#### Key Info

##### **Benefits and harms**

Small net benefit, or little difference between alternatives

Small benefits were seen in early well-resourced speech and language therapy intervention compared with visits from a volunteer in early stroke recovery (Bowen et al. 2012 [225]). No harm was reported in this study.



**Quality of evidence** Low  
 Overall quality of evidence is low as this is based on a study with small sample size.

**Preference and values** No substantial variability expected  
 Patients would prefer an early and sustained contact during their recovery. Patients value guidance, support, meeting of their individual needs and high amounts of contact during their recovery. In Bowen et al. (2012) [225], patients reported they felt targeted intervention caused improvements in mood, confidence and being able to recognise their own progress.

**Resources and other considerations** Important issues, or potential issues not investigated  
**Resources considerations**  
 Bowen et al. (2012) [225] investigated the cost-effectiveness of communication therapy for patients with stroke who have aphasia or dysarthria, compared to attention control (patient contact with a visitor who did not deliver communication therapy). This economic evaluation was based on data collected for an RCT conducted in the United Kingdom. It was unclear if communication therapy was more or less cost-effective than attention control. Additional economic evaluations are required in order to determine if this therapy is cost-effective.

**Rationale**

Early and sustained intervention for post-stroke dysarthria may improve functional speech outcomes. Interventions must be focused on patients' specific impairments, be functionally relevant and well-explained for patients to adhere to (Bowen et al. 2012 [225]). Group therapy involving family members has been shown to be effective for patient recovery.

**Clinical Question/ PICO**

- Population:** Stroke patients with dysarthria and aphasia
- Intervention:** Early, well-resourced communication therapy
- Comparator:** Attention control

**Summary**

A randomised trial by Bowen et al (2012) [209] included 170 people with aphasia or dysarthria following stroke. The intervention group received best-practice communication therapy, generally starting after 2 weeks, receiving up to 3 contacts per week for 16 weeks from speech and language therapists. At 6 months there was a non-significant trend towards improvement between the intervention and control groups on the Therapy Outcome Measure (MD 0.25, 95% CI -0.19 to 0.69). There were no significant differences on the Communication Outcomes After Stroke scale or for carer well-being and quality of life. Due to the small number of participants involved in the trial, there is only moderate certainty about the observed effects.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Attention control    Early communication therapy		Certainty in effect estimates (Quality of evidence)	Plain text summary
<b>Improved communication</b> <sup>1</sup> 6 months post randomisation.	Measured by: TOM. Reported means are raw data, reported difference is covariate adjusted. Scale: 0-5 High better	<b>3</b> points (Mean)	<b>3.3</b> points (Mean)	<b>Moderate</b> Due to serious imprecision <sup>2</sup>	Early communication therapy probably results in improved communication.
		Difference: <b>MD 0.25 higher</b>			

7 Critical	Based on data from: 153 patients in 1 studies. (Randomized controlled) Follow up 6 months post randomisation	( CI 95% 0.19 lower - 0.69 higher )			
<b>Carer burden</b> 6 months post treatment	Measured by: Carer COAST scale Scale: 0-100 High better Based on data from: 129 patients in 1 studies. <sup>3</sup> (Randomized controlled) Follow up 6 months	<b>62</b> percent (Mean)	<b>62</b> percent (Mean)	<b>Moderate</b> Due to serious imprecision <sup>4</sup>	There was probably no difference in carer burden as reported on carer COAST and COPE scales
7 Critical		Difference: <b>MD 0 higher</b> ( CI 95% 7 lower - 7 higher )			

<b>Practical issues</b>	<b>Attention control</b>	<b>Early, well-resourced communication therapy</b>	<b>Both</b>
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Emotional well-being  
Experience of patients and carers

Early, frequent attention by therapists or paid visitors was highly valued by patients and their carers, had good uptake and was perceived by users as being responsible for positive impacts on confidence and mood.

1. Patients with dysphasia or dysarthria post stroke who received an early well resources but individually tailored Best Practise SL intervention demonstrated similar levels of functional communication ability at 6 months to those who received Attention Control, involving largely informal conversation from volunteers trained to provide attention control not specific language trained intervention. Primary analysis of results estimated a change of .25 ( 95%CI-0.19 to 0.69) in favour of SL yet this result was removed through sensitivity analysis and leaving results to support no difference in improvement between groups.
2. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients, small sample size ; **Publication bias: No serious .**
3. Primary study [225]. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ; **Publication bias: No serious .**

## References

[213] Bowen A, Hesketh A, Patchick E, Young A, Davies L, Vail A, Long A, Watkins C, Wilkinson M, Pearl G, Lambon Ralph M, Tyrrell P : Clinical effectiveness, cost-effectiveness and service users' perceptions of early, well-resourced communication therapy following a stroke: a randomised controlled trial (the ACT NoW Study).. Health technology assessment (Winchester, England) 2012;16(26):1-160 [PubMed Journal](#)

Weak Recommendation

AGAINST

For stroke survivors with dysarthria, non-speech oromotor exercises have not been shown to provide additional benefit to behavioural speech practice and are not recommended. (Mackenzie et al. 2014 [224])

### Practical Info

Patients with unclear or unintelligible speech should be assessed to determine the nature and cause of the speech impairment.

Dysarthria Intervention should be individually tailored and should include speech practice of words, sentences and conversation, using strategies that include slowed speaking rate, emphasis on key syllables and articulatory placement. Inclusion of non-speech oromotor exercises has not been shown to result in functional speech improvements (Mackenzie et al. 2014 [224]), and therefore should be avoided. This recommendation needs to be considered in light of the small amount of research into this area and the small sample size of studies.

Dysarthria treatment should focus on functional communication use, e.g. speech production tasks used in context. Interventions for the treatment of dysarthria can include:

- biofeedback or a voice amplifier to change intensity and increase loudness
- intensive therapy aiming to increase loudness (e.g. Lee Silverman Voice Treatment)
- the use of strategies such as decreased rate, emphasis on key syllables and deliberate articulation (Mackenzie et al. 2014 [224]).

People with severe dysarthria can benefit from using augmentative and alternative communication devices in everyday activities.

### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

A small randomised controlled trial investigating the feasibility of non-speech oromotor exercises (NSOMEs) when added to behavioural speech production practice, provided no benefit (Mackenzie et al. 2014 [224]).

No harm was reported in this study.

#### Quality of evidence

Moderate

Overall quality of evidence is low as this is based on few studies with small sample sizes.

#### Preference and values

No substantial variability expected

Patients are unlikely to want to receive a treatment with no proven benefits.

#### Resources and other considerations

Factors not considered

### Rationale

The addition of non-speech oromotor exercises (NSOMEs) to behavioural speech intervention does not result in a functional gain in speech recovery, as evidenced through a small study. This study involved 20 participants, and results at 4 follow-up points indicated the use of NSOMEs was not statistically/functionally significant in recovery when compared to patients who received behavioural speech therapy alone. To date, no robust study has attributed speech improvements to the inclusion of non-speech oromotor exercises in treatment protocols. (Mackenzie et al. 2014 [224])

**Clinical Question/ PICO**

**Population:** Stroke patients with dysarthria  
**Intervention:** Communication therapy with non-speech oro-motor exercises  
**Comparator:** Communication therapy

**Summary**

Mackenzie et al (2014) [220] conducted a small feasibility randomised controlled trial. 39 participants from UK stroke units with post stroke dysarthria in the absence of significant cognitive impairment or dysphasia who were within 3 months of their stroke, were randomised into 2 groups. Both received behavioural dysarthria treatment. Group B received the addition of Non Speech Oromotor Exercises (NSOME's) in their treatment. 32 participants completed treatment. Both groups received equivalent amounts of treatment and home practice. Assessment was completed at 4 points during the study (pretreatment, soon after treatment commencement, at end of treatment and 8 weeks post-treatment). At the post treatment measure both groups were seen to have improved on all assessment measures. No difference in group abilities was seen between the two groups. The inclusion of NSOME's did not appear to impact outcomes. This study does not demonstrate additional benefit of adding non speech oromotor exercises into dysarthria treatment. These results need to be viewed in the context of the small sample size, the content and amount of treatment and outcome measures used. This study supports the use of behavioural dysarthria treatment in post stroke dysarthria.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Communication therapy	Non-speech oro- motor exercises		
<b>Improved communication (CEM)</b> Over 24 weeks  7 Critical	Based on data from 32 patients in 1 studies.	Differences in CEM across the treatment period (4 assessment points) were assessed using repeated measures ANOVA. The overall between-groups difference was non-significant ( $p = 0.13$ ), as was the interaction between group and assessment point ( $p = 0.80$ ), suggesting intervention and control groups did not differ in their degree of improvement. Confidence intervals and point estimates for the between group difference were not reported.		<b>Low</b> Due to very serious imprecision <sup>1</sup>	Non-Speech Oro-Motor Exercises may have little or no difference on improved communication

1. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Very Serious .** Only data from one study, Low number of patients, lack of point estimates ; **Publication bias: No serious .**

**References**

[224] Mackenzie C, Muir M, Allen C, Jensen A : Non-speech oro-motor exercises in post-stroke dysarthria intervention: a randomized feasibility trial.. International journal of language & communication disorders / Royal College of Speech & Language Therapists 49(5):602-17 [PubMed Journal](#)

## 12.4 - Apraxia of speech

Apraxia of speech (AOS) is a disruption in spatial and temporal planning and/or programming of movements for speech production, often caused by stroke (Ballard et al. 2015 [222]). AOS is characterised by slowed speech rate with distorted phonemes, distorted phoneme substitutions, and a tendency to segregate speech into individual syllables and equalise stress across adjacent syllables (Ballard et al. 2015 [222]). It is predominantly a disorder of articulation and prosody, though it can involve all speech subsystems (Ballard et al. 2015 [222]). Currently, there is no randomised controlled trial in AOS, possibly due to its rarity (Ballard et al. 2015 [222]). The research has primarily focused on identifying effective treatments that can be replicated in a larger population, and mostly consists of single-case experimental designs, case series, and uncontrolled case studies (Ballard et al. 2015 [222]).

### Weak Recommendation

For stroke survivors with apraxia of speech, individually tailored interventions incorporating articulatory-kinematic and rate/rhythm approaches may be used. (Ballard et al. 2015 [226])

In addition, therapy may incorporate (Ballard et al. 2015 [226]):

- Use of modelling and visual cueing.
- Principles of motor learning to structure practice sessions.
- Prompts for Restructuring Oral Muscular Phonetic Targets (PROMPT) therapy.
- Self-administered computer programs that use multimodal sensory stimulation.
- For functional activities, the use of augmentative and alternative communication modalities such as gesture or speech-generating devices is recommended.

### Practical Info

Articulatory-kinematic and rate/rhythm approaches may include articulatory placement and transitioning, speech rate and rhythm, increasing length and complexity of words and sentences, and prosody including lexical, phrasal, and contrastive stress production.

Treatments were typically applied for about 28 sessions over at least 7 weeks. In this review, 14 studies using articulatory-kinematic intervention reported using specific Principles of Motor Learning (Schmidt & Lee 2011, cited in Ballard et al. 2015 [226]). The principles applied or tested were level of feedback frequency, timing of feedback relative to participant's response, using variable practice (i.e. stimuli varied along some dimension such as voice onset time or phonetic context) and random versus blocked stimulus presentation, and using high-complexity (consonant clusters) versus low-complexity (singletons) stimuli.

One additional principle considered beneficial for motor learning is high-intensity practice, reflected in number of practice trials per sessions and/or number of sessions per week.

### Key Info

#### Benefits and harms

Substantial net benefits of the recommended alternative

The systematic review seems to support a strong effect for both articulatory-kinematic and rate/rhythm-based interventions (Ballard et al. 2015 [226]; Wambaugh et al. 2006 [227]). Harm was not reported in this review.

#### Quality of evidence

Low

The overall quality of evidence is low due to small sample size and high risk of bias.

#### Preference and values

No substantial variability expected

Stroke survivors with apraxia of speech would want to receive appropriate therapies, although the optimal approach remains unclear.

**Resources and other considerations**

No important issues with the recommended alternative

**Resources considerations**

No literature to understand or describe the potential economic implications of this recommendation was identified.

**Rationale**

The quality of evidence from a systematic review (Ballard et al. 2015 [226]) with 26 studies (evidence from 2004–2012) was added to the existing review (Wambaugh et al. 2006 [227]). Overall the evidence is low, therefore a stronger recommendation cannot be made at this time. Both articulatory–kinematic and rate/rhythm-based interventions may produce changes at the impairment level (i.e. production of speech sounds in isolation, in words and syllables), but research does not yet show any transfer of training or benefits in overall communication. Studies to date have used different interventions, dosage of therapy and measures. No meta-synthesis has been completed.

**Clinical Question/ PICO**

**Population:** Stroke patients with apraxia of speech  
**Intervention:** Articulatory–kinematic treatment  
**Comparator:** Usual care

**Summary**

A systematic review of treatments for apraxia of speech (Ballard et al 2014 [222]) included 24 studies investigating articulatory-kinematic treatments, all of which were within-participant experimental studies with a median sample size of 1. The review authors found that the evidence supported a strong beneficial effect of the intervention. However, the very small sample sizes and the non-randomised study designs mean that there is substantial uncertainty about the benefits of articulatory-kinematic treatment.

An earlier systematic review of treatments for apraxia of speech (Wambaugh et al 2006 [223]) included 59 publications, the majority of which investigated articulatory-kinematic treatments. Most studies were case studies or case series with very few participants. The review was not stroke specific but stroke was the most common aetiology. Almost all included studies (54/57) reported positive treatment effects. Again, given the study designs used and the very small numbers of participants included, there is substantial uncertainty about the possible benefits of the intervention.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Articulatory–kinematic treatment		
<b>Improved communication</b>	Based on data from 95 patients in 24 studies.		There is some supporting evidence for the articulatory-kinematic approach to apraxia of speech treatment, but the evidence is weak.	<b>Very Low</b> Small sample sizes of included studies in systematic review, and very serious risk of bias 1	Supporting evidence for articulatory-kinematic approach to apraxia treatment, but evidence is weak.

