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

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**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 Guideline is 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 - Citation: Stroke Foundation. Clinical Guidelines for Stroke Management. Melbourne Australia. © No part of this publication can be reproduced by any process without permission from the Stroke Foundation. November 2020.
### Sections

- **Summary of recommendations** .................................................................................................................. 5
- **Introduction** .................................................................................................................................................. 17
- **Methodology** .................................................................................................................................................. 20
- **Clinical questions** ....................................................................................................................................... 23
- **Rehabilitation - overview** ............................................................................................................................. 25
- **Commencement of rehabilitation** .................................................................................................................. 26
- **Amount of rehabilitation** ................................................................................................................................ 35
- **Early supported discharge services** .............................................................................................................. 44
- **Home-based rehabilitation** ........................................................................................................................... 48
- **Goal setting** ................................................................................................................................................... 52
- **Sensorimotor impairments** ............................................................................................................................ 57
  - **Weakness** .................................................................................................................................................... 57
  - **Loss of sensation** ....................................................................................................................................... 64
  - **Loss of cardiorespiratory fitness** .................................................................................................................. 69
  - **Visual field loss** ......................................................................................................................................... 74
- **Activity limitations** ........................................................................................................................................ 76
  - **Sitting** ....................................................................................................................................................... 76
  - **Standing up from sitting** ............................................................................................................................ 78
  - **Standing balance** ...................................................................................................................................... 82
  - **Walking** .................................................................................................................................................... 99
  - **Arm activity** ............................................................................................................................................... 110
- **Participation restrictions** .................................................................................................................................. 134
  - **Activities of daily living** ............................................................................................................................. 134
- **Communication difficulties** .......................................................................................................................... 155
  - **Assessment of communication deficits** ...................................................................................................... 155
  - **Aphasia** ...................................................................................................................................................... 155
  - **Apraxia of speech** ....................................................................................................................................... 166
  - **Dysarthria** ................................................................................................................................................... 169
  - **Cognitive communication deficits** .............................................................................................................. 173
- **Cognition and perception difficulties** ............................................................................................................. 175
  - **Assessment of cognition** ............................................................................................................................. 175
  - **Perception** .................................................................................................................................................. 175
  - **Attention and concentration** ..................................................................................................................... 176
  - **Memory** ..................................................................................................................................................... 182
  - **Executive function** .................................................................................................................................... 183
  - **Limb apraxia** .............................................................................................................................................. 187
Summary of recommendations

Introduction

Methodology

Clinical questions

Rehabilitation - overview

Commencement of rehabilitation

For stroke patients, starting intensive out-of-bed activities within 24 hours of stroke onset is not recommended. (Rethnam et al. 2020 [14], Langhorne et al. 2018 [15], Bernhardt et al. 2015 [9])

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 [9]; Lynch et al. 2014 [10])

Strong 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 [9])

Weak recommendation

Amount of rehabilitation

For stroke survivors, rehabilitation should be structured to provide as much scheduled therapy (occupational therapy and physiotherapy) as possible. (Lohse et al. 2014 [24]; Schneider et al. 2016 [30]; Veerbeek et al. 2014 [88])

Strong recommendation

For stroke survivors, group circuit class therapy should be used to increase scheduled therapy time. (English et al. 2015 [21])

Weak recommendation

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.

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 [24]; Schneider et al. 2016 [30])

Early supported discharge services

Where appropriate home-based coordinated stroke services are available (see Practical information section), early supported discharge services should be offered to stroke patients with mild to moderate disability. (Langhorne et al. 2017 [37])

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 [49]; Hillier et al. 2010 [51])

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 [63]; Taylor et al. 2012 [64])
- 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 [63]; Taylor et al. 2012 [64])

Sensorimotor impairments

Weakness

Strong recommendation

For stroke survivors with reduced strength in their arms or legs, progressive resistance training should be provided to improve strength. (Dorsch et al. 2018 [75])

Weak recommendation

- For stroke survivors with arm weakness, repetitive practice using assistive technology, constraint induced movement therapy (CIMT), and robotics may be used to improve arm strength. (de Sousa et al 2018 [74])
- For stroke survivors with leg weakness, task specific training, repetitive practice using cycling, or electrical stimulation may be used to improve leg strength. (de Sousa et al 2018 [74])

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. (de Sousa et al. 2018 [74]; Nascimento et al. 2014 [70])

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 [76]; Carey et al. 2011 [78]; Doyle et al. 2010 [79])

Loss of cardiorespiratory fitness

Strong recommendation

For stroke survivors, rehabilitation should include individually-tailored exercise interventions to improve cardiorespiratory fitness. (Saunders et al. 2020 [87])
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.

Visual field loss

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).

Activity limitations

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 [117])

Standing up from sitting

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 [126]; French et al. 2016 [193])

Standing balance

Strong recommendation

DRAFT RECOMMENDATION FOR CONSULTATION - MARCH 2021
For stroke survivors who have difficulty with standing balance, standing activities that are functional and challenge balance should be provided (French et al. 2016 [193], van Duijnhoven et al. 2016 [145], Hugues et al. 2019 [148]).

Remark: We provided additional updated information in the Evidence to decision, Rationale and Practical info. The recommendations have been updated also and simplified where possible.
Strong recommendation

For stroke survivors who have difficulty standing, task-specific practice of standing balance should be provided (French et al. 2016 [193]). Strategies could include:

- practising functional tasks while standing (van Duijnhoven et al. 2016 [145]);
- walking training that includes challenge to standing balance (e.g. overground walking, obstacle courses) (van Duijnhoven et al. 2016 [145]);
- providing visual or auditory feedback (Veerbeek et al. 2014 [117]; Stanton et al. 2011 [136]).

Remark: Existing recommendation to be updated by draft updated recommendations.

Weak recommendation

Updated

DRAFT RECOMMENDATION FOR PUBLIC CONSULTATION MARCH 2021

For stroke survivors who have difficulty with standing balance, one or more of the following interventions may be used in addition to practising functional tasks:

- Virtual reality training, which may include treadmill training, motion capture or force sensing devices (e.g. Wii Balance Boards) (Corbetta et al. 2015 [134]; Laver et al. 2017 [191]; Mohammadi et al. 2019 [149])
- Visual or auditory feedback e.g. force platform biofeedback (Veerbeek et al. 2014 [117]; Stanton et al. 2017 [147])
- Electromechanically assisted gait or standing training (Zheng et al. 2019 [150])

Remark: We provided additional updated information in the Practical info, rationale, evidence summaries and the recommendation has been updated.

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 [134])

Remark: Existing recommendation to be updated by draft updated recommendation above.

Walking

Strong recommendation

In review

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 [193])

The following modalities may be used:

- Circuit class therapy (with a focus on overground walking practice) (Veerbeek et al. 2014 [117]);
- Treadmill training with or without body weight support (Mehrholz et al. 2014 [160]).
In review

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 [167])
- Electromechanically assisted gait training. (Mehrholz et al. 2013 [164])
- Biofeedback. (Stanton et al. 2017 [147])
- Cueing of cadence. (Nascimento et al. 2015 [165])
- Electrical stimulation. (Howlett et al. 2015 [166])

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 [170])

Arm 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 [197])

Remark: Information previously included on trunk restraint during therapy has been moved to the practical info tab.

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. 2018 [184])

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 [189])

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)

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 [166]; Yang et al. 2019 [227])

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. (Barcley-Goddard et al. 2020 [186]; Borges et al. 2018 [204])
Weak recommendation

For stroke survivors with mild to moderate weakness, mirror therapy may be used as an adjunct to routine therapy to improve arm function after stroke. (Thieme et al. 2018 [188])

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 [193])

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. 2020 [176]; van Lieshout et al (2019)[209]; Hao et al. 2013 [180])

Participation restrictions

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. 2017 [230])
- Community-dwelling stroke survivors with confirmed difficulties in personal or extended activities of daily living 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. 2017 [230])

Weak recommendation against

For older stroke survivors living in a nursing home, routine occupational therapy is not recommended to improve activities of daily living function. (Sackley et al. 2015 [229])

Weak recommendation against

Acupuncture is not routinely recommended to improve activities of daily living. (Yang et al. 2016 [255])

Remark: Draft update which has moved from a STRONG (against) to WEAK (against) recommendation.

Strong recommendation against

For stroke survivors in the acute, sub-acute or chronic phase post-stroke, acupuncture should not be used to improve activities of daily living. (Kong et al. 2010 [239])

Remark: This existing recommendation has a draft update as above.

Strong recommendation against

Administration of amphetamines to improve activities of daily living is not recommended. (Martinsson et al. 2007 [242])
Weak recommendation against

**DRAFT FOR PUBLIC CONSULTATION MARCH 2021**

Selective serotonin reuptake inhibitors should not be used to reduce disability. (Legg et al. 2019 [249]; AFFINITY collaborators 2020 [252]; EFFECTS collaborators 2020 [251]).