1. **Risk of bias: Very Serious**. Most studies (21/26, 81%) were classified as AAN Class III (n = 6) or III-b (n = 15), indicating evidence of internal validity (i.e., some degree of experimental control was described, allowing reasonable confidence that the reported effects were due to the application of the treatment). The remaining five studies were classified as AAN Class IV, being uncontrolled studies

and/or containing no clear evidence that participants met diagnostic criteria for AOS. Of the 26 studies, 21 were judged to use some form of single-case experimental design and were scored on the SCED scale. Average SCED score was 6.6 out of 10 (SD = 2.4, range = 4–9, median = 7). Two studies were judged as group-experimental studies and were rated on the PEDro-P scale. These received scores of 7 out of 10 and 3 out of 10. Both group studies used random allocation of participants. Neither of these studies used intention to treat analyses. ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ; **Publication bias: No serious .**

## References

[226] Ballard KJ, Wambaugh JL, Duffy JR, Layfield C, Maas E, Mauszycki S, McNeil MR : Treatment for Acquired Apraxia of Speech: A Systematic Review of Intervention Research Between 2004 and 2012.. American journal of speech-language pathology / American Speech-Language-Hearing Association 2015;24(2):316-337 [Pubmed Journal](#)

## Clinical Question/ PICO

**Population:** Stroke patients with apraxia of speech  
**Intervention:** Rhythm/rate control methods  
**Comparator:** Usual care

## Summary

A systematic review of treatments for apraxia of speech (Ballard et al 2014 [222]) included 2 studies investigating rhythm/rate control treatments. Both were within-participant experimental studies with 1 and 10 participants. The majority of participants (8/11) included in these studies had a positive outcome, both following treatment and at follow-up  $\geq$  2 weeks later. However, the very small sample sizes and the non-randomised study designs mean that there is substantial uncertainty about the benefits of rhythm/rate control treatment approaches.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Rhythm/rate control methods		
<b>Improved communication</b>  7 Critical	Based on data from 21 patients in 3 studies.	Authors report global clinical outcomes that evidence supports an effect for rate/rhythm approach. Meta-analysis was not performed (the reason was not reported in the article). The 3 included studies had small sample sizes.		<b>Very Low</b> Due to serious risk of bias, and small sample size <sup>1</sup>	Rhythm/rate control methods may improve communication

1. **Risk of bias: Serious .** Most studies (21/26, 81%) were classified as AAN Class III (n = 6) or III-b (n = 15), indicating evidence of internal validity (i.e., some degree of experimental control was described, allowing reasonable confidence that the reported effects were due to the application of the treatment). The remaining five studies were classified as AAN Class IV, being uncontrolled studies and/or containing no clear evidence that participants met diagnostic criteria for AOS. Of the 26 studies, 21 were judged to use some

form of single-case experimental design and were scored on the SCED scale. Average SCED score was 6.6 out of 10 (SD = 2.4, range = 4–9, median = 7). Two studies were judged as group-experimental studies and were rated on the PEDro-P scale. These received scores of 7 out of 10 and 3 out of 10. Both group studies used random allocation of participants. Neither of these studies used intention to treat analyses. ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ; **Publication bias: No serious .** appears authors did a grey literature search, but not specifically stated ;

## References

[226] Ballard KJ, Wambaugh JL, Duffy JR, Layfield C, Maas E, Mauszycki S, McNeil MR : Treatment for Acquired Apraxia of Speech: A Systematic Review of Intervention Research Between 2004 and 2012.. American journal of speech-language pathology / American Speech-Language-Hearing Association 2015;24(2):316-337 [Pubmed Journal](#)

## 12.5 - Cognitive communication disorder in right hemisphere stroke

Right hemisphere brain damage, often caused by cerebrovascular accidents or traumatic brain injuries, results in a range of cognitive communication difficulties.

Right hemisphere and/or cognitive communication disorders can be presented as an exchange of communicative intent through nonverbal and verbal means, often at a conversational level represented by the following features (Lehman Blake et al. 2013 [224]) :

- Prosody (flat melody of speech or difficulties interpreting emotion/intent contained in another person's prosody).
- Expressive and receptive discourse (difficulties understanding intent in language that consists of two or more sentences to convey language, beyond simple words or sentences:
  - difficulties comprehending nonliteral language, including metaphors, idioms and sarcasm – problem selecting the meaning most plausible for the given context
  - difficulties producing discourse, often overpersonalised, can be impoverished or verbose – assessment can be difficult because of wide variation in healthy 'normal' population).
- Pragmatics (functional use of language in context, turn-taking adapting their communication for the social status of their communicative partner – note very little knowledge of communication partner interactions compared with left hemisphere literature).

Currently, the literature on its prevalence, assessment, and treatment is limited.



### Practice Statement

#### Consensus-based recommendations

Stroke survivors with cognitive involvement who have difficulties in communication should have input from a suitably trained health professional including:

- a comprehensive assessment,
- development of a management plan, and
- family education, support and counselling as required. (Lehman Blake et al. 2013 [228]; Ferre et al. 2011 [229])

Management may include:

- Motoric-imitative, cognitive-linguistic treatments to improve use of emotional tone in speech production. (Rosenbek et al. 2006 [230])
- Semantic-based treatment connecting literal and metaphorical senses to improve comprehension of conversational and metaphoric concept. (Lungren et al. 2011 [231])

#### Practical Info

Potentially effective treatments at sentence level or discourse level include:

- **Prosody:** Both motoric-imitative and cognitive-linguistic treatments provided for 20 sessions each were effective in improving ability of participants to convey emotional tone (Rosenbeck et al. 2006 [230]). However, it is unclear which treatment was more efficacious with generally the treatment delivered first having a slightly larger effect size.
- **Receptive language:** Lungren et al. (2011) [231] demonstrated that a semantic-based treatment connecting literal and metaphorical senses of concepts significantly improved the comprehension of metaphors in four participants with right cerebrovascular accident, three of which maintained these gains at three months follow-up.

#### Rationale

Overall, the small number of studies of high risk of bias and small sample size, along with the heterogeneity of treatment targets and specific outcomes, preclude strong conclusions in relation to the efficacy of treatments for cognitive communication disorders. There is some preliminary data that suggests that some people with cognitive communication disorders following stroke will benefit from treatment to improve their cognitive communication skills (including prosody and interpretation of metaphors) in the acute and chronic stages. However, further research is required.

## 13 - Cognition and perception

This section provides an overview of assessment of cognitive and perceptual impairment. Specific impairments are discussed in the following sections in more detail. Cognitive and perceptual impairments include attention, memory, orientation, language, executive functions, neglect, apraxia and agnosia. Cognitive impairment is common in acute stroke, with 60% of patients reported as having cognitive deficit on admission to rehabilitation (Stroke Foundation 2014 [9]). Cognitive impairment may be missed in those who present with mild stroke and this type of impairment can have a significant impact on life after stroke.

### 13.1 - Assessment of cognition

Early assessment for cognitive impairment is important. There are no universal gold-standard screening or assessment tools. If cognitive or perceptual deficits are suspected (or found on screening), a more detailed assessment (including functional assessment) conducted by a trained team member (e.g. neuropsychologist, occupational therapist or speech pathologist) can clarify the types of impairments and the impact of these impairments on function, in order to guide the team in providing the most appropriate rehabilitation interventions. Families and caregivers of stroke survivors with cognitive impairment should be provided with appropriate education and possible strategies relevant to the person's individual impairments.

#### Info Box

##### **Practice points**

- All stroke survivors should be screened for cognitive and perceptual deficits by a trained person (e.g. neuropsychologist, occupational therapist or speech pathologist) using validated and reliable screening tools, ideally prior to discharge from hospital.
- Stroke survivors identified during screening as having cognitive deficits should be referred for comprehensive clinical neuropsychological investigations.

#### **Practical Info**

Findings from neuropsychological testing should be discussed with the patient and family. Education and information should also be provided, verbally and in writing, about strategies which may help the person better engage in rehabilitation.

It is suggested cognitive and perceptual screening should occur prior to discharge from the acute hospital.

#### **Key Info**

##### **Resources and other considerations**

##### **Implementation considerations**

There are clinical indicators collected in the National Stroke Audit on the number of patients with an identified perceptual deficit and/or cognitive deficit on admission to acute care and/or rehabilitation.

### 13.2 - Executive function

Executive function is defined as the controlling mechanisms of the brain that include the processes of planning, initiation, organisation, inhibition, problem-solving, monitoring and error correction. Interventions for impaired executive function include strategy and cognitive training. National Stroke Audit results show that 99% of stroke patients are assessed by an occupational therapist and 66% within one day (Stroke Foundation 2015 [8]). They also showed that 76% of hospitals have locally agreed assessment protocols for executive function (Stroke Foundation 2014 [9]).

There is very little evidence for executive functioning and further research is required.

#### Info Box

#### Practice points

- Stroke survivors considered to have problems associated with executive functioning deficits should be formally assessed by a suitably qualified and trained person, using reliable and valid tools that include measures of behavioural symptoms.
- For stroke survivors with impaired executive functioning, the way in which information is provided should be tailored to accommodate/compensate for the particular area of dysfunction.

#### Weak Recommendation

For stroke survivors with cognitive impairment, meta-cognitive strategy and/or cognitive training may be provided. (Zucchella et al. 2014 [232]; Skidmore et al. 2015 [236])

#### Practical Info

Meta-cognitive strategy training (hereafter referred to as strategy training) is an intervention designed to harness a person's ability to observe, assess, and positively alter one's own behavior. Strategy training teaches individuals to identify and prioritise problematic daily activities, identify barriers impeding performance, generate and evaluate strategies addressing these barriers, and generalise learning through practice. Thus, strategy training teaches skills that can be used to address disability in "real-life" activities.

The hallmark of strategy training is its delineation between the therapist's role and the participant's role in the rehabilitation process. Therapists assume a role of guided discovery, systematically facilitating participants' learning through prompts and questions rather than directly instructing participants. In doing so, therapists guide participants, allowing participants to learn through their experiences.

Through strategy training, participants learn to work through or work around specific problems in selected daily activities. In addition, participants learn how to apply the process to novel activities and situations, with the goal of promoting additional recovery of independence with daily activities long after rehabilitation is completed (Skidmore et al. 2015 [236]).

#### Key Info

##### Benefits and harms

Small net benefit, or little difference between alternatives

Meta-cognitive strategy training and cognitive training may have some small benefits on measures of executive function, although evidence is not strong (Zucchella et al, 2014 [232]; Skidmore et al, 2015 [236]). No harms are anticipated from this intervention.

##### Quality of evidence

Low

Low quality due to serious risk of bias, imprecision and inconsistency.

##### Preference and values

No substantial variability expected

Client and family preference should be considered when providing meta-cognitive strategy and/or cognitive training.

##### Resources and other considerations

Important issues, or potential issues not investigated

##### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

**Implementation considerations**

There is an organisational indicator collected in the National Stroke Audit to determine whether hospitals have locally agreed assessment protocols for executive function.

**Rationale**

Low-level evidence suggests meta-cognitive strategy training may improve executive function, and cognitive training may improve executive function slightly (Zucchella et al. 2014 [232]; Skidmore et al. 2015 [236]).

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Strategy training  
**Comparator:** Attention control

**Summary**

A randomised trial including 30 acute stroke patients was conducted by Skidmore et al (2015) [232]. Participants in the intervention group received strategy training focussed on developing strategies to achieve self-selected goals, in addition to usual care. The control group received usual care plus reflective listening as an attentional control. Comparisons of Color Word Interference Cognitive Flexibility scores showed significantly improved performance in the strategy training group at 3 and 6 month follow-up. No confidence intervals were reported for the difference, making the range of possible benefits or harms difficult to determine. The trial also included few patients, suggesting serious imprecision in estimating the treatment effects.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Attention control	Strategy training		
<p><b>Executive functioning (CWI - Condition 4)</b> At 3 months 7 Critical</p>	<p>Measured by: Improvement from baseline on Color Word Interference - Cognitive Flexibility (Condition 4) High better Based on data from: 20 patients in 1 studies.<sup>1</sup> (Randomized controlled) Follow up 3 months after baseline</p>	<p><b>0.72</b> seconds (Mean)</p>	<p><b>5.5</b> seconds (Mean)</p>	<p><b>Low</b> The between-group difference was significant (p = 0.001). Due to serious risk of bias, Due to serious imprecision<sup>2</sup></p>	<p>Strategy training may increase executive functioning at 3 months.</p>
<p><b>Executive functioning (CWI- Condition 4)</b> At 6 months 7 Critical</p>	<p>Measured by: Improvement from baseline on Colour Word Interference - Cognitive Flexibility (Condition 4) High better Based on data from: 18 patients in 1 studies.<sup>3</sup> (Randomized controlled)</p>	<p><b>0.52</b> seconds (Mean)</p>	<p><b>4.91</b> seconds (Mean)</p>	<p><b>Low</b> The difference between groups was significant (p = 0.004). Due to serious imprecision, Due to serious risk of bias<sup>4</sup></p>	<p>Strategy training may increase executive functioning at 6 months.</p>

Follow up 6 months after  
baseline

1. Primary study [236]. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants, resulting in potential for performance bias ; **Inconsistency: No serious** . Point estimates vary widely ; **Imprecision: Serious** . Only data from one study, Low number of patients ;
3. Systematic review with included studies: [236]. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants, resulting in potential for performance bias ; **Inconsistency: No serious** . Point estimates vary widely ; **Imprecision: Serious** . Low number of patients, Only data from one study ;

### References

[236] Skidmore ER, Dawson DR, Butters MA, Grattan ES, Juengst SB, Whyte EM, Begley A, Holm MB, Becker JT : Strategy Training Shows Promise for Addressing Disability in the First 6 Months After Stroke.. *Neurorehabilitation and neural repair* 2015;29(7):668-76 [Pubmed](#) [Journal](#)

### Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Cognitive training  
**Comparator:** Control

### Summary

Zucchella et al (2014) [228] conducted a randomised trial of cognitive rehabilitation involving 92 stroke patients with cognitive deficits. Patients randomised to the intervention group completed 16 1 hour sessions of therapist-guided computer exercises. Between-group comparisons at 4 weeks showed non-significant differences in Frontal Assessment Battery scores, and a significant improvement on the trail making test B. The trial had high risk of bias due to a lack of allocation concealment and intention to treat analysis, and did not report confidence intervals for between-group differences, making the range of possible treatment benefits or harms difficult to determine.

A previous Cochrane review by Chung et al (2013) [228] investigated cognitive rehabilitation interventions for executive dysfunction, including 19 randomised trials. The review was not stroke-specific, but included data from 304 stroke patients. No trials were found reporting the review's primary outcome of global executive function. One trial showed significant improvement in concept formation, but other analyses of components of executive function or working memory showed non-significant differences. The review authors concluded that there was insufficient high-quality evidence to determine the benefits of cognitive rehabilitation on cognitive function.

Poulin et al (2012) [227] carried out a systematic review of cognitive interventions aimed at remediating executive function impairments or improving functional tasks compromised by executive function impairments. 10 stroke studies of mixed study types were included (2 randomised controlled trials; 1 randomised crossover trial, 4 single-subject design studies, 2 pre-post design studies and 1 pre-post controlled group study). Meta-analysis was not conducted due to the heterogeneity among the studies. Findings were qualitatively synthesised according to stage and intervention approaches, with the 2 randomised

controlled trials and 1 randomised crossover trial all classified as 'chronic' stage. The review authors concluded that people with stroke might benefit from specific executive function training and compensatory strategies, but the included studies provide limited evidence regarding these benefits.