Remark: Draft recommendation changed from Weak FOR to Weak AGAINST based on new evidence. We have also updated Evidence to decision, Rationale and have clarified outcomes (reduced disability rather than just ADL).

Weak recommendation

**For stroke survivors, selective serotonin reuptake inhibitors may be used to improve performance of activities of daily living.** (Mead et al. 2012 [249])

Remark: NOTE: This recommendation is currently being updated.

Weak recommendation against

Brain stimulation (transcranial direct stimulation or repetitive transcranial magnetic stimulation) should not be used in routine practice to improve activities of daily living and only used as part of a research framework. (Elsner et al. 2020 [176]; Hao et al. 2013 [180])

Weak recommendation

**For stroke survivors, virtual reality technology may be used to improve activities of daily living in addition to usual therapy.** (Laver et al. 2017 [244])

**Communication difficulties**

**Assessment of communication deficits**

**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.

**Aphasia**

**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 [258])
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 [258])

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 [259]; Elsner et al. 2015 [260])

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](https://www.aphasia.org.au) 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.

**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 [272])

In addition, therapy may incorporate (Ballard et al. 2015 [272]):

• 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.

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 [261])

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 [276])

Cognitive communication deficits

Practice statement

Consensus-based recommendations

Stroke survivors with difficulties in communication following right hemisphere damage 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 [278]; Ferre et al. 2011 [279])

Management may include:

• Motoric-imitative, cognitive-linguistic treatments to improve use of emotional tone in speech production. (Rosenbek et al. 2006 [280])
• Semantic-based treatment connecting literal and metaphorical senses to improve comprehension of conversational and metaphorical concept. (Lungren et al. 2011 [281])

Cognition and perception difficulties

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.

**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.

**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**

Updated evidence, no change in recommendation

For stroke survivors with attention and concentration deficits, cognitive rehabilitation may be used. (Loetscher et al. 2019 [287]; Rogers et al. 2018 [288]; Virk et al. 2016 [283])

**Weak recommendation**

Updated evidence, no change in recommendation

For stroke survivors with attention and concentration deficits, exercise training and leisure activities may be provided. (Liu-Ambrose et al. 2015 [284])

**Memory**
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 taught to use notebooks, diaries, audio, and audio alarms;
- 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.

Executive function

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 [318]; Skidmore et al. 2015 [322])

Limb apraxia

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 [331])

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 [344])

Weak recommendation

For stroke survivors with symptoms of unilateral neglect, mirror therapy may be used to improve arm function and ADL performance. (Thieme et al. 2018 [188])

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. (Salazar et al 2018 [354]; Kwon et al 2018 [352]; Fan et al 2018 [351])

Telehealth in rehabilitation

Glossary and abbreviations
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 and in 2017 released the fourth edition. 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 five years. As a result, the Stroke Foundation, in partnership with Cochrane Australia, is testing a model of living guidelines, in which recommendations are continually reviewed and updated in response to new evidence. This project commenced in July 2018 and is currently being funded by the Australian Government via the Medical Research Future Fund.

This online version of the Clinical Guidelines for Stroke Management updates and supersedes the Clinical Guidelines for Stroke Management 2017. 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 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 management, 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 practice, 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 (refer to Australian Childhood Stroke Advisory Committee, Guideline for the diagnosis and acute management of childhood stroke – 2017, and Victorian Subacute Childhood Stroke Advisory Committee, Guideline for the subacute management of childhood stroke – 2019, https://informme.org.au/Guidelines/Childhood-stroke-guidelines); or

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.

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.

**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 2019 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 (based on the 2017 version) 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**

**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 subsequent amendments approved on 22 November 2017, 9 July 2018 (updated recommendations for Neurointervention), 7 November 2019 (updated recommendations for Thrombolysis, Acute antiplatelet therapy, and Patent foramen ovale management), and 11 February 2021 (updated recommendations for oxygen therapy, cholesterol lowering targets, new acute antiplatelet agent, shoulder pain and weakness) 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 five 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.

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.

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The Stroke Foundation gratefully acknowledges the financial assistance provided by the Australian Government, Medical Research Future Fund. The development of the final recommendations has not been influenced by the views or interests of the funding body.

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Methodology

Development of questions
Questions have been extensively developed and reviewed over the four iterations of the guidelines. In this ‘living’ phase the Content Steering Group reviews the PICO questions on an annual basis. The clinical questions are listed at the start of each chapter. Individual PICO (population, intervention/s, comparator, outcomes) are listed in the research evidence section as related to each topic or recommendation.

Literature identification
On a monthly basis, we monitor the literature for relevant, new evidence by screening all randomised controlled trials or systematic reviews related to stroke published in the Pubmed database. One member of the project team initially screens all abstracts and excludes clearly irrelevant studies. Potentially included studies are allocated to relevant topics covered by the guidelines and a second member of the project team reviews and confirms included studies prior to sending to the relevant working group members. In addition, each month new economic studies and studies related to patient values and preferences are also captured.

Clinical expert review
Where new evidence has been identified by the project team a summary is sent to content experts who review and make a final decision to include or exclude the study and also to assess the potential impact of the new evidence on current recommendations. As a result of this assessment one of two options will be communicated for each topic:

a. New evidence is unlikely to change current recommendations: review and potentially integrate information in the next review cycle; or
b. New relevant evidence may change current recommendations: rapidly review.

Data extraction, updating evidence summary and GRADE profile
For rapid updates, the project team incorporates the new evidence into the existing body of evidence by:

• Updating the Summary of Findings table including the risk of bias assessment
• Review any additional studies related to Preferences and values of patients on the topic

Concurrently members of the economic working group review newly published economic studies.

The project team then drafts changes to the overall summary (GRADE profile). This profile is then reviewed and modified by clinical content experts and people with relevant lived experience (consumers). Finally changes to the changes to the recommendation, rationale and practical considerations are considered, discussed and agreed.

Draft changes are then circulated to the wider expert working groups (including consumer panel) for internal review. Once signed off by the Steering Group a period of public consultation is undertaken. Feedback is then reviewed and any changes made in response to feedback before finally submitting to the National Health and Medical Research Council (NHMRC) for approval.

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

GRADE ‘evidence to decision’ framework includes a minimum of 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.

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Strong Recommendation</td>
</tr>
<tr>
<td><strong>For patients</strong></td>
</tr>
<tr>
<td><strong>For clinicians</strong></td>
</tr>
<tr>
<td><strong>For policy makers</strong></td>
</tr>
</tbody>
</table>

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.
Clinical questions

5.1 When is the best time to start out of bed activities?

5.2 When is the best time to start communication training?

5.3 What is the best amount of therapy to improve movement ability in the acute period (0 to 7 days)?

5.4 What is the best amount of therapy to improve movement ability in the early and late subacute periods (7 days to 3 months) and chronic period (> 6 months)?

5.5 What is the best amount of therapy to improve communication in the acute period (0 to 7 days)?

5.6 What is the best amount of therapy to improve communication in the early subacute periods (7 days to 3 months)?

5.7 Does access to early supported discharge services improve outcomes for people with stroke?

5.8 Is home based rehabilitation more effective than hospital based care in reducing mortality and increasing independence amongst stroke patients?

5.9 Does patient-centred goal setting improve patient outcomes?

5.10 What interventions for strength improve outcomes for stroke survivors?

5.11 What interventions increase sensation in stroke survivors?

5.12 What interventions to improve cardiovascular fitness improve outcomes for people with stroke?

5.13 What interventions (compensatory or restorative) improve visual field loss?

5.14 What task-specific training improves outcomes for stroke survivors who have difficulties sitting?

5.15 What task-specific training improves outcomes for stroke survivors who have difficulties standing up?

5.16 What task-specific training improves outcomes for stroke survivors who have difficulties standing?

5.17 What interventions improve walking ability in stroke survivors?

5.18 What interventions improve upper limb activity in stroke patients who have difficulty using their upper limbs?

5.19 What interventions improve ADL in patients with stroke?

5.20 Assessment of communication deficits

5.21 What interventions improve outcomes for patients with aphasia?

5.22 What interventions improve outcomes for people with apraxia of speech?

5.23 What interventions improve outcomes for people with dysarthria?

5.24 What interventions improve outcomes in stroke patients with cognitive communication difficulties?

5.25 Assessment of cognition

5.26 What interventions improve perceptual impairment in stroke survivors?
5.27 What interventions improve outcomes in stroke patients with attention and concentration deficits?