Xu et al (2013) [229] carried out a literature review (not systematic) of 'neuropsychological interventions of stroke' (RCTs, pre-post design studies, case series and single case reports). This included a 'treatment of executive function' section, citing Poulin (a systematic review), Levine (matched study), Rand (preliminary study), Westerberg ("randomised study"), Nordvik (case study) and Dtablum (pre-post design). In this section, the literature review authors concluded that there was data to suggest the effectiveness of cognitive rehabilitation therapies but definitive conclusions were not possible due to the small number of studies available.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Cognitive training		
<b>Executive functioning (FAB)</b> Post intervention - 4 weeks of treatment	Measured by: Frontal Assessment Battery (FAB) High better Based on data from: 87 patients in 1 studies. <sup>1</sup> (Randomized controlled) Follow up 4 weeks after baseline	<b>13.8</b> points (Median)	<b>13.9</b> points (Median)	<b>Low</b> Due to serious risk of bias, Due to serious imprecision. The difference between groups was non-significant. No confidence interval was reported for the difference. <sup>2</sup>	Cognitive training may have little or no difference on executive functioning (FAB)
<b>Executive functioning (TMT-B)</b> Post intervention - 4 weeks of treatment	Measured by: Trail Making Test B Lower better Based on data from: 87 patients in 1 studies. <sup>3</sup> (Randomized controlled) Follow up 4 weeks after baseline	<b>318</b> (Median)	<b>259</b> (Median)	<b>Low</b> Due to serious risk of bias, Due to serious imprecision. The difference between groups was significant (p = 0.03) but no confidence interval was reported. <sup>4</sup>	Cognitive training may increase executive functioning (TMT-B) slightly

1. Primary study [232]. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Does not report using intention-to-treat analysis. ; **Inconsistency: No serious** . **Indirectness: No serious** . The outcome time frame in studies was insufficient ; **Imprecision: Serious** . Low number of patients, Only data from one study ; **Publication bias: No serious** .
3. Primary study [232]. **Baseline/comparator::** Primary study .

4. **Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . Point estimates vary widely ; **Indirectness: No serious** . **Imprecision: Serious** . Only data from one study, Low number of patients ; **Publication bias: No serious** .

### References

[232] Zucchella C, Capone A, Codella V, Vecchione C, Buccino G, Sandrini G, Pierelli F, Bartolo M : Assessing and restoring cognitive functions early after stroke.. *Functional neurology* 29(4):255-62 [Pubmed](#)

[233] Poulin V, Korner-Bitensky N, Dawson DR, Bherer L : Efficacy of executive function interventions after stroke: a systematic review.. *Topics in stroke rehabilitation* 19(2):158-71 [Pubmed](#) [Journal](#)

## 13.3 - Attention and concentration

Attention is the process of selectively concentrating on a discrete aspect of information while ignoring other information. Attention has also been referred to as the allocation of limited processing resources. Attention is a fundamental component of most cognitive and perceptual processes and, as such, an impairment of attention may have a significant effect on function. Attention impairments may be specific (e.g. selective, sustained, divided) or more generalised, affecting alertness and speed of processing, as characterised by poor engagement and general slowness. Deficits in attention are among the most commonly observed impairments after stroke (Loetscher and Lincoln 2013 [235]).

A Cochrane review (6 RCTs, N = 223) found that cognitive rehabilitation improved measures of divided attention (SMD 0.67, 95% CI 0.35 to 0.98; P < 0.0001) in the short term, but not for global measures of attention or functional outcome; nor did it provide persisting benefits. The review considered attention treatments to be any form of intervention with the aim of improving attention abilities. There was insufficient evidence to support or refute cognitive rehabilitation providing persisting improvements in attention (Loetscher and Lincoln 2013 [235]).

### Practice Statement

#### **Consensus-based recommendation**

For stroke survivors with attentional impairments or those who appear easily distracted or unable to concentrate, a formal neuropsychological or cognitive assessment should be performed.

### Weak Recommendation

For stroke survivors with attention and concentration deficits, cognitive rehabilitation may be used. (Loetscher et al. 2013 [242]; Virk et al. 2016 [243])

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

Cognitive rehabilitation provided some benefit for divided attention in the short term, but no persisting benefit. It did not show benefit in the short or long term for any other attentional domains or functional outcomes. A statistically significant effect was found in favour of cognitive rehabilitation when compared with control (Loetscher et al. 2013 [242]) (four studies, 165 participants; SMD 0.67, 95% CI 0.35 to 0.98; P value < 0.0001). No significance was found for selective and alternative measures or alertness.

#### Quality of evidence

Moderate

Overall we have moderate confidence in the effect estimates.

#### Preference and values

No substantial variability expected

Client and family preference should be considered when providing cognitive rehabilitation.

#### Resources and other considerations

Important issues, or potential issues not investigated

##### Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

### Rationale

It is unclear whether cognitive rehabilitation improves attention and concentration. The results suggest there may be a short-term effect on attentional abilities, but additional research is required to assess the persisting effects and measure attentional skills in daily life. These trials need higher methodological quality and better reporting.

### Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Cognitive rehabilitation  
**Comparator:** Control

#### Summary

Two systematic reviews (Loetscher et al 2013 [238]; Virk et al 2015 [239]) (both included the same stroke studies) showed that cognitive rehabilitation improved divided attention in stroke survivors. No benefit was shown for sustained, selective or alternating attention or alertness.

The Cochrane review by Loetscher et al (2013) included 6 randomised controlled trials (RCTs), involving 223 participants with impaired attention following stroke. Interventions used in the trials either aimed to restore attentional functions or provide compensatory strategies. Meta-analysis showed no significant differences in global attention either immediately following treatment or in the long term. However, pooled results from 4 trials showed an improvement in divided attention at the end of intervention. The review authors concluded that there was insufficient evidence to confirm the benefits of cognitive rehabilitation.

The systematic review by Virk et al (2015) included 12 RCTs with 584 patients, but this included patients with traumatic brain injury and central nervous system-impacting malignancy. 6 trials including only stroke patients were included in a subgroup analysis. Cognitive rehabilitation improved divided attention in stroke survivors (g 0.67; 95% confidence interval, 0.35 to 0.98; p < 0.0001) but not other acquired brain injury (ABI) populations. Sustained attention (g 0.28; 95% CI, -0.19-0.75; p = 0.24; I<sup>2</sup> = 61%), selective attention (g -0.08; 95% CI, -0.35-0.18; p = 0.53; I<sup>2</sup> = 0%) and alternating attention (g 0.18; 95% CI, -0.23-0.59; p = 0.38; I<sup>2</sup> = 33%) were not significantly improved in any ABI population. Follow-up data showed no evidence of long-term benefit.



Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Cognitive rehabilitation		
<b>Sustained attention</b> Post intervention  7 Critical	Measured by: Various e.g. IVA-CPT, TAP, Konzentrations-Verlaufs-Test High better Based on data from: 169 patients in 4 studies. <sup>1</sup> (Randomized controlled) Follow up 3 to 11 weeks of treatment		Difference: <b>SMD 0.39 higher</b> ( CI 95% 0.16 lower - 0.94 higher )	<b>Moderate</b> Due to serious risk of bias <sup>2</sup>	Cognitive rehabilitation probably has little or no difference on sustained attention
<b>Divided attention</b> Post intervention  7 Critical	Measured by: Various e.g. PASAT, TAP divided attention, Trail Making B High better Based on data from: 165 patients in 4 studies. <sup>3</sup> (Randomized controlled) Follow up 3 to 11 weeks of treatment		Difference: <b>SMD 0.67 higher</b> ( CI 95% 0.35 higher - 0.98 higher )	<b>Moderate</b> Due to serious risk of bias <sup>4</sup>	Cognitive rehabilitation probably improves divided attention
<b>Alertness</b> At follow up  7 Critical	Measured by: Various e.g. TAP intrinsic alertness, Cognitrone, Simple reaction time High better Based on data from: 31 patients in 1 studies. <sup>5</sup> (Randomized controlled) Follow up 3 months		Difference: <b>SMD 0.26 lower</b> ( CI 95% 0.97 lower - 0.45 higher )	<b>Very Low</b> Due to serious risk of bias, Due to very serious imprecision <sup>6</sup>	We are uncertain whether cognitive rehabilitation increases or decreases alertness
<b>Selective attention</b> At follow up  7 Critical	Measured by: Various e.g. Bells test, TAP selective attention, Cognitrone, Stroop High better Based on data from: 99 patients in 2 studies. <sup>7</sup> (Randomized controlled) Follow up 3 to 6 months		Difference: <b>SMD 0.07 higher</b> ( CI 95% 0.32 lower - 0.47 higher )	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>8</sup>	Cognitive rehabilitation may have little or no difference on selective attention
<b>Sustained attention</b> At follow up	Measured by: Various e.g. IVA-CPT, TAP, Konzentrations-Verlaufs-Test High better		Difference: <b>SMD 0.05 higher</b> ( CI 95% 0.44 lower - 0.53 higher )	<b>Very Low</b> Due to serious risk of bias, Due to very serious imprecision <sup>10</sup>	We are uncertain whether cognitive rehabilitation increases or decreases sustained attention

7 Critical	Based on data from: 66 patients in 1 studies. <sup>9</sup> (Randomized controlled) Follow up 6 months			
<b>Divided attention</b> At follow up	Measured by: Various e.g. PASAT, TAP divided attention, Trail Making B High better Based on data from: 99 patients in 2 studies. <sup>11</sup> (Randomized controlled) Follow up 3 to 6 months	Difference: <b>SMD 0.36 higher</b> ( CI 95% 0.04 lower - 0.76 higher )	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>12</sup>	Cognitive rehabilitation may have little or no difference on divided attention
<b>Alertness</b> Post intervention	Measured by: Various e.g. TAP intrinsic alertness, Cognitrone, Simple reaction time High better Based on data from: 136 patients in 4 studies. <sup>13</sup> (Randomized controlled) Follow up 3 to 11 weeks of treatment	Difference: <b>SMD 0.14 higher</b> ( CI 95% 0.2 lower - 0.48 higher )	<b>Moderate</b> Due to serious risk of bias <sup>14</sup>	Cognitive rehabilitation probably has little or no difference on alertness
<b>Selective attention</b> Post intervention	Measured by: Various e.g. Bells test, TAP selective attention, Cognitrone, Stroop High better Based on data from: 223 patients in 6 studies. <sup>15</sup> (Randomized controlled) Follow up 3 to 11 weeks of treatment	Difference: <b>SMD 0.08 lower</b> ( CI 95% 0.35 lower - 0.18 higher )	<b>Moderate</b> Due to serious risk of bias <sup>16</sup>	Cognitive rehabilitation probably has little or no difference on selective attention

1. Systematic review [242] with included studies: Barker-Collo 2009, Sturm 1991, Schottke 1997, Rohring 2004. **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . Blinding of participants not possible, resulting in potential for performance bias, concealment and sequence generation not well reported ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . Low number of patients ; **Publication bias: No serious** .
3. Systematic review [242] with included studies: Rohring 2004, Barker-Collo 2009, Winkens 2009, Westerberg 2007. **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: Serious** . Blinding of participants not possible, resulting in potential for performance bias, concealment and sequence generation not well reported ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . Low number of patients ; **Publication bias: No serious** .
5. Systematic review [242] with included studies: Winkens 2009. **Baseline/comparator::** Control arm of reference used for intervention .
6. **Risk of bias: Serious** . Blinding of participants not possible, resulting in potential for performance bias, concealment and sequence generation not well reported ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Only data from one

study, Wide confidence intervals, Low number of patients ; **Publication bias: No serious .**

7. Systematic review [242] with included studies: Winkens 2009, Barker-Collo 2009. **Baseline/comparator::** Control arm of reference used for intervention .

8. **Risk of bias: Serious .** Blinding of participants not possible, resulting in potential for performance bias, concealment and sequence generation not well reported ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients, Wide confidence intervals ; **Publication bias: No serious .**

9. Systematic review [242] with included studies: Barker-Collo 2009. **Baseline/comparator::** Control arm of reference used for intervention .

10. **Risk of bias: Serious .** Blinding of participants not possible, resulting in potential for performance bias, concealment and sequence generation not well reported ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Very Serious .** Only data from one study, Wide confidence intervals, Low number of patients ; **Publication bias: No serious .**

11. Systematic review [242] with included studies: Barker-Collo 2009, Winkens 2009. **Baseline/comparator::** Control arm of reference used for intervention .

12. **Risk of bias: Serious .** Blinding of participants not possible, resulting in potential for performance bias, concealment and sequence generation not well reported ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients, Wide confidence intervals ; **Publication bias: No serious .**

13. Systematic review [242] with included studies: Schottke 1997, Rohring 2004, Winkens 2009, Sturm 1991. **Baseline/comparator::** Control arm of reference used for intervention .

14. **Risk of bias: Serious .** Blinding of participants not possible, resulting in potential for performance bias, concealment and sequence generation not well reported ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious .** Low number of patients ; **Publication bias: No serious .**

15. Systematic review [242] with included studies: Winkens 2009, Westerberg 2007, Rohring 2004, Barker-Collo 2009, Sturm 1991, Schottke 1997. **Baseline/comparator::** Control arm of reference used for intervention .

16. **Risk of bias: Serious .** Blinding of participants not possible, resulting in potential for performance bias, concealment and sequence generation not well reported ; **Inconsistency: No serious . Indirectness: No serious . Imprecision: No serious .** Low number of patients ; **Publication bias: No serious .**

## References

[241] Loetscher T, Lincoln NB : Cognitive rehabilitation for attention deficits following stroke.. The Cochrane database of systematic reviews 2013;(5):CD002842 [Pubmed Journal](#)

[242] Loetscher T, Lincoln NB : Cognitive rehabilitation for attention deficits following stroke. Cochrane Database of Systematic Reviews 2013; [Pubmed Journal](#)

[243] Virk S, Williams T, Brunsdon R, Suh F, Morrow A : Cognitive remediation of attention deficits following acquired brain injury: A systematic review and meta-analysis.. NeuroRehabilitation 2015;36(3):367-77 [Pubmed Journal](#)

## Weak Recommendation

For stroke survivors with attention and concentration deficits, exercise training and leisure activities may be provided. (Liu-Ambrose et al. 2015 [244])

## Practical Info

The evidence for the benefits of exercise training and leisure activities comes from a single trial of people later after stroke (Liu-Ambrose et al. 2015 [244]) which, while not excluding participants on the basis of severity of cognitive impairment, did include a sample of people with predominantly mild cognitive impairment. This means that the effectiveness of these interventions on people with moderate to severe cognitive impairment remains unknown.