5.28 What interventions improve outcomes in stroke patients with memory difficulties?

5.29 What interventions to initiate everyday activities in stroke patients improve impaired executive functioning?

5.30 What interventions improve outcomes for stroke patients with limb apraxia?

5.31 What interventions improve the outcome of stroke patients with unilateral spatial neglect?

5.32 Does the use of telehealth improve outcomes for patients with subacute stroke?
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.
Commencement of rehabilitation

Mortality and morbidity are reduced when people with stroke receive care in stroke units (Stroke Unit Trialists 2020 [13]). 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 [9]). While the best timing to commence active rehabilitation including mobilisation is evolving observational studies have found very little therapy is provided during acute inpatient care. Serra et al (2016) [19] found 36.7 minutes of combined physiotherapy and occupational therapy was provided per day of which about 8 minutes focused on upper limb rehabilitation.

Practical Info

Intensive out-of-bed activities (not recommended) typically consist of about 6 out-of-bed activities per day (Bernhardt et al. 2015[9]). Baseline stroke severity and stroke type should be considered when deciding when and how much to mobilise after stroke. Patients who are independently mobile should not have their mobility restricted during the early phase after stroke.

Evidence To Decision

Benefits and harms

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 [9]). Individual patient data meta-analysis from five trials found VEM led to less favourable outcome at 3 months (mRS 0-2) (OR 0.75, 95%CI 0.62-0.92). While not significant there was a trend to increase mortality which was more event for patients with severe stroke and haemorrhagic stroke. There was no difference in ADL (Rethnam et al 2020 [14]).

Certainty of the Evidence

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

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

Resources considerations

There is currently little economic evidence on the potential cost-effectiveness of very early rehabilitation interventions within 24 hours of stroke onset (Gao et al 2019[17]). In a multi-country randomised control trial (n=2104; with 1054 patients from Australia) the cost-effectiveness of a very early mobilisation rehabilitation intervention in addition to usual care was compared to usual care alone. Health care utilisation and other costs (for example home modification, change in accommodation, informal care, changes to employment) were collected on cost case report forms. Country specific unit prices were then applied to
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 [9]).

Clinical Question/ PICO
Population: Adults with stroke
Intervention: Very early mobilisation (<24 hrs)
Comparator: Usual care

Summary
Langhorne et al (2018)[15] conducted a Cochrane review involving nine trials (N=2958 participants) of very early mobilisation (VEM). Data from the AVERT study contributed 2/3 of the data (Bernhardt et al 2015 [9]). The median delay to starting mobilisation after stroke onset was 18.5 (13.1 to 43) hours in the VEM group and 33.3 (22.5 to 71.5) hours in the usual care group. In five trials, the VEM group were also reported to have received more mobilisation activity. VEM has similar overall rates of poor outcome (51% versus 49%; OR 1.08, 95% CI 0.92 to 1.26). Death appears slightly more in VEM (8.5% vs 7%) although this was not statistically significant (OR 1.27, 95%CI 0.95 to 1.70). There was no difference in complications but ADL scores were higher (low quality evidence). VEM may lead to reduction in acute hospital LOS (low quality evidence). Effects are robust based on sensitivity analysis by study quality.

Cummings et al (2019)[16] reported the prespecified secondary analysis of AVERT for quality of life. No significant different change was found in quality of life between early and more frequent mobilisation vs usual care (p=0.86). There was no difference across any of the four QoL-4D domains.

Rethnam et al (2020)[14] conducted an individual participant data (IPD) meta-analysis including six trials (five of the 9 from the Cochrane review and one that was recently published). Out of bed mobilisation commenced at a median 20 hours post stroke compared to 23 hours in the usual care. Favourable outcome at 3 months (mRS 0-2) occurred less often in the VEM group (OR 0.75, 95%CI 0.62-0.92). There was no difference in mortality at 3 months (OR 1.46, 95%CI 0.92-2.31). No difference in ADL (Barthel Index) was found at 3 months (MD 0.16; aOR 1.21, 95%CI 0.71–2.06). Similar to the findings from AVERT VEM may be harmful for patients with severe stroke and haemorrhagic stroke, although this was also not significant in this IPD. Given that VEM and usual care only had a median 3 hours difference in commencing it is possible that increased amount of early mobilisation led to possible harm. In a prespecified analysis of AVERT (Bernhard et al 2016)[12] increased daily out-of-bed sessions (keeping time to first mobilization and mobilization amount constant) improved outcome (OR 1.13, 95%CI 1.09 to 1.18). However, increased amount (minutes per day) of mobilization reduced the odds of a good outcome (OR 0.94, 95% CI 0.91 to 0.97). Session frequency was the most important variable in the CART analysis, after prognostic variables age and baseline stroke severity.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death or dependency</td>
<td>3 months</td>
<td>Odds Ratio 1.08 (CI 95% 0.92 - 1.26) Based on data from 2,542 patients in 8 studies. (Randomized controlled) Follow up: 3 months.</td>
<td>486 per 1000</td>
<td>Moderate</td>
<td>Very early mobilisation (&lt;24 hrs) may increase the odds of a poor outcome.</td>
</tr>
<tr>
<td></td>
<td>9 Critical</td>
<td></td>
<td>507 per 1000</td>
<td>Due to serious risk of performance bias. Largest and high quality study found increase risk of poor outcome.</td>
<td></td>
</tr>
</tbody>
</table>

1. (Australian) Clinical Guidelines for Stroke Management - Chapter 5 of 8: Rehabilitation - Stroke Foundation

27 of 234
### Outcome Timeframe

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Death</strong> 3 months</td>
<td><strong>Critical</strong></td>
<td><strong>Odds Ratio 1.27 (CI 95% 0.95 - 1.7)</strong>&lt;br&gt;Based on data from 2,542 patients in 8 studies.&lt;br&gt;(Randomized controlled)&lt;br&gt;Follow up: median 3 months.</td>
<td><strong>68</strong> per 1000&lt;br&gt;Difference: <strong>17 more</strong> per 1000 (CI 95% 3 fewer - 44 more)</td>
<td><strong>Moderate</strong>&lt;br&gt;Due to serious risk of performance bias. Sensitivity analysis suggest increase death with VEM. ³</td>
</tr>
<tr>
<td><strong>Any complication</strong> 3 months</td>
<td><strong>Critical</strong></td>
<td><strong>Odds Ratio 0.88 (CI 95% 0.73 - 1.06)</strong>&lt;br&gt;Based on data from 2,778 patients in 6 studies.&lt;br&gt;(Randomized controlled)&lt;br&gt;Follow up: 3 months.</td>
<td><strong>224</strong> per 1000&lt;br&gt;Difference: <strong>24 fewer</strong> per 1000 (CI 95% 50 fewer - 10 more)</td>
<td><strong>Low</strong>&lt;br&gt;Due to serious risk of bias, Due to serious imprecision ⁴</td>
</tr>
<tr>
<td><strong>ADL (Barthel Index)</strong> median 3 months</td>
<td><strong>Critical</strong></td>
<td><strong>High better</strong>&lt;br&gt;Based on data from: 2,630 patients in 8 studies.&lt;br&gt;(Randomized controlled)&lt;br&gt;Follow up: median 3 months.</td>
<td><strong>MD 1.94 higher</strong>&lt;br&gt;(CI 95% 0.75 higher - 3.13 higher)</td>
<td><strong>Low</strong>&lt;br&gt;Due to serious risk of bias, Due to serious inconsistency ⁵</td>
</tr>
<tr>
<td><strong>Length of stay</strong></td>
<td><strong>Critical</strong></td>
<td><strong>Lower better</strong>&lt;br&gt;Based on data from: 2,551 patients in 8 studies.&lt;br&gt;(Randomized controlled)</td>
<td><strong>MD 1.44 lower</strong>&lt;br&gt;(CI 95% 2.28 lower - 0.6 lower)</td>
<td><strong>Low</strong>&lt;br&gt;Due to serious risk of bias, Due to serious inconsistency ⁶</td>
</tr>
</tbody>
</table>

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1. **Systematic review** with included studies: [9]. **Baseline/comparator**: Control arm of reference used for intervention.
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**. **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**: **No serious**. **Publication bias**: **No serious**.
4. **Risk of bias**: **Serious**. Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias. Inconsistency: **No serious**. **Indirectness**: **No serious**. **Imprecision**: **Serious**. Wide confidence intervals. **Publication bias**: **No serious**.
5. **Risk of bias**: **Serious**. Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Incomplete data and/or large loss to follow up. **Inconsistency**: **Serious**. The magnitude of statistical heterogeneity was high, with $I^2$:93%.. **Indirectness**: **No serious**. **Imprecision**: **No serious**. **Publication bias**: **No serious**.
6. **Risk of bias**: **Serious**. Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias. Inconsistency: **Serious**. The magnitude of statistical heterogeneity was high, with $I^2$:... %,. **Indirectness**: **No serious**. **Imprecision**: **No serious**. **Publication bias**: **No serious**.
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 in out-of-bed activities (Bernhardt et al. 2016 [12]). As patients tolerate more out-of-bed activity, it is better to increase the frequency of sessions, rather than the duration of each session. Particular care should be taken to avoid long durations of out of bed activity in people >76 years old and with more severe strokes (NIHSS >7).

There is no rationale for restricting people to bed rest if they are able to move independently.

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.

Evidence To Decision

**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 [9]; Lynch et al. 2014 [10])

Benefits and harms

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 [9]). 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 [10]).

Certainty of the Evidence

The overall evidence is low, based on a systematic review (Lynch et al. 2014 [10]) that included three studies that looked at physical rehabilitation within 3 days of stroke.

Preference and values

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

**Resources considerations**

There is evidence that participation in an early exercise and education program may result in favourable long-term outcomes and be cost saving from a hospital perspective (Faulkner et al. 2017 [18]). In a randomised controlled trial conducted in New Zealand, 60 participants were randomised to either an 8-week exercise and education program or to usual care within two weeks of TIA or minor stroke diagnosis. To assess the long term effects of the intervention at 3.5 years post randomisation hospital records were screened. At 3.5 years follow up, participants in the intervention group had fewer recurrent strokes and TIAs, adverse events, deaths than the control group. Hospital admissions costs per person in the intervention group (US$6000 ± 10,000, reference year for costs not stated, data were collected in 2011) were lower than in the control group (US$14,000 ± 15,000). Only costs attributed to emergency department presentation and in-patient admission, obtained from medical records, were included in the cost analysis. A limitation of the economic evaluation was that other factors that may have influenced long-term outcome were not considered e.g. use of secondary prevention interventions.

Implementation and consideration

There is a clinical indicator collected in the National Stroke Audit on whether patients with stroke were mobilised within 24
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. [10]). In a subsequent large, high-quality trial (n = 2104) that included a 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 [9]).

Clinical Question/ PICO

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

Summary
Lynch et al (2015) [10] 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.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Timeframe</th>
<th>Study results and measurements</th>
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<tr>
<td>Mortality</td>
<td>1</td>
<td>Based on data from: 5,482 patients in 1 studies. (Randomized controlled) Follow up: in-hospital mortality.</td>
<td>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)</td>
<td>Moderate Due to serious risk of bias 2</td>
<td>physical rehabilitation commencing within 3 days of stroke may have little or no difference on mortality</td>
</tr>
<tr>
<td></td>
<td>9 Critical</td>
<td></td>
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<td></td>
<td>9 Critical</td>
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<tr>
<td>Disability</td>
<td>3 months</td>
<td>Based on data from: 6,292 patients in 4 studies. (Randomized controlled) Follow up: varied between in-hospital to 1 year post-stroke.</td>
<td>Findings from 1 RCT and 3 observational studies investigating the effect of commencing physical rehabilitation within 3 days were synthesised in a systematic review</td>
<td>Moderate Due to serious risk of bias 4</td>
<td>physical rehabilitation commenced within 3 days may improve disability</td>
</tr>
<tr>
<td></td>
<td>8 Critical</td>
<td></td>
<td></td>
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<td></td>
<td>8 Critical</td>
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<tr>
<td>Functional</td>
<td></td>
<td>Based on data from: 30 patients in 1 studies.</td>
<td>A small observational study indicated that commencing rehabilitation within 3</td>
<td>Very Low Due to serious risk</td>
<td>Commencing physical rehabilitation early (&lt;3</td>
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</table>
Practical Info

AVERT investigators conducted a analysis of how the timing and dose of therapy (duration and frequency) affected outcome in different sub-groups of stroke patients (Bernhardt et al 2016[12]). The key take home message is that little and often is the best approach. Specifically, they found:

- Younger patients (≤76 years) and those with less severe stroke (NIHSS ≤7.5) were more likely to do well, regardless of the dose of therapy provided.
- Overall increasing session frequency (but not total duration of therapy) reduced the odds of death.
- Patients aged 76-86 years were more likely to do well if they received therapy of no more than 13.5 minutes a day, distributed across several sessions, with a higher frequency of sessions leading to better outcomes.
- Overall there was a 13% improvement in the odds of a favourable outcome for each additional session of out of bed activity provided per day, keeping the total duration of therapy time constant.

### Table: Outcome Timetable

<table>
<thead>
<tr>
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<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Outcome in hospital</td>
<td>(Observational (non-randomized))</td>
<td>Follow up: 3 months.</td>
<td>days of stroke was associated with better walking ability and activities of daily living function.</td>
<td></td>
<td>of bias as non-randomised 6 days) may increase functional outcome slightly</td>
</tr>
<tr>
<td>8 Complications until hospital discharge</td>
<td>Based on data from: 42 patients in 1 studies. Follow up: in hospital.</td>
<td>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%).</td>
<td></td>
<td>Moderate</td>
<td>Due to serious imprecision, Due to serious risk of bias 8</td>
</tr>
</tbody>
</table>

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
3. Studies examined the effect of timing of commencement of physical rehabilitation on Barthel Index at 3 months
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.

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 [9])
Evidence To Decision

Benefits and harms

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 [9]). 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 [9]). 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 [9]). The odds of a favourable outcome are increased when the mobilisation sessions are shorter and more frequent (see practical info section) (Bernhardt et al. 2015 [9]).

Certainty of the Evidence

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 [9]). 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

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

Resources and other considerations

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 [9]). There is still uncertainty about the optimal dose (amount and frequency) of out-of-bed activity for people early after stroke.

Clinical Question/ PICO

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

Summary

Langhorne et al (2018)[15] conducted a Cochrane review involving nine trials (N=2958 participants) of very early mobilisation (VEM). Data from the AVERT study contributed 2/3 of the data (Bernhardt et al 2015 [9]). The median delay to starting mobilisation after stroke onset was 18.5 (13.1 to 43) hours in the VEM group and 33.3 (22.5 to 71.5) hours in the usual care group. In five trials, the VEM group were also reported to have received more mobilisation activity. VEM has similar overall rates of poor outcome (51% versus 49%; OR 1.08, 95% CI 0.92 to 1.26). Death appears slightly more in VEM (8.5% vs 7%) although this was not statistically significant (OR 1.27, 95%CI 0.95 to 1.70). There was no difference in complications but ADL scores were higher (low quality evidence). VEM may lead to reduction in acute hospital LOS (low quality evidence). Effects are robust based on sensitivity analysis by study quality.

Cummings et al (2019)[16] reported the prespecified secondary analysis of AVERT for quality of life. No significant different change was found in quality of life between early and more frequent mobilisation vs usual care (p=0.86). There was no
difference across any of the four QoL-4D domains.