## Key Info

<b>Benefits and harms</b>	Substantial net benefits of the recommended alternative
A six-month community-based structured program that included two sessions of exercise training and one session of recreation and leisure activities per week significantly improved selective attention and conflict resolution ( $p = 0.02$ ) at the end of the six-month intervention period compared with usual care (Liu-Ambrose et al. 2015 [244]). Improved selective attention and conflict resolution were significantly associated with functional capacity at six months ( $r = 0.39$ , $p = 0.04$ ).	
No adverse events were reported.	
<b>Quality of evidence</b>	Low
This was a small single trial ( $N = 28$ ), so our confidence in the effect estimates is low.	
<b>Preference and values</b>	Substantial variability is expected or uncertain
The target population for exercise training would need to be carefully selected, given the wide variation in mobility and preferences for physical activity.	
<b>Resources and other considerations</b>	Important issues, or potential issues not investigated
<b>Resources considerations</b> No literature to understand or describe the potential economic implications of this recommendation was identified.	

## Rationale

While the study was a proof-of-concept trial and thus numbers were small ( $n = 28$ ), the results demonstrated significant benefits to the participants both at the impairment level and in functional capacity (Liu-Ambrose et al. 2015 [244]). The intervention is not suitable for all stroke survivors as it largely depends on their level of independence and overall general health.

## Clinical Question/ PICO

<b>Population:</b>	Adults with chronic stroke
<b>Intervention:</b>	Exercise training and leisure/recreation activities
<b>Comparator:</b>	Usual care

## Summary

Liu-Ambrose and Eng (2015) [240] assessed the effect of a six-month exercise and recreation program on executive functions in adults with chronic stroke in a randomised controlled trial ( $N = 28$ ). The intervention group received a six-month community-based structured program that included two sessions of exercise training and one session of recreation and leisure activities per week. The control group received usual care. The intervention group significantly improved selective attention and conflict resolution ( $p=0.02$ ) at the end of the six-month intervention period. Improved selective attention and conflict resolution was significantly associated with functional capacity at six months ( $r=0.39$ ;  $p=0.04$ ). The authors concluded "that an exercise and

recreation program can significantly benefit executive functions in community-dwelling chronic stroke survivors who are mildly cognitively impaired – a population at high-risk for dementia and functional decline. Thus, clinicians should consider prescribing exercise and recreational activities in the cognitive rehabilitation of chronic stroke survivors". However, due to the small sample size in this single study and the fact that confidence intervals were not reported for the between-group comparisons, there is considerable uncertainty about the degree of benefit that might be seen in patients receiving exercise training.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Usual care	Exercise training and leisure/recreation activities		
<b>Selective attention and conflict resolution</b> <sup>1</sup> After 6 months of treatment  7 Critical	Measured by: Improvement over 6 months on Stroop test High better Based on data from: 24 patients in 1 studies. <sup>2</sup> (Randomized controlled) Follow up 6 months of treatment	<b>6.7</b> seconds (Mean)	<b>24.6</b> seconds (Mean)	<b>Low</b> The difference between groups was significant. Due to very serious imprecision <sup>3</sup>	Exercise training and leisure/recreation activities may improve selective attention and conflict resolution
		Difference: <b>MD 17.9 higher</b>			

1. Liu-Ambrose et al. (2015) used the Stroop test for assessing selective attention and conflict resolution, measuring "the time difference between naming the ink colour in which the words were printed (while ignoring the word itself) and naming coloured Xs. Smaller time differences indicate better performance"
2. Primary study [244]. Liu-Ambrose (2015) used a non-parametric test to compare the intervention and control groups due to non-normality of the outcome, so do not report a CI for the difference between groups.. **Baseline/comparator**:: Control arm of reference used for intervention .
3. **Inconsistency: No serious** . N/A: Single trial ; **Indirectness: No serious** . **Imprecision: Very Serious** . Only data from one study, Low number of patients, Precision unclear: confidence intervals not reported ; **Publication bias: No serious** . N/A: Single study ;

## References

[244] Liu-Ambrose T, Eng JJ : Exercise training and recreational activities to promote executive functions in chronic stroke: a proof-of-concept study.. Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association 2015;24(1):130-7 [Pubmed Journal](#)

## 13.4 - Memory

It is estimated that one-third of stroke survivors will have some form of memory loss. People with stroke with memory deficits can have longer hospital stays, poorer functional outcomes, risks to personal safety, and memory deficits can cause subjective distress to people with stroke and their families. It should be noted that memory loss can be associated with damage to other cognitive functions such as executive function and attention.

While there is some evidence for memory training in other brain injury populations, the evidence is very limited in stroke and not sufficient to

make a recommendation. Further research is required.

#### Practice Statement

##### Consensus-based recommendations

Any stroke survivor found to have memory impairment causing difficulties in rehabilitation or adaptive functioning should:

- be referred to a suitably qualified healthcare professional for a more comprehensive assessment of their memory abilities;
- have their nursing and therapy sessions tailored to use techniques that capitalise on preserved memory abilities;
- be assessed to see if compensatory techniques to reduce their disabilities, such as notebooks, diaries, audiotapes, electronic organisers and audio alarms are useful;
- have therapy delivered in an environment as similar to the stroke survivor's usual environment as possible to encourage generalisation;
- be taught strategies aimed at assisting their memory, e.g. using a notebook, diary, mobile phone/audio alerts, electronic calendars and/or reminders;
- be taught approaches aimed at directly improving their memory, e.g. computerised memory training games and learning mnemonic strategies.

## 13.5 - Perception

The topic of perception is complex and appears to overlap with other cognitive and sensory areas. Perceptual disorders may affect any or all of the sensory modalities. This is demonstrated in the wide range of perceptual disorders, which include visual, object, visual object agnosia, prosopagnosia, spatial, visuospatial, tactile, body, sensation, location, motion, colour processing and auditory perceptual disorders. Visual perceptual disorders are the most commonly researched (Bowen et al. 2011 [245]). It is important here to distinguish between deficits affecting the whole perceptual field (covered in this section) and unilateral deficits (see Neglect) or damage to the visual pathway or eye movement systems (see Vision).

The National Stroke Audit shows that at least 25% of stroke patients have a perceptual deficit on admission (Stroke Foundation 2014 [9]). Perceptual rehabilitation includes functional training, sensory stimulation, strategy training and task repetition (Bowen et al. 2011 [245]), although none have shown any measurable benefit. The impact of perceptual disorders on activities of daily living (ADL) is varied. It can range from difficulty crossing the road (due to an impairment of distance perception) to an inability to recognise a familiar object (for example a toothbrush – object agnosia) or person's face (such as a spouse – prosopagnosia). These disorders can cause distress for the person affected and their family, and increase their dependence on others. Perceptual disorders can also hinder a person's ability to participate fully in their rehabilitation programme, for example, in their sessions with the physiotherapist or occupational therapist. Perceptual disorders can be detected using standardised assessment tools.

There is very little evidence for interventions to improve perception and further research is required.

#### Practice Statement

#### Consensus-based recommendations

- Stroke survivors with identified perceptual difficulties should have a formal perceptual (i.e. neurological and neuropsychological) assessment.
- Stroke survivors with an identified perceptual impairment and their carer should receive:
  - verbal and written information about the impairment;
  - an assessment and adaptation of their environment to reduce potential risk and promote independence;
  - practical advice/strategies to reduce risk (e.g. trips, falls, limb injury) and promote independence;
  - intervention to address the perceptual difficulties, ideally within the context of a clinical trial.

## 13.6 - Limb apraxia

Apraxia is impaired planning and sequencing of movement that is not due to weakness, incoordination, or sensory loss. It is associated with left hemisphere stroke and has a marked impact on the functional performance of activities (Lindsten-McQueen et al. 2014 [248]). Estimates of the prevalence of apraxia in people with left hemisphere stroke range from 28% to 51% (Lindsten-McQueen et al. 2014 [248]). There are few studies of interventions for apraxia, such as strategy training in ADL (e.g. verbalisation of actions), sensory stimulation (touching the limbs), proprioceptive stimulation (e.g. applying weight to the limbs), cueing, chaining (i.e. breaking tasks into individual steps), and normal movement approaches (in which a clinician guides the body through normal patterns of movement). Speech apraxia is discussed separately (see Apraxia of speech).

#### Info Box

#### Practice point

Stroke survivors who have suspected difficulties executing tasks but who have adequate limb movement and sensation should be screened for apraxia.

#### Weak Recommendation

For stroke survivors with limb apraxia, interventions such as gesture training, strategy training and/or errorless learning may be provided. (Lindsten-McQueen et al. 2014 [252])

#### Practical Info

There is insufficient evidence to recommend a specific approach or the amount of time that should be dedicated to therapy specifically to address limb apraxia. In the absence of evidence, therapists may incorporate the training approaches into therapy sessions.

#### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

There is uncertainty about the benefits of the different treatment strategies for limb apraxia, although there is suggestion of some positive effects (Lindsten-McQueen et al. 2014 [252]). People participating in the therapy are at low risk of harm.

**Quality of evidence**

Low

Included studies have high risk of bias and small sample sizes.

**Preference and values**

No substantial variability expected

Stroke survivors may have difficulty understanding the concept of apraxia or recognising the presence of apraxia, but most clients are motivated to improve their limb function. Therefore, it is expected they would want to participate in this treatment approach.

**Resources and other considerations**

Important issues, or potential issues not investigated

Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified.

**Rationale**

Limb apraxia can impact significantly on one's ability to use their limb in functional tasks. There are very few research studies evaluating interventions for limb apraxia and these studies have tested different approaches. At present, the overall quality of evidence is low and the studies have mixed results, suggesting either no benefit or small benefits. Furthermore, there is insufficient evidence to recommend one strategy over another. It is suggested that these strategies are incorporated into therapy sessions.

**Clinical Question/ PICO**

- Population:** Adults with stroke
- Intervention:** Gesture training
- Comparator:** Control

**Summary**

A systematic review of treatments for apraxia (Lindsten-McQueen et al 2014 [248]) included 2 small randomised controlled trials (RCTs) of gesture training, with 46 total participants. Both trials reported that gesture training produced significant improvements in both ideational and ideomotor tests of apraxia. 1 trial also reported improvements in gesture comprehension and ADL.

A narrative review of apraxia assessments and treatments by Dovern et al (2012) [247] discussed the same RCTs included in the Lindsten-McQueen review, noting the apparent benefits but also the very small sample sizes of the two studies. Since gesture training was the only treatment approach included in their review that appeared to show persisting benefits, they concluded that gesture training appeared to be the best-supported treatment for apraxia. However, the evidence is very limited due to the small number of trials and patients.

The evidence reviewed here suggests that gesture training may slightly improve performance on ideational and ideomotor tests of apraxia.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Gesture training		



<p><b>Ideational test of apraxia</b></p> <p>7 Critical</p>	<p>Based on data from 46 patients in 2 studies.</p>	<p>Two RCTs reported that gesture training resulted in significantly improved performance in tests of ideational apraxia</p>	<p><b>Low</b></p> <p>Due to serious risk of bias, Due to serious imprecision <sup>1</sup></p>	<p>Gesture training may increase ideational test of apraxia slightly</p>
<p><b>Ideomotor test of apraxia</b></p> <p>7 Critical</p>	<p>Based on data from 46 patients in 2 studies.</p>		<p><b>Low</b></p> <p>Due to serious risk of bias, Due to serious imprecision <sup>2</sup></p>	<p>Gesture training may increase ideomotor test of apraxia slightly</p>

1. **Risk of bias: Serious . Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ; **Publication bias: No serious .**

2. **Risk of bias: Serious . Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ; **Publication bias: No serious .**

**References**

[252] Lindsten-McQueen K, Weiner NW, Wang H-Y, Josman N, Connor LT : Systematic review of apraxia treatments to improve occupational performance outcomes.. OTJR : occupation, participation and health 2014;34(4):183-92 [Pubmed Journal](#)

[253] Dovern A, Fink GR, Weiss PH : Diagnosis and treatment of upper limb apraxia.. Journal of neurology 2012;259(7):1269-83 [Pubmed Journal](#)

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Error-less learning  
**Comparator:** Control

**Summary**

A systematic review of treatments for apraxia (Lindsten-McQueen et al 2014 [248]) included 1 small trial of errorless learning using a pre-post test design. The trial showed a significant decrease in errors on activities of daily living (ADL) tasks that had been trained, but the improvement did not generalise to other tasks. The narrative review by Dovern et al (2012) [247] discussed this trial, noting the lack of benefit at 6-month follow-up. It is uncertain whether error-less learning training for limb apraxia improves performance of activities of daily living.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Control      Error-less learning	Certainty in effect estimates (Quality of evidence)	Plain text summary
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<p><b>ADL activities</b></p> <p>8 Critical</p>	<p>Based on data from 15 patients in 1 studies.</p>	<p>One pre-post test study reported that training resulted in a decrease in errors but that training did not generalise</p>	<p><b>Very Low</b> Due to serious risk of bias, Due to serious imprecision <sup>1</sup></p>	<p>We are uncertain whether error-less learning increases performance of ADL activities</p>
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1. **Risk of bias: Serious . Inconsistency: No serious . Indirectness: No serious . Imprecision: Serious .** Low number of patients ; **Publication bias: No serious .**

**References**

[252] Lindsten-McQueen K, Weiner NW, Wang H-Y, Josman N, Connor LT : Systematic review of apraxia treatments to improve occupational performance outcomes.. OTJR : occupation, participation and health 2014;34(4):183-92 [Pubmed Journal](#)

[253] Dovern A, Fink GR, Weiss PH : Diagnosis and treatment of upper limb apraxia.. Journal of neurology 2012;259(7):1269-83 [Pubmed Journal](#)

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Strategy training  
**Comparator:** Control

**Summary**

A systematic review of treatments for apraxia (Lindsten-McQueen et al 2014 [248]) included one randomised controlled trial (RCT) of strategy training (N = 113) as well as two studies employing a pre-post test design. The review reported that the RCT showed significant (p = 0.03) improvement in activities of daily living (ADL) following strategy training, with an effect size of 0.37. However, confidence intervals were not reported so the precision of the trial is difficult to determine. The same RCT showed non-significant differences between the strategy training and control groups on the Motricity Index, Functional Motricity Index or The Apraxia Test. This review provides insufficient evidence to confirm the benefits of strategy training for treatment of apraxia.