Rethnam et al [2020][14] conducted an individual participant data (IPD) meta-analysis including six trials (five of the 9 from the Cochrane review and one that was recently published). Out of bed mobilisation commenced at a median 20 hours post stroke compared to 23 hours in the usual care. Favourable outcome at 3 months (mRS 0-2) occurred less often in the VEM group (OR 0.75, 95%CI 0.62-0.92). There was no difference in mortality at 3 months (OR 1.46, 95%CI 0.92-2.31). No difference in ADL (Barthel Index) was found at 3 months (MD 0.16; aOR 1.21, 95%CI 0.71–2.06). Similar to the findings from AVERT VEM may be harmful for patients with severe stroke and haemorrhagic stroke, although this was also not significant in this IPD. Given that VEM and usual care only had a median 3 hours difference in commencing it is possible that increased amount of early mobilisation led to possible harm. In a prespecified analysis of AVERT (Bernhard et al 2016)[12] increased daily out-of-bed sessions (keeping time to first mobilization and mobilization amount constant) improved outcome (OR 1.13, 95%CI 1.09 to 1.18). However, increased amount (minutes per day) of mobilization reduced the odds of a good outcome (OR 0.94, 95% CI 0.91 to 0.97). Session frequency was the most important variable in the CART analysis, after prognostic variables age and baseline stroke severity.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death or dependency 3 months</td>
<td>Odds Ratio 1.08 (CI 95% 0.92 - 1.26) Based on data from 2,542 patients in 8 studies. (Randomized controlled) Follow up: 3 months.</td>
<td>486 per 1000</td>
<td>Moderate Due to serious risk of performance bias. Largest and high quality study found increase risk of poor outcome.</td>
<td>Very early mobilisation (&lt;24 hrs) may increase the odds of a poor outcome.</td>
</tr>
<tr>
<td>Death 3 months</td>
<td>Odds Ratio 1.27 (CI 95% 0.95 - 1.7) Based on data from 2,542 patients in 8 studies. (Randomized controlled) Follow up: median 3 months.</td>
<td>68 per 1000</td>
<td>Moderate Due to serious risk of performance bias. Sensitivity analysis suggest increase death with VEM.</td>
<td>Very early mobilisation (&lt;24 hrs) may lead to an increase in death</td>
</tr>
<tr>
<td>Any complication 3 months</td>
<td>Odds Ratio 0.88 (CI 95% 0.73 - 1.06) Based on data from 2,778 patients in 6 studies. (Randomized controlled) Follow up: 3 months.</td>
<td>224 per 1000</td>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>Very early mobilisation (&lt;24 hrs) may have little or no difference on adverse events</td>
</tr>
<tr>
<td>ADL (Barthel Index) median 3 months</td>
<td>High better Based on data from: 2,630 patients in 8 studies. (Randomized controlled) Follow up: median 3 months.</td>
<td>Difference: MD 1.94 higher (CI 95% 0.75 higher - 3.13 higher)</td>
<td>Low Due to serious risk of bias, Due to serious inconsistency</td>
<td>Very early mobilisation (&lt;24 hrs) may improve ADL (barthel index)</td>
</tr>
<tr>
<td>Length of stay</td>
<td>Lower better</td>
<td>Difference: MD 1.44 lower</td>
<td>Low Due to serious risk</td>
<td>Very early mobilisation (&lt;24 hrs) may decrease</td>
</tr>
<tr>
<td>Outcome Timeframe</td>
<td>Study results and measurements</td>
<td>Absolute effect estimates</td>
<td>Certainty of the Evidence (Quality of evidence)</td>
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<tr>
<td>------------------</td>
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<td>------------------</td>
</tr>
<tr>
<td>7 Critical</td>
<td>Based on data from: 2,551 patients in 8 studies, (Randomized controlled)</td>
<td>Usual care Very early mobilisation (&lt;24 hrs)</td>
<td>( CI 95% 2.28 lower - 0.6 lower )</td>
<td>of bias, Due to serious inconsistency 6 length of stay slightly</td>
</tr>
</tbody>
</table>

1. Systematic review with included studies: [9]. **Baseline/comparator:** Control arm of reference used for intervention.
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. **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:** No serious. **Publication bias:** No serious.
4. **Risk of bias:** Serious. Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias. **Inconsistency:** No serious. **Indirectness:** No serious. **Imprecision:** Serious. Wide confidence intervals. **Publication bias:** No serious.
5. **Risk of bias:** Serious. Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, incomplete data and/or large loss to follow up. **Inconsistency:** Serious. The magnitude of statistical heterogeneity was high, with I^2:93%. **Indirectness:** No serious. **Imprecision:** No serious. **Publication bias:** No serious.
6. **Risk of bias:** Serious. Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias. **Inconsistency:** Serious. The magnitude of statistical heterogeneity was high, with I^2:... %. **Indirectness:** No serious. **Imprecision:** No serious. **Publication bias:** No serious.
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 [32]). Yet scheduled therapy time is often the only metric used (Lohse et al. 2014 [24]). 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.

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 [21]). Other methods could include use of therapy assistants and family members.

Evidence To Decision

<table>
<thead>
<tr>
<th>Benefits and harms</th>
<th>Substantial net benefits of the recommended alternative</th>
</tr>
</thead>
</table>

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 [24]); Schneider et al. 2016 [30]; Veerbeek et al. 2014 [88])
- For stroke survivors, group circuit class therapy should be used to increase scheduled therapy time. (English et al. 2015 [21])
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 [24] 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 [24]). Twelve (86%) of the 14 papers in the Schneider review included participants within 6 months of stroke (Schneider et al. 2016 [30]).

With regards to 5 versus 7 days per week therapy, a recent individual patient data meta-analysis (English et al. 2016 [31]) 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.

Certainty of the Evidence

The evidence comes from a high-quality meta-regression study (Lohse et al. 2014 [24]) and systematic review (Schneider et al. 2016 [30]). The evidence for circuit class therapy increasing therapy time comes from a high-quality randomised controlled trial (English et al. 2015 [21]). The evidence applies to both upper and lower limb.

Preference and values

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 [33]).

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.

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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 [24]). Twelve (86%) of the 14 papers in the Schneider review included participants within 6 months of stroke (Schneider et al. 2016 [30]).

With regards to 5 versus 7 days per week therapy, a recent individual patient data meta-analysis (English et al. 2016 [31]) 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) [20] 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) [24] 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 [30]). 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 [27]) 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 [34] ) Only 10 trials (12%) compared the effect of additional scheduled therapy time, without specifying what people practiced in that time (English and Veerbeek 2015 [34]). 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) [25] 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 [196]). The CIRCIT randomised trial (English et al 2015 [21]) 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.
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.

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.

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.

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 [21]) 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 [35]). 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 [31]).

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various function and impairment measures - pooled 1</td>
<td>Based on data from: 2,284 patients in 34 studies. (Randomized controlled) Follow up: End of treatment.</td>
<td>Usual care Increased scheduled therapy time</td>
<td>Moderate Due to serious risk of bias 2</td>
<td>Increased scheduled therapy time probably improves various function and impairment measures</td>
</tr>
<tr>
<td>Variable - end of treatment estimates 7 Critical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

**Inconsistency:** No serious. **Indirectness:** No serious. **Imprecision:** Serious. Only data from one study, Difference between groups was not statistically significant.

**Publication bias:** No serious.

Clinical Question/ PICO

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

Summary

Schneider et al ([30]) 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 statistically heterogeneity decreased (SMD 0.59, 95% CI 0.23 to 0.94, I²=44%). Hayward et al (2014) [25] 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 [29]). However, the increased therapy dose of 28 hours may still be sub-threshold.
<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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</tr>
</thead>
</table>
| **Activities of daily living** 8 Critical | Measured by: Variety of ADL scales  
High better  
Based on data from: 3,064 patients in 36 studies.  
(1) (Randomized controlled)  
Follow up: Post intervention. | Difference: SMD 0.22 higher  
( CI 95% 0.09 higher - 0.34 higher ) | Moderate  
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.  
Additional active practice probably improves activities of daily living | |
| **Walking ability 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: SMD 0.29 higher  
( CI 95% 0.17 higher - 0.41 higher ) | High  
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).  
Additional active practice improves walking speed | |
| **Arm function and walking ability** 4 End of intervention 7 Critical | Based on data from: 954 patients in 14 studies. (Randomized controlled)  
Follow up: End of intervention. | 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). | Moderate  
Many of the included studies had small sample size and the statistical heterogeneity was high (66%)  
Additional active practice probably improves arm function and walking ability | |

1. Systematic review [177]. **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**. Many of the included studies had small sample size and the statistical heterogeneity was high (66%). **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
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.

**Evidence To Decision**

**Rationale**

The recommended 3 hours per day of therapy is based on a mean 57 hours in the paper by Lohse et al. 2014 [24], delivered 5 days a week over 4 weeks. This is consistent with a large, 3-armed multicentre randomised controlled trial (English et al. 2015 [21]), 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 [32]). A more recent systematic review (Schneider et al. 2016 [30]) 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).

**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 [24]; Schneider et al. 2016 [30])

**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.

**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 [24]). 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 [30]) 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 [24], Schneider et al. 2016 [30]).
Schneider et al ([30]) 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 statistically heterogeneity decreased (SMD 0.59, 95% CI 0.23 to 0.94, I²=44%). Hayward et al (2014) [25] 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 [29]). However, the increased therapy dose of 28 hours may still be sub-threshold.

### Outcome Timeframe

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities of daily living</td>
<td>Measured by: Variety of ADL scales High better Based on data from: 3,064 patients in 36 studies.</td>
<td>Difference: SMD 0.22 higher ( CI 95% 0.09 higher - 0.34 higher )</td>
<td>Moderate 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.</td>
<td>Additional active practice probably improves activities of daily living</td>
</tr>
<tr>
<td>8 Critical</td>
<td>Follow up: Post intervention.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking ability Immediate</td>
<td>Measured by: Comfortable walking speed Scale: 0-1.4 High better Based on data from: 1,097 patients in 22 studies.</td>
<td>Difference: SMD 0.29 higher ( CI 95% 0.17 higher - 0.41 higher )</td>
<td>High 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</td>
<td>Additional active practice improves walking speed</td>
</tr>
<tr>
<td>treatment effects</td>
<td>(Randomized controlled)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Critical</td>
<td></td>
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<td>Outcome Timeframe</td>
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</tr>
<tr>
<td>Arm function and walking ability</td>
<td>Based on data from: 954 patients in 14 studies. (Randomized controlled) Follow up: End of intervention.</td>
<td>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).</td>
<td>Moderate Many of the included studies had small sample size and the statistical heterogeneity was high (66%)</td>
<td>Additional active practice probably improves arm function and walking ability</td>
</tr>
</tbody>
</table>

1. Systematic review [177]. **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.
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 2020 [8]).