A narrative review of apraxia assessments and treatments by Dovern et al (2012) [247] discussed the same RCT included in the Lindsten-McQueen review, noting that while ADL showed significant differences at 8 weeks, at 5 month follow-up there was no difference between intervention and control groups, suggesting the effects of strategy training may not persist. They concluded that gesture training appeared to be the best-supported treatment for apraxia, although evidence was limited.

The existing evidence suggests that strategy training may improve ADL slightly and may have little or no difference on motor function or apraxia.

Outcome Timeframe	Study results and measurements	Absolute effect estimates Control      Strategy training		Certainty in effect estimates (Quality of	Plain text summary
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			evidence)	
<b>ADL</b> 8 Critical	Based on data from 113 patients in 1 studies.	The treatment group improved significantly (p=0.03) in ADL functioning when compared to the control group post intervention. At 5 months there was no difference between the groups.	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>1</sup>	Strategy training may improve ADL slightly
<b>Motor function</b> 7 Critical	Based on data from 113 patients in 1 studies.	No significant difference between groups on the Motricity Index or Functional Motricity Index	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>2</sup>	Strategy training may have little or no difference on motor function
<b>Apraxia</b> 7 Critical	Based on data from 113 patients in 1 studies.	No significant difference between groups on The Apraxia Test	<b>Low</b> Due to serious risk of bias, Due to serious imprecision <sup>3</sup>	Strategy training may have little or no difference on apraxia

1. **Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
2. **Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .
3. **Risk of bias: Serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Serious** . Low number of patients ; **Publication bias: No serious** .

## References

[252] Lindsten-McQueen K, Weiner NW, Wang H-Y, Josman N, Connor LT : Systematic review of apraxia treatments to improve occupational performance outcomes.. OTJR : occupation, participation and health 2014;34(4):183-92 [Pubmed Journal](#)

[253] Dovern A, Fink GR, Weiss PH : Diagnosis and treatment of upper limb apraxia.. Journal of neurology 2012;259(7):1269-83 [Pubmed Journal](#)

## 13.7 - Neglect

Unilateral spatial neglect, or hemi-inattention, is the failure to attend to sensory or visual stimuli on the affected side, or to make movements towards one side of the environment, typically the left side due to lesions in the right hemisphere. Unilateral spatial neglect has deleterious effects on all aspects of a person's ADL and is a predictor of poor functional outcome. Neglect was identified in approximately 30% of stroke survivors in Australia (Stroke Foundation 2015 & 2016 [8][9]). Management strategies used included visual scanning with sensory stimulation (73%), eye patching (4%), simple cues (83%), mental imagery training (21%) and other therapies (34%) (Stroke Foundation 2014 [9]).

Evidence of the effectiveness of rehabilitation interventions to reduce the impact of neglect and improve ADL performance is inconclusive. Further high-quality research is required.

#### Info Box

##### **Practice point**

Any stroke survivor with suspected or actual neglect or impairment of spatial awareness should have a full assessment using validated tools.

#### Key Info

##### **Resources and other considerations**

##### **Implementation considerations**

There is a clinical indicator collected in the National Stroke Audit on the number of patients with an identified neglect on admission to acute care and/or rehabilitation.

#### Weak Recommendation

For stroke survivors with symptoms of unilateral neglect, cognitive rehabilitation (e.g. computerised scanning training, pen and paper tasks, visual scanning training, eye patching, mental practice) may be provided. (Bowen et al. 2013 [268])

#### Practical Info

Consideration will need to be given to the specific modality of cognitive rehabilitation (studies included computerised scanning training, pen and paper tasks, visual scanning training, eye patching, and mental practice).

Access and cost of computerised scanning software would need to be considered. No adverse outcomes or contraindications were reported in the literature.

#### Key Info

##### **Benefits and harms**

Small net benefit, or little difference between alternatives

Cognitive rehabilitation should be considered to decrease symptoms of unilateral neglect (Bowen et al. 2013 [268]). Cognitive rehabilitation does not have proven effects on the ADL performance of patients with unilateral neglect (Bowen et al. 2013 [268]).

##### **Quality of evidence**

Low

Methodological limitations and small sample sizes impacted the quality of evidence available.

##### **Preference and values**

No substantial variability expected

Stroke survivors with unilateral neglect would want to receive appropriate treatments, although the optimal approach remains unclear.

##### **Resources and other considerations**

Important issues, or potential issues not investigated

##### **Resources considerations**

No literature to understand or describe the potential economic implications of this recommendation was identified.

## Rationale

Cognitive rehabilitation should be considered to reduce the symptoms of unilateral neglect. The evidence around the effectiveness of cognitive rehabilitation in improving ADL performance is inconclusive, with further high-quality studies required in this area. Outcome measures should reflect the specific areas of ADL that are targeted in interventions.

It is important to consider the impact of generally poor study design in relation to outcome measures relating to ADL (e.g. using Functional Independence Measure or Barthel Index to measure change relating to an intervention that was delivered through computerised scanning training or pen and paper tasks, is a bit of a stretch when the actual functional tasks were not trained in the studies).

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## Clinical Question/ PICO

**Population:** Adults with stroke with neglect  
**Intervention:** Cognitive rehabilitation  
**Comparator:** Control

### Summary

The overarching trend in recent reviews and trials of cognitive rehabilitation is that the change seen on standardised neglect tests following cognitive rehabilitation does not appear to translate to daily activities (i.e. nil trend towards improvement in ADLs following these interventions). Most interventions included visual scanning training, with some computerised training and most including pen/paper tasks. Further research is required investigating scanning training in the context of daily activities. Recent reviews and trials of cognitive rehabilitation include:

Bowen et al (2013) [264] conducted a Cochrane review showing no persisting effects of cognitive rehabilitation on neglect or ADL, and no immediate effects for ADLs. There was some limited evidence to support immediate effects of cognitive rehabilitation on the severity of neglect (as indicated on neuropsychological tests).

Klinke et al (2015) [263] conducted a literature review of ward-based interventions for hemispatial neglect. They identified a diverse range of interventions that could be implemented on the ward, however, there was a general low level of evidence to support specific interventions. Interventions were limited to those that could be delivered on the ward by nursing staff – this resulted in an omission of some interventions that were considered too complex to implement. 41 studies were included, but the review provided descriptive characteristics of studies and the associated interventions only, with no statistical analysis. Many studies had small sample sizes. Recommendations were made regarding ward based interventions based on a work group formed as part of the study, with 11 interventions recommended for consideration for nursing implementation with varying ratings (i.e. all interventions were Grade B-D). It is difficult to apply the results of the review due to the heterogeneity of samples, study designs and interventions.

Aparicio-Lopez et al (2015) [264] conducted a small randomised trial comparing computer-based cognitive rehabilitation (n=7) to a combination treatment group (i.e. computer-based cognitive rehabilitation plus right hemifield eye-patching (n=5). Treatment involved 15 sessions of 1 hour. Significant (p = 0.048) between-group differences were found post-treatment for a reading task (in favour of the combination therapy group). However no differences were present in the Catherine Bergego scale or functional measures such as a baking tray task. The single therapy group also demonstrated statistically significant improvements in a line bisection task. The small sample size and other study design limitations (bias) limits the ability to generalise results from this study to this population.

Van Wyk et al (2014) [265] conducted a matched pair RCT comparing saccadic eye movement training with visual scanning exercises integrated within task-specific activities (n = 12) to a control group completing task-specific activities (n = 12). All participants received task-specific activities for 45min/session, 5 days a week for 4 weeks. The saccadic eye movement training group performed significantly better in the King Devick test following completion of the intervention (p=0.211). The control group also demonstrated statistically significant improvement in star cancellation test (p=0.02). Barthel Index scores improved significantly, with the intervention group improving from “severe dependence” to “moderate dependence” over the 4 week intervention period. The trial had a small sample size and there were differences in baseline characteristics between the groups.

A literature review by Smania et al (2013) [266] described results of 13 studies investigating eye patching for treatment of USN (6 x RCTs, 5 x case-series, 2 x single-case studies). 7 studies investigated right monocular eye patching, 5 studies investigated effects of right hemifield eye patching, and one study compared monocular and hemifield eye patching. Study designs were variable, with outcomes assessed before and after intervention in some cases, while other studies assessed outcomes during normal viewing and wearing eye patches. Right hemifield eye patching may be promising based on the study results, however methodological limitations impact the ability to make recommendations (e.g. small sample size, conflicting results).

In a small RCT (N = 29), Van Kessel et al (2013) [267] compared dual task training added to visual scanning and a driving simulator task to a control group completing a single lane tracking task. Participants in both groups showed a significant reduction in neglect symptoms on paper tests of neglect. However, there were no significant between-group differences. There was a lack of variation in treatment provided across groups (i.e. 2 x 35min sessions across the 3 weeks was the only difference between the groups)

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Cognitive rehabilitation		
<p><b>Falls</b> During treatment: 4 weeks  7 Critical</p>	<p>Odds Ratio 1.21 (CI 95% 0.26 - 5.76) Based on data from 39 patients in 1 studies.<sup>1</sup> (Randomized controlled) Follow up 4 weeks of treatment</p>	<p><b>190</b> per 1000</p>	<p><b>221</b> per 1000</p>	<p><b>Low</b> Due to serious risk of bias, Due to serious imprecision<sup>2</sup></p>	<p>Cognitive rehabilitation may have little or no effect on reducing falls for people with neglect. Falls were a secondary outcome measure - further quality studies are required to draw conclusions</p>
<p><b>Activities of daily living</b> Post intervention  8 Critical</p>	<p>Measured by: Barthel Index, Functional Impairment Measure, Catherine Bergego Scale High better Based on data from: 343 patients in 10 studies.<sup>3</sup> (Randomized controlled) Follow up 1 to 12 weeks of treatment</p>	<p>Difference: <b>SMD 0.23 higher</b> ( CI 95% 0.02 lower - 0.48 higher )</p>		<p><b>Low</b> Due to serious risk of bias<sup>4</sup></p>	<p>Cognitive rehabilitation may have little or no difference on level of disability/activities of daily living immediately following intervention</p>
<p><b>Neglect</b> Post intervention  8 Critical</p>	<p>Measured by: Target cancellation, line bisection, BIT substests High better Based on data from: 437 patients in 16 studies. (Randomized controlled)</p>	<p>Difference: <b>SMD 0.35 higher</b> ( CI 95% 0.09 higher - 0.62 higher )</p>		<p><b>Moderate</b> Due to serious risk of bias<sup>5</sup></p>	<p>Cognitive rehabilitation probably decreases neglect slightly/slightly improves neglect symptoms</p>

Follow up 1 to 12 weeks  
of treatment

1. Systematic review [268] . **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . Baseline differences in population/comparator groups ; **Imprecision: Serious** . Only data from one study, Low number of patients ; **Publication bias: No serious** .
3. Systematic review [268] . **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: Serious** . Incomplete data and/or large loss to follow up, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
5. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Incomplete data and/or large loss to follow up, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . baseline differences in populations of several included studies ; **Imprecision: No serious** . **Publication bias: No serious** .

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#### Weak Recommendation

For stroke survivors with symptoms of unilateral neglect, mirror therapy may be used to improve arm function and ADL performance. (Pandian et al. 2015 [259]; Thieme et al. 2012 [256])

### Practical Info

Information regarding the dosage of mirror therapy requires further exploration, as this varied considerably across studies.

There is still limited high-quality evidence about the effect of mirror therapy on the symptoms of unilateral spatial neglect, but mirror therapy may improve performance of activities of daily living.

### Key Info

#### Benefits and harms

Small net benefit, or little difference between alternatives

Mirror therapy may improve performance in ADLs, but there is conflicting evidence of effectiveness based on two small trials (Pandian et al. 2015 [259]; Thieme et al. 2012 [256]). No adverse outcomes relating to this intervention have been reported in studies.

#### Quality of evidence

Low

Small trials included with some risk of bias.

Dosage and method of delivery of mirror therapy did vary across studies, and should be considered for future studies (i.e. there was variation with active vs passive movement, movement of affected vs unaffected limb).

#### Preference and values

Substantial variability is expected or uncertain

Patients' preferences are likely to vary due to unclear evidence of benefits.



Important issues, or potential issues not investigated

**Resources and other considerations**

**Resources considerations**

No literature to understand or describe the potential economic implications of this recommendation was identified.

**Rationale**

Overall there is limited high-quality evidence to support the use of mirror therapy to decrease symptoms of unilateral spatial neglect. However, there is some suggestion that mirror therapy may improve activities of daily living (ADL) performance.

**Clinical Question/ PICO**

**Population:** Adults with stroke with neglect

**Intervention:** Mirror therapy

**Comparator:** Control

**Summary**

Overall there is limited high-quality evidence to support the use of mirror therapy to decrease symptoms of unilateral spatial neglect, however, there is some suggestion that mirror therapy may improve activities of daily living (ADL) performance.

Pandian et al (2014) [255] conducted a small randomised controlled trial with 48 total participants with thalamic and parietal lobe lesions following stroke. The intervention consisted of 1 hour of mirror therapy 1-2 hours/day for 4 weeks combined with limb activation therapy, while the control group also received limb activation therapy in combination with sham mirror therapy. Improvements over 6 months of follow-up were greater for the mirror therapy group than control group, with improvements across all outcome measures reaching statistical significance (star cancellation: SMD = 23, 95% CI 19-28; p < 0.0001; picture identification: SMD 3.2, 95%CI 2.4-4.0; p<0.0001; line bisection: SMD 8.6, 95%CI 2.7-14.6; p = 0.006). Participants in the treatment group were also significantly more likely to be independent on the Functional Independence Measure at follow-up.

An earlier Cochrane review by Thieme et al (2012) [252] found a significant effect of mirror therapy compared to all other interventions on unilateral spatial neglect in one study only, and 4 studies showing an improvement in activities of daily living. The single study showing an improvement in neglect supports the use of mirror therapy to improve both spatial awareness and activities of daily living post-stroke, however, this trial had a small sample size (9 experimental, 11 control).

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Mirror therapy		
<p><b>Functional dependence (FIM ≤ 5)</b><sup>1</sup> At 6 month follow-up</p>	<p>n/a Based on data from 46 patients in 1 studies.<sup>2</sup> (Randomized controlled) Follow up 4 weeks treatment, 6 months follow-up</p>	<p><b>950</b> per 1000</p>	<p><b>577</b> per 1000</p>	<p><b>Low</b> The difference between groups was significant (p = 0.004)., Due to serious inconsistency (single study), Due to serious imprecision (single study with few participants)<sup>3</sup></p>	<p>Mirror therapy may decrease functional dependence</p>
		<p>Difference: <b>373 fewer</b> per 1000</p>			

<p><b>Activities of daily living</b> Post intervention: 4 to 6 weeks</p>	<p>Measured by: FIM - self-care &amp; mobility items, Barthel Index High better Based on data from: 217 patients in 4 studies.<sup>4</sup> (Randomized controlled) Follow up 4 to 6 weeks of treatment</p>	<p>points (n/a) Difference: <b>SMD 0.33 higher</b> ( CI 95% 0.05 higher - 0.6 higher )</p>	<p><b>Moderate</b> Due to serious risk of bias<sup>5</sup></p>	<p>Mirror therapy probably improves activities of daily living at the end of intervention phase. Mode of delivery of MT variable across studies (i.e. active, passive, or no mvt of affected side)</p>
<p><b>Visuospatial neglect</b> Post intervention: 6 weeks</p>	<p>Measured by: Self-defined scale based on BIT and TAP High better Based on data from: 20 patients in 1 studies.<sup>6</sup> (Randomized controlled) Follow up 6 weeks</p>	<p><b>-2.33</b> points (Mean)      <b>-1.36</b> points (Mean) Difference: <b>SMD 1.22 higher</b> ( CI 95% 0.24 higher - 2.19 higher )</p>	<p><b>Low</b> Results based on 1 x RCT with small sample size<sup>7</sup></p>	<p>Mirror therapy may decrease visuospatial neglect at the end of intervention slightly</p>
<p><b>Visual neglect - star cancellation test</b> At 6 month follow-up</p>	<p>Measured by: Improvement from baseline on star cancellation test High better Based on data from: 47 patients in 1 studies.<sup>8</sup> (Randomized controlled) Follow up 4 weeks treatment, 6 months follow-up</p>	<p><b>12</b> points (Mean)      <b>35</b> points (Mean) Difference: <b>MD 23 higher</b> ( CI 95% 19 higher - 28 higher )</p>	<p><b>Low</b> Due to serious inconsistency (single study), Due to serious imprecision (single study, few patients)<sup>9</sup></p>	<p>Mirror therapy may improve visual neglect (as measured by the star cancellation test)</p>
<p><b>Visual neglect - line bisection test</b> At 6 month follow-up</p>	<p>Measured by: Improvement from baseline on line bisection test High better Based on data from: 47 patients in 1 studies.<sup>10</sup> (Randomized controlled) Follow up 4 weeks treatment, 6 months follow-up</p>	<p><b>10.4</b> centimetres (Mean)      <b>19</b> centimetres (Mean) Difference: <b>MD 8.6 higher</b> ( CI 95% 2.7 higher - 14.6 lower )</p>	<p><b>Low</b> Due to serious inconsistency (single study), Due to serious imprecision (single study, few patients)<sup>11</sup></p>	<p>Mirror therapy may improve visual neglect (as measured by the line bisection test)</p>
<p><b>Visual neglect - picture identification task</b> At 6 month follow-up</p>	<p>Measured by: Improvement from baseline on picture identification task High better Based on data from: 47 patients in 1 studies.<sup>12</sup> (Randomized controlled) Follow up 4 weeks treatment, 6 months follow-up</p>	<p><b>2</b> points (Mean)      <b>5.2</b> points (Mean) Difference: <b>MD 3.2 higher</b> ( CI 95% 2.4 higher - 4 lower )</p>	<p><b>Low</b> Due to serious inconsistency (single study), Due to serious imprecision (single study, few patients)<sup>13</sup></p>	<p>Mirror therapy may improve visual neglect (as measured by the picture identification task)</p>

1. Participants were classified as dependent if they had Functional Independence Measure scores  $\leq 5$
2. Primary study [259]. **Baseline/comparator::** Control arm of reference used for intervention .
3. **Risk of bias: No serious** . Lack of blinding of participants and personnel, resulting in potential for performance bias, but blinded assessors used ; **Inconsistency: Serious** . Can't determine how reliable the benefits are from a single study ; **Indirectness: No serious** . Differences between the population of interest and those studied: trial conducted in India, may differ from Australian stroke patients ; **Imprecision: Serious** . Low number of patients, Only data from one study ; **Publication bias: No serious** .
4. Systematic review [258] with included studies: Dohle 2009, Sütbeyaz 2007, Ietswaart 2011, Yavuzer 2008. **Baseline/comparator::** Control arm of reference used for intervention .
5. **Risk of bias: Serious** . Missing intention-to-treat analysis in 3/4 studies ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
6. Systematic review [258] with included studies: Dohle 2009. **Baseline/comparator::** Control arm of reference used for intervention .
7. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . Only data from one study, Low number of patients ; **Publication bias: No serious** .
8. Primary study [259]. **Baseline/comparator::** Control arm of reference used for intervention .
9. **Risk of bias: No serious** . Lack of blinding of participants and personnel, resulting in potential for performance bias, but blinded assessors used ; **Inconsistency: Serious** . Can't determine how reliable the benefits are from single study ; **Indirectness: No serious** . Differences between the population of interest and those studied: Indian patient population may differ from Australian stroke patients ; **Imprecision: Serious** . Low number of patients, Only data from one study ; **Publication bias: No serious** .
10. Primary study [259]. **Baseline/comparator::** Control arm of reference used for intervention .
11. **Risk of bias: No serious** . Lack of blinding of participants and personnel, resulting in potential for performance bias, but blinded assessors used ; **Inconsistency: Serious** . Can't determine how reliable the benefits are from single study ; **Indirectness: No serious** . Differences between the population of interest and those studied ; **Imprecision: Serious** . Low number of patients, Only data from one study ; **Publication bias: No serious** .
12. Primary study [259]. **Baseline/comparator::** Control arm of reference used for intervention .
13. **Risk of bias: No serious** . Lack of blinding of participants and personnel, resulting in potential for performance bias, but blinded assessors used ; **Inconsistency: Serious** . Can't determine how reliable the benefits are from single study ; **Indirectness: No serious** . Differences between the population of interest and those studied ; **Imprecision: Serious** . Low number of patients, Only data from one study ; **Publication bias: No serious** .

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### Practice Statement

#### Consensus-based recommendations

Stroke survivors with impaired attention to one side should be:

- given a clear explanation of the impairment;
- taught compensatory strategies systematically, such as visual scanning to reduce the impact of neglect on activities such as reading, eating and walking;
- given cues to draw attention to the affected side during therapy and nursing procedures;
- monitored to ensure that they do not eat too little through missing food on one side of the plate.

### Key Info

#### Resources and other considerations

#### Implementation considerations

There is a clinical indicator collected in the National Stroke Audit on the types of management implemented for those patients with identified neglect. These types of management include visual scanning training with sensory stimulation, prism adaptation, eye patching, simple cues and mental imagery training.

### Clinical Question/ PICO

<b>Population:</b>	Adults with stroke with neglect
<b>Intervention:</b>	Cognitive rehabilitation
<b>Comparator:</b>	Control

#### Summary

The overarching trend in recent reviews and trials of cognitive rehabilitation is that the change seen on standardised neglect tests following cognitive rehabilitation does not appear to translate to daily activities (i.e. nil trend towards improvement in ADLs following these interventions). Most interventions included visual scanning training, with some computerised training and most including pen/paper tasks. Further research is required investigating scanning training in the context of daily activities. Recent reviews and trials of cognitive rehabilitation include:

Bowen et al (2013) [264] conducted a Cochrane review showing no persisting effects of cognitive rehabilitation on neglect or ADL, and no immediate effects for ADLs. There was some limited evidence to support immediate effects of cognitive rehabilitation on the severity of neglect (as indicated on neuropsychological tests).

Klinke et al (2015) [263] conducted a literature review of ward-based interventions for hemispatial neglect. They identified a diverse range of interventions that could be implemented on the ward, however, there was a general low level of evidence to support specific interventions. Interventions were limited to those that could be delivered on the ward by nursing staff – this resulted in an omission of some interventions that were considered too complex to implement. 41 studies were included, but the review provided descriptive characteristics of studies and the associated interventions only, with no statistical analysis. Many studies had small sample sizes. Recommendations were made regarding ward based interventions based on a work group formed as part of the study, with 11 interventions recommended for consideration for nursing implementation with varying ratings (i.e. all interventions were Grade B-D). It is difficult to apply the results of the review due to the heterogeneity of samples, study designs and interventions.

Aparicio-Lopez et al (2015) [264] conducted a small randomised trial comparing computer-based cognitive rehabilitation (n=7) to

a combination treatment group (i.e. computer-based cognitive rehabilitation plus right hemifield eye-patching (n=5). Treatment involved 15 sessions of 1 hour. Significant (p = 0.048) between-group differences were found post-treatment for a reading task (in favour of the combination therapy group). However no differences were present in the Catherine Bergego scale or functional measures such as a baking tray task. The single therapy group also demonstrated statistically significant improvements in a line bisection task. The small sample size and other study design limitations (bias) limits the ability to generalise results from this study to this population.

Van Wyk et al (2014) [265] conducted a matched pair RCT comparing saccadic eye movement training with visual scanning exercises integrated within task-specific activities (n = 12) to a control group completing task-specific activities (n = 12). All participants received task-specific activities for 45min/session, 5 days a week for 4 weeks. The saccadic eye movement training group performed significantly better in the King Devick test following completion of the intervention (p=0.211). The control group also demonstrated statistically significant improvement in star cancellation test (p=0.02). Barthel Index scores improved significantly, with the intervention group improving from "severe dependence" to "moderate dependence" over the 4 week intervention period. The trial had a small sample size and there were differences in baseline characteristics between the groups.

A literature review by Smania et al (2013) [266] described results of 13 studies investigating eye patching for treatment of USN (6 x RCTs, 5 x case-series, 2 x single-case studies). 7 studies investigated right monocular eye patching, 5 studies investigated effects of right hemifield eye patching, and one study compared monocular and hemifield eye patching. Study designs were variable, with outcomes assessed before and after intervention in some cases, while other studies assessed outcomes during normal viewing and wearing eye patches. Right hemifield eye patching may be promising based on the study results, however methodological limitations impact the ability to make recommendations (e.g. small sample size, conflicting results).

In a small RCT (N = 29), Van Kessel et al (2013) [267] compared dual task training added to visual scanning and a driving simulator task to a control group completing a single lane tracking task. Participants in both groups showed a significant reduction in neglect symptoms on paper tests of neglect. However, there were no significant between-group differences. There was a lack of variation in treatment provided across groups (i.e. 2 x 35min sessions across the 3 weeks was the only difference between the groups)

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	Cognitive rehabilitation		
<p><b>Falls</b> During treatment: 4 weeks</p> <p>7 Critical</p>	<p>Odds Ratio 1.21 (CI 95% 0.26 - 5.76) Based on data from 39 patients in 1 studies.<sup>1</sup> (Randomized controlled) Follow up 4 weeks of treatment</p>	<p><b>190</b> per 1000</p>	<p><b>221</b> per 1000</p>	<p><b>Low</b> Due to serious risk of bias, Due to serious imprecision<sup>2</sup></p>	<p>Cognitive rehabilitation may have little or no effect on reducing falls for people with neglect. Falls were a secondary outcome measure - further quality studies are required to draw conclusions</p>
<p><b>Activities of daily living</b> Post intervention</p>	<p>Measured by: Barthel Index, Functional Impairment Measure, Catherine Bergego Scale</p>	<p>Difference: <b>SMD 0.23 higher</b> ( CI 95% 0.02 lower - 0.48 higher )</p>		<p><b>Low</b> Due to serious risk of bias<sup>4</sup></p>	<p>Cognitive rehabilitation may have little or no difference on level of disability/activities of</p>

8 Critical	High better Based on data from: 343 patients in 10 studies. <sup>3</sup> (Randomized controlled) Follow up 1 to 12 weeks of treatment			daily living immediately following intervention
<b>Neglect</b> Post intervention 8 Critical	Measured by: Target cancellation, line bisection, BIT subtests High better Based on data from: 437 patients in 16 studies. (Randomized controlled) Follow up 1 to 12 weeks of treatment	Difference: <b>SMD 0.35 higher</b> ( CI 95% 0.09 higher - 0.62 higher )	<b>Moderate</b> Due to serious risk of bias <sup>5</sup>	Cognitive rehabilitation probably decreases neglect slightly/slightly improves neglect symptoms

1. Systematic review [268] . **Baseline/comparator::** Control arm of reference used for intervention .
2. **Risk of bias: Serious** . Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . Baseline differences in population/comparator groups ; **Imprecision: Serious** . Only data from one study, Low number of patients ; **Publication bias: No serious** .
3. Systematic review [268] . **Baseline/comparator::** Control arm of reference used for intervention .
4. **Risk of bias: Serious** . Incomplete data and/or large loss to follow up, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . **Publication bias: No serious** .
5. **Risk of bias: Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Incomplete data and/or large loss to follow up, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . baseline differences in populations of several included studies ; **Imprecision: No serious** . **Publication bias: No serious** .

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Weak Recommendation

AGAINST

Non-invasive brain stimulation should not be used in routine clinical practice to decrease unilateral neglect, but may be used within a research framework. (Kim et al. 2015 [260]; Cha et al. 2015 [261]; Bang et al. 2015 [262]; Fu et al. 2015 [265])

## Practical Info

Details around dosages vary considerably across studies. Side effects of mild headache were seen in three studies only for a small proportion of participants; further exploration of potential harm is required.

Further exploration is also required around scope of practice for modality delivery (i.e. consideration of which practitioners/clinicians are able to complete training in delivery of this intervention in order to translate this into clinical environments).

## Key Info

### Benefits and harms

Small net benefit, or little difference between alternatives

There is some evidence to support the use of non-invasive brain stimulation to decrease symptoms of unilateral neglect.

No significant adverse outcomes were reported, with three studies reporting mild headache only following stimulation sessions.

### Quality of evidence

Low

The evidence comes from several randomised controlled trials, however small sample size in most studies warrants further larger studies in this area.

Methodological differences remain a challenge: some studies suggest electrode placement on the affected side, others suggest electrode placement on the unaffected side; dose and stimulation parameters varied across studies.

### Preference and values

Substantial variability is expected or uncertain

Patients' preferences are likely to vary due to unclear evidence of benefits.

### Resources and other considerations

Factors not considered

## Rationale

Further clinical trials need to be completed with a standardised protocol recommended before this intervention can be introduced into routine clinical practice for stroke survivors with neglect.

Variations in methodology (i.e. parameters and modes of delivery) makes the introduction into clinical practice of non-invasive brain stimulation challenging at this stage.

Further investigation into the side effects/possible harm is required before introducing this intervention into clinical practice.