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 3.1 full-time equivalent (FTE) staff (range 2.6 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 0.3, assistant 0.4, social work (0 to 0.5 FTE) and secretarial support (Langhorne et al. 2017 [37]). Patients tended to be a selected elderly group with moderate disability (Barthel Index [BI] scores between 10 to 18 points). Most trials were conducted in the urban centres of the United Kingdom, so there may be subtle differences in care in the Australian context.

Trials of ESD suggest 15% of patients may be eligible based on objective measure of both physical and cognitive function e.g. BI scores of 16 to 19 and an MMSE greater than 23, in addition to caregiver availability, suitability of the home environment, and proximity to the hospital. Furthermore, the average patient age in the trials ranged from 60 to 80 years (Langhorne et al 2017 [37]). While ESD services are not widely available in Australia the inclusion and impact specifically on people with stroke <65 years requires consideration. Working aged people with stroke may exhibit less physical disability, but often experience significant cognitive challenges, and tend to have specific needs in relation to returning to work, parenting and psychosocial aspects of recovery, yet often don't receive rehabilitation services within 3 months of their stroke (Walters et al 2020 [47]).

Studies suggest ESD service will require 4-5 weeks on average to be effective (Meyer et al 2016 [43]).

Evidence To Decision

Benefits and harms

In the Cochrane review by Langhorne et al. (2017) [37], participants receiving early supported discharge (ESD) services showed significant reductions ($P < 0.0001$) in the length of hospital stay equivalent to approximately six days. ESD also resulted in reduced odds of death or dependency which equated to five fewer adverse outcomes per 100 patients. ESD also reduced the outcome of death or institutional care, and extended activities of daily living scores and level of patient satisfaction. Benefits were less at one and five year follow-up. Rate of readmission to hospital was no different between ESD and conventional services groups. The greatest benefits were seen in the trials evaluating a coordinated ESD team and in stroke patients with mild to moderate disability.

Certainty of the Evidence

The quality of the evidence was rated moderate by Langhorne et al 2017 [37] for most outcomes but low for extended ADL, satisfaction and readmission. Evidence was downgraded primarily due to potential performance bias (patients and staff aware of treatment allocation), however, senstivity analysis indicated little risk from other potential biases. It was the view of the working
Early supported discharge (ESD) with well-organised discharge teams and coordinated community support showed overall benefit for stroke patients with mild to moderate disability, based on a meta-analysis of 16 trials (N = 2359) (Langhorne et al. 2017). The updated patient data analysis demonstrated that patients receiving ESD services were more likely to be independent and living in a group that further trials were unlikely to effect the overall certainty of effects and are robust.

Preference and values

ESD is likely to be consistently preferred than conventional therapy given reduced risk of being dependent and in institutional care, and greater patient satisfaction. There are no real adverse outcomes with ESD, however, some patients and their family may have reservations with leaving hospital early. But trials have found no difference in carers’ subjective health status, mood or satisfaction.

No substantial variability expected

Resources and other considerations

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. In a Cochrane review (Langhorne et al. 2017) conducted to investigate services such as ESD with rehabilitation at home for reducing duration of hospital care for patients with acute stroke, costs from seven trials ranged from 23% less to 15% greater for the ESD group in comparison to controls, and these estimates were reported to be stable in sensitivity analyses. This is consistent with evidence from economic evaluations conducted parallel to randomised controlled trials. In a single-centre randomised controlled trial conducted in the United Kingdom, patients were randomised to receive care in a stroke unit (n=152), or in a general ward (n=152) or domiciliary care (n=153) within 72 hours of stroke onset (Patel et al. 2004). While more effective than domiciliary care, care in a stroke unit cost an additional £64,079 to £136,609 per QALY gained when compared to domiciliary care (cost reference year 1997–1998), but domiciliary care produced greater health gains for lower costs than care in a general ward. In another single-centre randomised controlled trial (n=320) comparing stroke unit care and stroke unit care with ESD in Norway (Fjaerloft et al. 2005) and fewer deaths and nursing home admissions at 5 years post-stroke, patients provided ESD had lower costs at 12 months (EUR 18,937 vs EUR 21,824) (Fjaerloft et al. 2005) and fewer deaths and nursing home admissions at 5 years post-stroke (Fjaerloft et al. 2011) than the control group (cost reference year not mentioned, data were collected from 1995-1997).

Other evidence in support of ESD comes from observational comparative-effectiveness studies such as one conducted in Sweden (Tistad and von Koch 2015), in which patients who had received the ESD service (n=40) were compared to those eligible for ESD but had received conventional inpatient rehabilitation (n=110). Only costs of healthcare services utilised during the first year after stroke were included and were obtained from an administrative database. At 12 months post 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). Comparable findings have also been reported from a study conducted in Canada (n=100) (Tam et al 2018), in which patients who were ‘fast-tracked’ to receive high-intensity outpatient rehabilitation commencing within a week of discharge after stroke were compared to a simulated cohort of patients who were not ‘fast-tracked’ (remaining in acute or receiving inpatient rehabilitation). Costs from a healthcare perspective were included, with administrative patient-level data used to obtain the cost estimates (cost reference year 2016). Per additional inpatient day saved, the ‘fast-tracked’ program cost an additional CAN$37 (95% CI: CAN$20–55) for patients who were discharged from acute care and an additional CAN$404 (95% CI: CAN$270–620) for those discharged from inpatient rehabilitation. This was cheaper than the cost of an additional inpatient bed day (CAN$698). A limitation of the economic evaluation was that other relevant costs (for example transportation to and from out-patient rehabilitation, and cost to patients and their caregivers), which may be important, were not included in this analysis.

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 mild to moderate disability, based on a meta-analysis of 16 trials (N = 2359) (Langhorne et al. 2017). 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.

**Clinical Question/ PICO**

**Population:** Adults with stroke  
**Intervention:** Early supported discharge services  
**Comparator:** Conventional care

**Summary**

A Cochrane review by Langhorne et al (2017) [37] included 17 trials (N = 2422) comparing conventional care to interventions providing community-based rehabilitation and support and aiming to reduce the duration of hospital care. Overall, ESD services were associated with a significant reduction in death or dependency at the end of median 6 month follow-up (OR 0.80, 95% CI 0.67 to 0.95), significant reduction of death or institutionalisation (OR 0.75, 95% CI 0.59 to 0.96) and significantly reduced length of intial hospital stay by approximately 6 days. There was more satisfaction from patients provided ESD who also had higher extended ADL scores. There was no difference in mortality or readmissions to hospital. In subgroup analyses those services with a multidisciplinary team (MDT) providing active community rehabilitation was found to be more effective than services that just coordinated services without providing full MDT input.

A subsequently published study (Rafsten et al 2019 [44]) reported significantly improved level of disability at 3 months (p=0.0004) which became non-significant at 12 months. No difference in anxiety was found at any time point.

### Outcome  
**Timeframe**  
**Study results and measurements**  
**Absolute effect estimates**  
**Certainty of the Evidence** (Quality of evidence)  
**Plain text summary**

<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| **Death** | Odds Ratio 1.04 (CI 95% 0.77 - 1.4)  
Based on data from 2,116 patients in 16 studies.  
(Randomized controlled)  
Follow up: median 6 months. | Odds Ratio 1.04  
**Odds Ratio** 90  
per 1000  
93 per 1000 | Moderate  
Downgraded due to potential performance bias | ESD services in general probably have little or no difference on death |
| **Death or requiring institutional care** | Odds Ratio 0.75 (CI 95% 0.59 - 0.96)  
Based on data from 1,664 patients in 12 studies.  
(Randomized controlled)  
Follow up: median 6 months. | Odds Ratio 0.75  
**Odds Ratio** 270  
per 1000  
217 per 1000 | Moderate  
**Difference:** 53 fewer per 1000  
( CI 95% 91 fewer - 8 fewer ) | ESD services in general decrease death or requiring institutional care |
| **Death or dependency** | Odds Ratio 0.8 (CI 95% 0.67 - 0.95)  
Based on data from 2,359 patients in 16 studies.  
(Randomized controlled)  
Follow up: median 6 months. | Odds Ratio 0.8  
**Odds Ratio** 450  
per 1000  
396 per 1000 | Moderate  
**Difference:** 54 fewer per 1000  
( CI 95% 96 fewer - 13 fewer ) | ESD services in general decrease death or dependency |
| **Satisfaction with services** | Odds Ratio 1.6 (CI 95% 1.08 - 2.38)  
Based on data from 513 patients. | Odds Ratio 1.6  
**Odds Ratio** 610  
per 1000  
715 per 1000 | Low  
**Difference:** 115 fewer per 1000  
( CI 95% 180 fewer - 18 fewer ) | ESD services in general improve satisfaction with services |
### Outcome Timeframe