## Clinical Question/ PICO

- Population:** Adults with stroke with neglect  
**Intervention:** transcranial direct current stimulation (tDCS)  
**Comparator:** Control

### Summary

A number of recent trials have assessed the effectiveness of brain stimulation interventions for treating hemispatial neglect such as repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS). There is a general trend in all of these studies in favour of non-invasive brain stimulation in reducing USN symptoms. The mode of delivery (high vs low-frequency stimulation, stimulating the affected vs unaffected parietal lobe) and dosage varied considerably across these trials. These trials included:

Kim et al (2015) [256]: A randomised trial (N = 34) with 2 groups compared rTMS applied during one session over the unaffected parietal cortex (n=19) to 10 sessions of low-frequency rTMS (i.e. 5 days a week for 2 weeks) (n = 15). Both groups also received conventional visuospatial rehabilitation including visual scanning training & systematic training of visual organisation skills. The 10 sessions of low-intensity rTMS showed significantly better outcomes in all measures of neglect (letter cancellation, line bisection, Ota's task) compared to the single session group ( $p < 0.01$ ). The trial had small sample size and the timing of follow-up



measures differed between the two groups.

A randomised controlled trial (RCT) (N = 22) by Cha et al (2015) [257] compared rTMS plus "comprehensive rehabilitation therapy" (i.e. 10mins of TMS & 30mins of "neurodevelopmental facilitation techniques" to sham TMS plus "comprehensive rehabilitation therapy". Both groups received therapy 5 days a week for 4 weeks. The results indicated a significant decrease in USN symptoms in the experimental group compared to control.

Bang et al (2015) [258] conducted an RCT (N = 12) where the intervention group received tDCS stimulating the affected posterior parietal cortex (PPC) plus feedback training and the control group received feedback training alone. Both groups showed significant improvements in MVPT, line bisection test, and the Barthel Index. The tDCS +FT group showed more significant improvements than the control group on these same measures (i.e. reduction in neglect). The feedback therapy both groups received was not well defined (i.e. it was stated that participants were required to look in a mirror, however it is unclear if they completed structured exercise/activities)

A prospective, double-blind, sham-controlled trial by Kim et al (2013) [257] compared low-frequency rTMS over the non-lesioned PPC (n=9), high frequency rTMS over the lesioned PPC (n=9), and sham stimulation (n=9). Stimulation was delivered 5 days a week for 2 weeks (20min/session). High-frequency rTMS significantly increased the accuracy of line bisection (i.e. more than low frequency rTMS or sham). The trial had a short follow-up period (2 weeks) and lacked the ability to establish improvements in ADLs.

Sunwoo et al (2013) [258] conducted a small double-blind trial (N = 10) with a random crossover design. All participants received dual-mode anodal tDCS (over right and left-hemisphere PPC), single mode tDCS over the right-hemisphere posterior parietal cortex, and sham stimulation. Each session was 20 minutes in duration. Limited information was provided about the study design (i.e. time lapse between interventions, number of sessions). Significant improvements were noted after both dual & single mode tDCS compared to the sham (i.e. on line bisection test). The trial had a small sample size and showed heterogeneity in the included participants.

Fu et al (2015) [261] conducted an RCT (N = 20) comparing continuous theta-burst stimulation (cTBS) over the unaffected hemisphere to sham cTBS. The intervention period was 2 weeks and follow-up measures were completed at 4 weeks. All participants received scanning training 30min 2 x day for 2 weeks, and either the cTBS or sham stimulation for 14 consecutive days. cTBS resulted in a reduction in USN (i.e. a significant improvement in both the star cancellation test and line bisection scores between baseline and 4 weeks follow-up when compared to the control group). The trial had a small sample size and used strict exclusion criteria that meant that only less impaired participants were included.

Cazzoli et al (2012) [261] conducted a trial using a double-blind, sham-controlled crossover design, comparing continuous theta-burst stimulation (TBS) followed by sham (n=8), sham followed by continuous TBS (n=8), and a control group (n=8) receiving no stimulation. The TBS groups received 8 continuous TBS trains (i.e. cTBS delivered to the unaffected PPC for 2 consecutive days). All participants also received 1 hour of neuropsychological training (visuospatial exploration training, and attention and concentration training), 1 hour of occupational therapy and 1 hour of physiotherapy per day. A significant reduction in neglect severity (Catherine Bergego scale) was found in both experimental groups after delivery of TBS (nil significant change across control or sham conditions). The included participants showed substantial heterogeneity in age and stroke onset.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	transcranial direct current stimulation (tDCS)		
<b>Neglect (Motor-Free Visual Perception Test)</b>	Measured by: Motor-Free Visual Perception Test (MVPT)	<b>25.3</b> (Mean)	<b>30.83</b> (Mean)	<b>Very Low</b> Due to very serious risk of bias,	We are uncertain whether transcranial direct current stimulation

3 weeks 7 Critical	High better Based on data from: 12 patients in 1 studies. (Randomized controlled)	Difference: <b>MD 5.8 higher</b> n/a		Due to serious imprecision, Due to serious indirectness <sup>1</sup>	(tdcs) improves or worsen neglect (motor-free visual perception test).
<b>Neglect (Line Bisection Test)</b> 3 weeks 7 Critical	Measured by: Line Bisection Test Based on data from: 12 patients in 1 studies. (Randomized controlled)	<b>5.9</b> (Mean)	<b>5.37</b> (Mean)	<b>Very Low</b> Due to very serious risk of bias, Due to serious indirectness, Due to serious imprecision <sup>2</sup>	We are uncertain whether transcranial direct current stimulation (tdcs) increases or decreases neglect (line bisection test).
<b>Functional independence</b> 3 weeks 8 Critical	Measured by: Modified Barthel Index Based on data from: 12 patients in 1 studies. (Randomized controlled)	<b>69.2</b> (Mean)	<b>78.3</b> (Mean)	<b>Very Low</b> Due to very serious risk of bias, Due to serious indirectness, Due to serious imprecision <sup>3</sup>	We are uncertain whether transcranial direct current stimulation (tdcs) increases or decreases functional independence.

- Risk of bias: Very Serious** . Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: Serious** . Participants selected from among those with unilateral spatial neglect'; suggesting high risk of bias in participant selection. ; **Imprecision: Serious** . Low number of patients, Only data from one study, Low number of patients, Only data from one study ; **Publication bias: No serious** .
- Risk of bias: Very Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: Serious** . Participants selected from among those with unilateral spatial neglect'; suggesting high risk of bias in participant selection. ; **Imprecision: Serious** . Low number of patients, Only data from one study, Low number of patients, Only data from one study ; **Publication bias: No serious** .
- Risk of bias: Very Serious** . Inadequate sequence generation/ generation of comparable groups, resulting in potential for selection bias, Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: Serious** . Participants selected from among those with unilateral spatial neglect'; suggesting high risk of bias in participant selection. ; **Imprecision: Serious** . Low number of patients, Only data from one study ; **Publication bias: No serious** .

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## Clinical Question/ PICO

**Population:** Adults with stroke with neglect  
**Intervention:** Continuous theta-burst stimulation (cTBS)  
**Comparator:** Sham

### Summary

A number of recent trials have assessed the effectiveness of brain stimulation interventions for treating hemispatial neglect such as repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS). There is a general trend in all of these studies in favour of non-invasive brain stimulation in reducing USN symptoms. The mode of delivery (high vs low-frequency stimulation, stimulating the affected vs unaffected parietal lobe) and dosage varied considerably across these trials. These trials included:

Kim et al (2015) [256] : A randomised trial (N = 34) with 2 groups compared rTMS applied during one session over the unaffected parietal cortex (n=19) to 10 sessions of low-frequency rTMS (i.e. 5 days a week for 2 weeks) (n = 15). Both groups also received conventional visuospatial rehabilitation including visual scanning training & systematic training of visual organisation skills. The 10 sessions of low-intensity rTMS showed significantly better outcomes in all measures of neglect (letter cancellation, line bisection, Ota's task) compared to the single session group (p < 0.01). The trial had small sample size and the timing of follow-up measures differed between the two groups.

A randomised controlled trial (RCT) (N = 22) by Cha et al (2015) [257] compared rTMS plus "comprehensive rehabilitation therapy" (i.e. 10mins of TMS & 30mins of "neurodevelopmental facilitation techniques" to sham TMS plus "comprehensive rehabilitation therapy". Both groups received therapy 5 days a week for 4 weeks. The results indicated a significant decrease in USN symptoms in the experimental group compared to control.

Bang et al (2015) [258] conducted an RCT (N = 12) where the intervention group received tDCS stimulating the affected posterior parietal cortex (PPC) plus feedback training and the control group received feedback training alone. Both groups showed significant improvements in MVPT, line bisection test, and the Barthel Index. The tDCS +FT group showed more significant improvements than the control group on these same measures (i.e. reduction in neglect). The feedback therapy both groups received was not well defined (i.e. it was stated that participants were required to look in a mirror, however it is unclear if they completed structured exercise/activities)

A prospective, double-blind, sham-controlled trial by Kim et al (2013) [257] compared low-frequency rTMS over the non-lesioned PPC (n=9), high frequency rTMS over the lesioned PPC (n=9), and sham stimulation (n=9). Stimulation was delivered 5 days a week for 2 weeks (20min/session). High-frequency rTMS significantly increased the accuracy of line bisection (i.e. more than low frequency rTMS or sham). The trial had a short follow-up period (2 weeks) and lacked the ability to establish improvements in ADLs.

Sunwoo et al (2013) [258] conducted a small double-blind trial (N = 10) with a random crossover design. All participants received dual-mode anodal tDCS (over right and left-hemisphere PPC), single mode tDCS over the right-hemisphere posterior parietal cortex, and sham stimulation. Each session was 20 minutes in duration. Limited information was provided about the study design (i.e. time lapse between interventions, number of sessions). Significant improvements were noted after both dual & single mode tDCS compared to the sham (i.e. on line bisection test). The trial had a small sample size and showed heterogeneity in the included

participants.

Fu et al (2015) [261] conducted an RCT (N = 20) comparing continuous theta-burst stimulation (cTBS) over the unaffected hemisphere to sham cTBS. The intervention period was 2 weeks and follow-up measures were completed at 4 weeks. All participants received scanning training 30min 2 x day for 2 weeks, and either the cTBS or sham stimulation for 14 consecutive days. cTBS resulted in a reduction in USN (i.e. a significant improvement in both the star cancellation test and line bisection scores between baseline and 4 weeks follow-up when compared to the control group). The trial had a small sample size and used strict exclusion criteria that meant that only less impaired participants were included.

Cazzoli et al (2012) [261] conducted a trial using a double-blind, sham-controlled crossover design, comparing continuous theta-burst stimulation (TBS) followed by sham (n=8), sham followed by continuous TBS (n=8), and a control group (n=8) receiving no stimulation. The TBS groups received 8 continuous TBS trains (i.e. cTBS delivered to the unaffected PPC for 2 consecutive days). All participants also received 1 hour of neuropsychological training (visuospatial exploration training, and attention and concentration training), 1 hour of occupational therapy and 1 hour of physiotherapy per day. A significant reduction in neglect severity (Catherine Bergego scale) was found in both experimental groups after delivery of TBS (nil significant change across control or sham conditions). The included participants showed substantial heterogeneity in age and stroke onset.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Sham	Continuous theta- burst stimulation (cTBS)		
<b>Neglect (Line Bisection Test)</b> 4 weeks  8 Critical	Measured by: Line bisection test Lower better Based on data from: 20 patients in 1 studies. (Randomized controlled) Follow up 4 weeks	<b>35.79</b> (Mean)	<b>11.17</b> (Mean)	<b>Low</b> Due to very serious imprecision <sup>1</sup>	Continuous theta-burst stimulation (ctbs) may improve neglect (line bisection test).
<b>Neglect (Star cancellation test)</b> 4 weeks  7 Critical	Measured by: Star cancellation test Lower better Based on data from: 20 patients in 1 studies. (Randomized controlled) Follow up 4 weeks	<b>45.29</b> (Mean)	<b>6.25</b> (Mean)	<b>Low</b> Due to very serious imprecision <sup>2</sup>	Continuous theta-burst stimulation (ctbs) may improve neglect (star cancellation test).

1. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Very Serious .** Low number of patients, Only data from one study, no power calculation ; **Publication bias: No serious .**

2. **Inconsistency: No serious . Indirectness: No serious . Imprecision: Very Serious .** Low number of patients, Only data from one study, no power calculations reported ; **Publication bias: No serious .**

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visuospatial neglect.. The Journal of international medical research 2015;43(2):196-203 [Pubmed Journal](#)

## Clinical Question/ PICO

**Population:** Adults with stroke with neglect  
**Intervention:** repetitive transcranial magnetic stimulation (rTMS)  
**Comparator:** Control

### Summary

A number of recent trials have assessed the effectiveness of brain stimulation interventions for treating hemispatial neglect such as repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS). There is a general trend in all of these studies in favour of non-invasive brain stimulation in reducing USN symptoms. The mode of delivery (high vs low-frequency stimulation, stimulating the affected vs unaffected parietal lobe) and dosage varied considerably across these trials. These trials included:

Kim et al (2015) [256]: A randomised trial (N = 34) with 2 groups compared rTMS applied during one session over the unaffected parietal cortex (n=19) to 10 sessions of low-frequency rTMS (i.e. 5 days a week for 2 weeks) (n = 15). Both groups also received conventional visuospatial rehabilitation including visual scanning training & systematic training of visual organisation skills. The 10 sessions of low-intensity rTMS showed significantly better outcomes in all measures of neglect (letter cancellation, line bisection, Ota's task) compared to the single session group ( $p < 0.01$ ). The trial had small sample size and the timing of follow-up measures differed between the two groups.

A randomised controlled trial (RCT) (N = 30) by Cha et al (2015) [261] compared rTMS plus "comprehensive rehabilitation therapy" (i.e. 20mins of TMS & 30mins of "neurodevelopmental facilitation techniques" to sham TMS plus "comprehensive rehabilitation therapy". Both groups received therapy 5 days a week for 4 weeks. The results indicated a significant decrease in USN symptoms in the experimental group compared to control.

Bang et al (2015) [258] conducted an RCT (N = 12) where the intervention group received tDCS stimulating the affected posterior parietal cortex (PPC) plus feedback training and the control group received feedback training alone. Both groups showed significant improvements in MVPT, line bisection test, and the Barthel Index. The tDCS + FT group showed more significant improvements than the control group on these same measures (i.e. reduction in neglect). The feedback therapy both groups received was not well defined (i.e. it was stated that participants were required to look in a mirror, however it is unclear if they completed structured exercise/activities)

A prospective, double-blind, sham-controlled trial by Kim et al (2013) [257] compared low-frequency rTMS over the non-lesioned PPC (n=9), high frequency rTMS over the lesioned PPC (n=9), and sham stimulation (n=9). Stimulation was delivered 5 days a week for 2 weeks (20min/session). High-frequency rTMS significantly increased the accuracy of line bisection (i.e. more than low frequency rTMS or sham). The trial had a short follow-up period (2 weeks) and lacked the ability to establish improvements in ADLs.

Sunwoo et al (2013) [258] conducted a small double-blind trial (N = 10) with a random crossover design. All participants received dual-mode anodal tDCS (over right and left-hemisphere PPC), single mode tDCS over the right-hemisphere posterior parietal cortex, and sham stimulation. Each session was 20 minutes in duration. Limited information was provided about the study design (i.e. time lapse between interventions, number of sessions). Significant improvements were noted after both dual & single mode tDCS compared to the sham (i.e. on line bisection test). The trial had a small sample size and showed heterogeneity in the included participants.

Fu et al (2015) [261] conducted an RCT (N = 20) comparing continuous theta-burst stimulation (cTBS) over the unaffected hemisphere to sham cTBS. The intervention period was 2 weeks and follow-up measures were completed at 4 weeks. All participants received scanning training 30min 2 x day for 2 weeks, and either the cTBS or sham stimulation for 14 consecutive days. cTBS resulted in a reduction in USN (i.e. a significant improvement in both the star cancellation test and line bisection scores between baseline and 4 weeks follow-up when compared to the control group). The trial had a small sample size and used strict exclusion criteria that meant that only less impaired participants were included.

Cazzoli et al (2012) [261] conducted a trial using a double-blind, sham-controlled crossover design, comparing continuous theta-burst stimulation (TBS) followed by sham (n=8), sham followed by continuous TBS (n=8), and a control group (n=8) receiving no stimulation. The TBS groups received 8 continuous TBS trains (i.e. cTBS delivered to the unaffected PPC for 2 consecutive days). All participants also received 1 hour of neuropsychological training (visuospatial exploration training, and attention and concentration training), 1 hour of occupational therapy and 1 hour of physiotherapy per day. A significant reduction in neglect severity (Catherine Bergego scale) was found in both experimental groups after delivery of TBS (nil significant change across control or sham conditions). The included participants showed substantial heterogeneity in age and stroke onset.

Outcome Timeframe	Study results and measurements	Absolute effect estimates		Certainty in effect estimates (Quality of evidence)	Plain text summary
		Control	repetitive transcranial magnetic stimulation (rTMS)		
<b>Spatial awareness (Line bisection test)<sup>1</sup></b> Group 1: same day; Group 2: 2 weeks  7 Critical	Measured by: Line bisection test Lower better Based on data from: 34 patients in 1 studies. <sup>2</sup> (Randomized controlled) Follow up 1 day or 2 weeks of treatment	<b>39.26</b> mm from midline (Mean)	<b>14.45</b> mm from midline (Mean)	<b>Moderate</b> The difference between groups was significant (controlling for baseline). Discrepancy in timing of follow-up measures across groups may have impacted conclusions around maintenance effects. <sup>3</sup>	rTMS may improve spatial awareness as tested by the line bisection test
<b>Spatial awareness (Letter cancellation test)<sup>4</sup></b> Group 1: same day; Group 2: 2 weeks  7 Critical	Measured by: Letter cancellation Scale: 0-20 High better Based on data from: 34 patients in 1 studies. (Randomized controlled) Follow up 1 day or 2 weeks of treatment	<b>16.63</b> points (Mean)	<b>17</b> points (Mean)	<b>Moderate</b> The difference between groups was significant (controlling for baseline). Issues with discrepancy in timing of outcome measures across groups may impact findings/ direct comparisons of groups &	rTMS may improve spatial awareness as tested by the letter cancellation test.

<p><b>Unilateral neglect (Line bisection test)</b> 4 weeks post-intervention</p> <p>8 Critical</p> <p>Measured by: Line bisection test High better Based on data from: 30 patients in 1 studies. (Randomized controlled)</p>	<p><b>34.6</b> (Mean)</p> <p><b>19.33</b> (Mean)</p> <p>Difference: <b>MD 10.5 lower</b> CI 95%</p>	<p>associated maintenance effects.<sup>5</sup></p> <p><b>Low</b> Due to very serious imprecision<sup>6</sup></p> <p>rTMS may improve unilateral neglect as tested by the line bisection test.</p>
<p><b>Unilateral neglect (Albert test)</b> 4 weeks post-intervention</p> <p>8 Critical</p> <p>Measured by: Albert test High better Based on data from: 30 patients in 1 studies. (Randomized controlled)</p>	<p><b>27.33</b> (Mean)</p> <p><b>35.55</b> (Mean)</p> <p>Difference: <b>MD 7.1 higher</b> CI 95%</p>	<p><b>Low</b> Due to very serious imprecision<sup>7</sup></p> <p>rTMS may improve unilateral neglect as tested by the albert test.</p>
<p><b>Spatial awareness (Ota's task)</b> Group 1: same day; Group 2: 2 weeks</p> <p>7 Critical</p> <p>Based on data from 34 patients in 1 studies.</p>	<p>Group 2 (2 weeks of rTMS) showed significantly greater correct responses to O on the left side and responses to reverse C on the left side compared to Group 1 (1 day of rTMS). Between group differences were not significant for responses to O on the left, responses to C on the left, correct responses to C on the left, and correct responses to reverse C on the left.</p>	<p><b>Moderate</b> Discrepancy in timing of assessments across groups makes conclusions around sustainability of effects challenging.<sup>8</sup></p> <p>rTMS may improve spatial awareness as tested by ota's task</p>

1. discrepancy in timing of follow-up assessments across groups
2. Primary study [260]. **Baseline/comparator::** Control arm of reference used for intervention .
3. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . Only data from one study ; **Publication bias: No serious** .
4. discrepancy in timing of follow-up assessments across groups
5. **Risk of bias: No serious** . Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias ; **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: No serious** . Only data from one study ; **Publication bias: No serious** .
6. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients, Only data from one study, no power calculations ; **Publication bias: No serious** .
7. **Inconsistency: No serious** . **Indirectness: No serious** . **Imprecision: Very Serious** . Low number of patients, Only data from one study, no power calculations ; **Publication bias: No serious** .
8. **Risk of bias: No serious** . Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias ; **Inconsistency: No serious** . **Indirectness:**

**No serious . Imprecision: No serious . Only data from one study ; Publication bias: No serious .**

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## 14 - Glossary and abbreviations

### Glossary

**Activities of daily living:** The basic elements of personal care such as eating, washing and showering, grooming, walking, standing up from a chair and using the toilet.

**Activity:** The execution of a task or action by an individual. Activity limitations are difficulties an individual may have in executing activities.

**Agnosia:** The inability to recognise sounds, smells, objects or body parts (other people's or one's own) despite having no primary sensory deficits.

**Aphasia:** Impairment of language, affecting the production or comprehension of speech and the ability to read and write.

**Apraxia:** Impaired planning and sequencing of movement that is not due to weakness, incoordination or sensory loss.

**Apraxia of speech:** Inability to produce clear speech due to impaired planning and sequencing of movement in the muscles used for speech.

**Atrial fibrillation:** Rapid, irregular beating of the heart.

**Augmentative and alternative communication:** Non-verbal communication, e.g. through gestures or by using computerised devices.

**Central register:** collection of large dataset related to patients' diagnoses, treatments and outcomes

**Cochrane review:** a comprehensive systematic review and meta-analysis published online in Cochrane library, internationally recognized as the highest standard in evidence-based health care resources

**Deep vein thrombosis:** Thrombosis (a clot of blood) in the deep veins of the leg, arm, or abdomen.

**Disability:** A defect in performing a normal activity or action (e.g. inability to dress or walk).

**Drip and ship:** A model of thrombolysis service provision that involves assessment of patients at a non-specialist centres with telemedicine support by stroke specialists, commencing thrombolysis (if deemed appropriate) and subsequent transfer to the stroke specialist centre.

**Dyad:** involvement of both patients and their caregivers

**Dysarthria:** Impaired ability to produce clear speech due to the impaired function of the speech muscles.

**Dysphagia:** Difficulty swallowing.

**Dysphasia:** Reduced ability to communicate using language (spoken, written or gesture).

**Emotionalism:** An increase in emotional behaviour—usually crying, but sometimes laughing that is outside normal control and may be unpredictable as a result of the stroke.

**Endovascular thrombectomy** (also called mechanical thrombectomy or endovascular clot retrieval): a minimally invasive procedure performed via angiogram, in which a catheter passes up into the brain to remove the clot in the blocked blood vessel.

**Enteral tube feeding:** Delivery of nutrients directly into the intestine via a tube.

**Executive function:** Cognitive functions usually associated with the frontal lobes including planning, reasoning, time perception, complex goal-directed behaviour, decision making and working memory.

**Family support / liaison worker:** A person who assists stroke survivors and their families to achieve improved quality of life by providing psychosocial support, information and referrals to other stroke service providers.

**Impairment:** A problem in the structure of the body (e.g. loss of a limb) or the way the body or a body part functions (e.g. hemiplegia).

**Infarction:** Death of cells in an organ (e.g. the brain or heart) due to lack of blood supply.

**Inpatient stroke care coordinator:** A person who works with people with stroke and with their carers to construct care plans and discharge plans and to help coordinate the use of healthcare services during recovery in hospital.

**Interdisciplinary team:** group of health care professionals (including doctors, nurses, therapists, social workers, psychologists and other health personnel) working collaboratively for the common good of the patient.

**Ischaemia:** An inadequate flow of blood to part of the body due to blockage or constriction of the arteries that supply it.

**Neglect:** The failure to attend or respond to or make movements towards one side of the environment.

**Participation:** Involvement in a life situation.

**Participation restrictions:** Problems an individual may experience in involvement in life situations.

**Penumbra-based imaging:** brain imaging that uses advanced MRI or CT angiography imaging to detect parts of the brain where the blood supply has been compromised but the tissue is still viable.

**Percutaneous endoscopic gastrostomy (PEG):** A form of enteral feeding in which nutrition is delivered via a tube that is surgically inserted into the stomach through the skin.

**Pharmaceutical Benefits Scheme (PBS):** A scheme whereby the costs of prescription medicine are subsidised by the Australian Government to make them more affordable.

**Phonological deficits:** Language deficits characterised by impaired recognition and/or selection of speech sounds.

**Pulmonary embolism:** Blockage of the pulmonary artery (which carries blood from the heart to the lungs) with a solid material, usually a blood clot or fat, that has travelled there via the circulatory system.

**Rehabilitation:** Restoration of the disabled person to optimal physical and psychological functional independence.

**Risk factor:** A characteristic of a person (or people) that is positively associated with a particular disease or condition.

**Stroke unit:** A section of a hospital dedicated to comprehensive acute and/or rehabilitation programs for people with a stroke.

**Stroke:** Sudden and unexpected damage to brain cells that causes symptoms that last for more than 24 hours in the parts of the body controlled by those cells. Stroke happens when the blood supply to part of the brain is suddenly disrupted, either by blockage of an artery or by bleeding within the brain.

**Task-specific training:** Training that involves repetition of a functional task or part of the task.

**Transient ischaemic attack:** Stroke-like symptoms that last less than 24 hours. While TIA is not actually a stroke, it has the same cause. A TIA

may be the precursor to a stroke, and people who have had a TIA require urgent assessment and intervention to prevent stroke.

## Abbreviations

ACE	Angiotensin-converting enzyme
ADL	Activities of daily living
AF	Atrial fibrillation
AFO	Ankle foot orthosis
BAO	Basilar artery occlusion
BI	Barthel Index
BMI	Body mass index
BP	Blood pressure
CEA	Carotid endarterectomy
CEMRA	Contrast-enhanced magnetic resonance angiography
CI	Confidence interval
CIMT	Constraint induced movement therapy
CT	Computed tomography
CTA	Computed tomography angiography
CVD	Cardiovascular disease
DALY	Disability-adjusted life years
DBP	Diastolic blood pressure
DOAC	Direct oral anticoagulant
DSA	Digital subtraction angiography
DUS	Doppler ultrasonography
DVT	Deep vein thrombosis
DWI	Diffusion-weighted imaging

ECG	Electrocardiography
ED	Emergency department
EMG	Electromyographic feedback
EMS	Emergency medical services
ESD	Early supported discharge
ESS	European Stroke Scale
FAST	Face, Arm, Speech, Time
FEES	Fibre-optic endoscopic examination of swallowing
FeSS	Fever, Sugar, Swallowing
FFP	Fresh frozen plasma
FIM	Functional independence measure
GP	General practitioner
HR	Hazard ratio
HRQOL	Health related quality of life
HRT	Hormone replacement therapy
IA	Intra-arterial
ICH	Intracerebral haemorrhage
ICU	Intensive care unit
INR	International normalised ratio
IPC	Intermittent pneumatic compression
IV	Intravenous
LMWH	Low molecular weight heparin
LOS	Length of stay
MCA	Middle cerebral artery

MD	Mean difference
MI	Myocardial infarction
MNA	Mini Nutritional Assessment
MR	Magnetic resonance
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
mRS	Modified rankin scale
MST	Malnutrition screening tool
MUST	Malnutrition universal screening tool
N	Number of participants in a trial
NASCET	North American Symptomatic Carotid Endarterectomy Trial
NG	Nasogastric
NHMRC	National Health and Medical Research Council
NIHSS	National Institutes of Health Stroke Scale
NMES	Neuromuscular electrical stimulation
NNH	Numbers needed to harm
NNT	Numbers needed to treat
OR	Odds ratio
OT	Occupational therapist
PBS	Pharmaceutical Benefits Scheme
PE	Pulmonary embolism
PEG	Percutaneous endoscopic gastrostomy
PFO	Patent foramen ovale
PPV	Positive predictive value

QALYs	Quality-adjusted life years
QOL	Quality of life
RCT	Randomised controlled trial
rFVIIa	recombinant activated factor VII
RHS	Right hemisphere syndrome
ROC	Receiver operator curve
ROM	Range of motion
ROSIER	Recognition of stroke in the emergency room
RR	Relative risk
RRR	Relative risk reduction
rTMS	repetitive transcranial magnetic stimulation
rt-PA	Recombinant tissue plasminogen activator
SBP	Systolic blood pressure
SC	Subcutaneous
SD	Standard deviation
SE	Standard error
SES	Standardised effect size
SGA	Subjective global assessment
sICH	symptomatic intracerebral haemorrhage
SMD	Standardised mean difference
SSS	Scandinavian stroke scale
TEE	Transoesophageal echocardiography
TIA	Transient ischaemic attack
TOE	Transoesophageal echocardiography

TOR-BSST	Toronto Bedside Swallowing Screening test
tPA	Tissue plasminogen activator
TTE	Transthoracic echocardiography
UFH	Unfractionated heparin
UK	United Kingdom
UL	Upper limb
VF or VFS	Videofluoroscopy
VR	Virtual reality
VTE	Venous thromboembolism
WMD	Weighted mean difference

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