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Readmission</strong></td>
<td>patients in 5 studies. (Randomized controlled) Follow up: median 6 months.</td>
<td>Difference: <strong>104 more</strong> per 1000 (CI 95% 18 more - 178 more)</td>
<td>Performance bias and potential risk of missing data ^4</td>
<td>Low Downgraded twice for risk of performance bias and potential risk of missing data ^5</td>
</tr>
<tr>
<td><strong>Critical</strong></td>
<td>Odds Ratio 1.09 (CI 95% 0.79 - 1.51) Based on data from 784 patients in 6 studies. (Randomized controlled) Follow up: median 6 months.</td>
<td>250 per 1000</td>
<td>ESD service may have little or no difference on readmission</td>
<td></td>
</tr>
<tr>
<td><strong>Length of stay</strong></td>
<td>Measured by: EADL High better Based on data from: 1,262 patients in 11 studies. (Randomized controlled) Follow up: median 6 months.</td>
<td>Difference: <strong>SMD 0.14 higher</strong> (CI 95% 0.03 higher - 0.25 higher)</td>
<td>Low Downgraded twice for risk of performance bias and potential risk of missing data ^6</td>
<td>ESD services in general slightly improve extended activities of daily living</td>
</tr>
<tr>
<td><strong>Critical</strong></td>
<td>Measured by: Length of stay High better Based on data from: 2,161 patients in 16 studies. (Randomized controlled)</td>
<td>Difference: <strong>MD 5.5 lower</strong> (CI 95% 2.9 lower - 8.2 lower)</td>
<td>Moderate Downgraded due to potential performance bias ^7</td>
<td>ESD service probably decreases length of stay</td>
</tr>
</tbody>
</table>

1. **Risk of bias**: Serious. 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.
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**: 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**: Serious. 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**: Serious. Wide confidence intervals. **Publication bias**: No serious.
6. **Risk of bias**: Serious. 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.
7. **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**: No serious. Wide confidence intervals. **Publication bias**: No serious.
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 [51]), although referral to community rehabilitation offered in the home is increasing (Stroke Foundation 2019 [7]). In the National Stroke Audit of Acute Services, 10% of patients were referred to home-based community rehabilitation (Stroke Foundation 2019 [7]), while in the National Stroke Audit of Rehabilitation Services, this increased to 24% (Stroke Foundation 2020 [8]). On the other hand, 68 out 111 (61%) surveyed in the National Stroke Audit of Rehabilitation Services reported having access to community-based rehabilitation provided in the home (Stroke Foundation 2020 [8]). 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).

Evidence To Decision

**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 [49]; Hillier et al. 2010 [51])

**Benefits and harms**

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 [51]). 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 [49]). 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 Barthe 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.

**Certainty of the Evidence**

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

**Preference and values**

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

**Resources and other considerations**

**Economics considerations**

There is some evidence that home based rehabilitation may be cost saving and more effective compared to standard inpatient rehabilitation care. In an economic evaluation conducted parallel to a randomised controlled trial in Denmark, home-based rehabilitation (n=38) was compared to standard inpatient rehabilitation care (n=33) (Rasmussen et al. 2016 [49]). Quality of life was assessed using the EuroQol-5D and costs related to the delivery of the intervention and the hospital admission were collected. At 90 days post stroke, participants in the intervention group had better modified Rankin Scale scores and greater quality of life. 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, data were collected in 2011). There were similar findings from an economic evaluation in which a home-based rehabilitation programme provided in Canada was compared to usual care where patients had limited access to specialist rehabilitation (Allen et al 2018 [60]). Home-based rehabilitation was provided to survivors of stroke by a multidisciplinary team over multiple visits. Costs to the healthcare sector and QALYs were modelled...
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) [49].

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) [49].

Clinical Question/ PICO

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

Summary
Hillier et al (2010) [51] 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) [49] 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) [50] 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.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Short-term functional independence 6-8 weeks</td>
<td>Measured by: Barthel index High better Based on data from: 245 patients in 2 studies. (Randomized controlled)</td>
<td>Difference: <strong>MD 1 higher</strong> ( CI 95% 0.12 higher - 1.88 higher )</td>
<td>Low Due to serious imprecision, Due to serious risk of bias ¹</td>
<td>Home-based rehabilitation may have little or no difference on short-term functional independence</td>
</tr>
<tr>
<td>Outcome Timeframe</td>
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<tr>
<td>8 Critical</td>
<td>Follow up: 6-8 weeks.</td>
<td>Difference: <strong>MD 0.65 higher</strong> (CI 95% 0.5 lower - 1.81 higher)</td>
<td>Low Due to very serious inconsistency 2</td>
<td>Home-based rehabilitation may have little or no difference on medium-term functional independence</td>
</tr>
<tr>
<td>Medium-term functional independence 6 months</td>
<td>Measured by: Barthel Index High better Based on data from: 912 patients in 6 studies. (Randomized controlled) Follow up: 6 months.</td>
<td>0.66 points (Median) 0.77 points (Median)</td>
<td>Low Due to serious risk of bias, Due to serious imprecision 3</td>
<td>Home-based rehabilitation may improve quality of life</td>
</tr>
<tr>
<td>Quality of Life 90 days post stroke</td>
<td>Measured by: Euro-Qol-5D High better Based on data from: 61 patients in 1 studies. (Randomized controlled) Follow up: 90 days.</td>
<td>3 (Median) 2 (Median) CI 95%</td>
<td>Low Due to serious risk of bias, Due to serious imprecision 4</td>
<td>Home-based rehabilitation may improve disability</td>
</tr>
<tr>
<td>Disability 90 days</td>
<td>Measured by: mRS Scale: 0-6 Lower better Based on data from: 61 patients in 1 studies. (Randomized controlled) Follow up: 90 days.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **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**.

2. **Inconsistency**: **Very Serious**. The magnitude of statistical heterogeneity was high, with I^2:80%. 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..

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**: **Serious**. Low number of patients. **Publication bias**: **No serious**.

4. **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**.

**Clinical Question/ PICO**

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

Hillier et al (2010) [51] 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) [49] 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) [50] 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.

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

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.

**Goal setting**

Goal setting helps direct rehabilitation efforts throughout the various stages of recovery (Rosewilliam et al. 2015 [65]). 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 cultural and 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 [65]). The National Stroke Audit revealed 15% of acute stroke patients and 8% of patients in inpatient rehabilitation did not have documented evidence that goals were set jointly with the interdisciplinary team and patient (Stroke Foundation 2019 [7]; Stroke Foundation 2020 [8]). 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 [63]; Taylor et al. 2012 [64])
- 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 [63]; Taylor et al. 2012 [64])

### Practical Info

The SMART principles are a useful tool for goal setting:

Goal setting is facilitated by:

1. Tailoring the process to individual patient’s needs and preferences
2. Using structured processes, tools and resources
3. Early, effective and frequent communication between staff and patients.
The EnableMe website can be used to enter patient goals which can be monitored and updated over time.

Be aware that some patients may not be ready to identify goals immediately after a stroke as they are still trying to process the stroke. It is important that once goals are identified, they are discussed with everyone involved with the patient, and are reviewed regularly. A patient’s goals sometimes change along the way, and so it is important to be flexible.

Setting timeframes do not work for everyone - sometimes if a patient does not achieve a goal in a set timeframe it can have a negative effect on their rehabilitation. Consider, instead, providing positive encouragement, and a timeline of improvement from the ‘stroke event’ to ‘now’.

**Evidence To Decision**

<table>
<thead>
<tr>
<th>Benefits and harms</th>
<th>Small net benefit, or little difference between alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>A systematic review (Sugavanam et al. 2013 [63]) reports favourable effects of goal setting, although these have not been demonstrated in randomised controlled trials to date. No harms have been identified.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certainty of the Evidence</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a lack of high quality trials and thus the evidence is low.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preference and values</th>
<th>No substantial variability expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual preferences and cultural background may influence involvement of the stroke survivor and their family in goal</td>
<td></td>
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</tbody>
</table>
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 [66]). 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) [64] 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) [65] 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) [63] 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.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of life</td>
<td>12 weeks post admission</td>
<td>Measured by: SEIQOL-DW Scale: 0-100 High better Based on data from: 41 patients in 1 studies. (Randomized controlled) Follow up: 12 weeks.</td>
<td>Difference: MD 3.1 higher ( CI 95% 40 lower - 46.2 higher )</td>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>It is uncertain whether goal setting leads to improved quality of life.</td>
</tr>
<tr>
<td>ADL function</td>
<td>12 weeks post admission</td>
<td>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.</td>
<td>Difference: MD 0.9 higher ( CI 95% 9.1 lower - 10.8 higher )</td>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>The systematic review (Sugavanam et al) reported that all four studies reported improved ‘performance and ‘satisfaction’ at discharge implying recovery.</td>
</tr>
<tr>
<td>Length of stay</td>
<td>at time of discharge</td>
<td>Measured by: Days Lower better Based on data from: 41 patients in 1 studies. (Randomized controlled) Follow up: at discharge.</td>
<td>26.8 (Mean) 51.7 (Mean) CI 95%</td>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>It is uncertain whether goal setting leads to a difference in length of stay.</td>
</tr>
<tr>
<td>Self efficacy</td>
<td>Not specified</td>
<td>Based on data from: 142 patients in 2 studies. (Observational (non-randomized)) Follow up: Not reported.</td>
<td>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 Very Low Due to very serious risk of bias, Due to serious inconsistency, Due to serious indirectness, Due to serious</td>
<td>Very Low Due to very serious risk of bias, Due to serious indirectness, Due to serious</td>
<td>It is uncertain whether goal setting leads to improved self efficacy; two studies suggest improved perception of performance and improved recall of treatment goals.</td>
</tr>
<tr>
<td>Outcome Timeframe</td>
<td>Study results and measurements</td>
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<tr>
<td></td>
<td></td>
<td>Usual care</td>
<td>Patient centred goal setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td>their treatment goals better and 'manage more tasks'</td>
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<tr>
<td>2. Measured using FIM (Functional Independence Measure)</td>
<td></td>
<td></td>
<td>imprecision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
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</table>
Sensorimotor impairments

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

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, the effect of different types of training have been investigated including repetitive practice (De Sousa et al 2018 [74]) and progressive resistance training (Dorsch et al 2018 [75]). Repetitive practice is defined as repeated voluntary contraction of affected upper or lower limb muscles. Practice can include a whole task (such as standing up and walking, or components of a task such as elbow extension/flexion. Repetitive task training can be provided using different therapy modalities including electrotherapy such as FES robotics and virtual reality. Progressive resistance training according to the American College of Sports Medicine is defined as resistance training using a load of 8-12 repetition at maximum for at least two sets and these loads need to increase progressively.

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 [70]).

Practical Info

In many studies and in clinical settings, strengthening interventions are not progressive resistance training (PRT) as defined by the American College of Sports Medicine, which states that training should use a load of 8-12 repetitions maximum (i.e. the highest load that can be moved no more than 8-12 times before muscle fatigue) for at least two sets and these loads need to increase progressively. In this review of PRT, the majority of studies targeted leg strength including the following muscle groups: hip extensors and flexors in four studies, hip abductors in one trial, knee extensors in nine studies, knee flexors in six studies and ankle dorsiflexors and plantar flexors in six studies.

In two studies arm strength was targeted, focussing on shoulder flexors and extensors and elbow flexors and extensors in two studies and shoulder external and internal rotators, shoulder abductors and adductors, wrist flexors and extensors and hand muscles in one study.

The load ranged between 7 and 15 repetition maximum (RM) or between 50-80% of 1 RM. The number of sets ranged from 2-4, frequency of training from 2-4 days a week and duration from 4 -12 weeks.

As PRT is applied using high external resistance to movement, participants need to have sufficient strength to do this type of training, i.e. greater than anti-gravity strength. Some stroke survivors will not have sufficient initial strength to participate in this type of training and will need to use other strengthening interventions.

The person with stroke should be given simple, clear pictorial instructions including the use of any equipment or safety issues if repetitions are required outside of therapy. Progress could be charted to to help motivation but post-stroke fatigue or pain should be monitored.

Evidence To Decision

For stroke survivors with reduced strength in their arms or legs, progressive resistance training should be provided to improve strength. (Dorsch et al. 2018 [75])
Rationale

Dorsch et al (2018)[75] reported a systemic review on progressive strength resistance (PRT) training that included six trials (163 participants). PRT was defined using the American College of Sports Medicine definition, which states that training should include a load of 8-12 repetition maximum for at least two sets and these loads need to increase progressively. The results show that PRT had a large effect (SMD 0.98, 95% CI 0.67 to 1.29) on improving strength compared to no intervention or placebo and should therefore be undertaken by people with weakness post stroke.

PRT is effective in improving arm or leg activity. (Dorsch et al 2018 [75]) There is no evidence of harm.

Certainty of the Evidence

Evidence quality is moderate due to risk of bias and/or degree of statistical heterogeneity.

Preference and values

No substantial variability expected in preferences and values of people with stroke.

Resources and other considerations

Little or no additional resources are required to implement PRT, however, therapists need to ensure this is part of active stroke rehabilitation where appropriate.

Clinical Question/ PICO

Population: Adults with stroke
Intervention: Progressive resistance training
Comparator: Control

Summary

A systematic review by Dorsch et al (2018)[75] investigated the effectiveness of progressive strength resistance (PRT) training which was defined using the American College of Sports Medicine definition. Eleven trials (N=314 participants) were included, six (N=163) of which were pooled to report strength and activity outcomes. The main outcome was muscle strength measured as maximum force/torque and congruent with the muscles trained, measured immediately after the intervention. Secondary outcome was activity. The results show that PRT has a large effect on improving strength compared to no intervention or placebo (SMD 0.98, 95% CI 0.67 to 1.29) but the effect on activity was unclear (SMD 0.42, 95% CI –0.08 to 0.91, I² = 54%).

Previous systematic review of upper-limb strength training included 13 randomised controlled trials with 517 total participants (Harris et al 2010[72]). 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.
1. Measures of strength were maximum force (six studies) or torque (five studies). Four studies measured force or torque isometrically, while seven studies measured it dynamically (isokinetically or isotonically).

2. Systematic review [75]. Baseline/comparator: Control arm of reference used for intervention.

3. **Risk of bias: Serious.** The majority of studies randomly allocated participants (100%), had similar groups at baseline (91%), had blinded assessors (73%), reported < 15% dropouts (91%), reported between-group differences (100%), and reported point estimate and variability (100%). The majority of studies did not report that they concealed allocation (55%) or carried out an intention-to-treat analysis (64%). All studies did not blind therapists and participants, which is not possible for this intervention. Inconsistency: No serious. Indirectness: No serious. Imprecision: No serious. Publication bias: No serious.

4. Of the nine lower limb studies, seven measured activity as walking speed, one as the Timed Up and Go test, and one as the lower limb part of the Fugl-Meyer Assessment. Of the two upper limb studies, one measured activity as the Wolf Motor Function Test and one as the Functional Test of Hemiparetic Upper Extremity.

5. Systematic review [75]. Baseline/comparator: Control arm of reference used for intervention.

6. **Risk of bias: Serious.** The majority of studies randomly allocated participants (100%), had similar groups at baseline (91%), had blinded assessors (73%), reported < 15% dropouts (91%), reported between-group differences (100%), and reported point estimate and variability (100%). The majority of studies did not report that they concealed allocation (55%) or carried out an intention-to-treat analysis (64%). All studies did not blind therapists and participants, which is not possible for this intervention. Inconsistency: No serious. Indirectness: No serious. Imprecision: No serious. Wide confidence intervals. Publication bias: No serious.

<table>
<thead>
<tr>
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<th>Timeframe</th>
<th>Study results and measurements</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>End of treatment (mean 9 weeks)</td>
<td>Measured by: Maximum force or torque (Randomized controlled) Follow up: Mean 9 weeks of treatment.</td>
<td>Difference: SMD 0.98 higher (CI 95% 0.67 higher - 1.29 higher)</td>
<td>Moderate Due to serious risk of bias</td>
<td>Progressive resistance training improves strength</td>
</tr>
<tr>
<td>Functional activity</td>
<td>End of treatment (mean 9 weeks)</td>
<td>Measured by: Various (Randomized controlled) Follow up: Mean 9 weeks of treatment.</td>
<td>Difference: SMD 0.42 higher (CI 95% 0.08 lower - 0.91 higher)</td>
<td>Moderate Due to risk of bias, Due to serious inconsistency</td>
<td>Progressive resistance training may improve activity</td>
</tr>
</tbody>
</table>

- For stroke survivors with arm weakness, repetitive practice using assistive technology, constraint induced movement therapy (CIMT), and robotics may be used to improve arm strength. (de Sousa et al 2018 [74])
- For stroke survivors with leg weakness, task specific training, repetitive practice using cycling, or electrical stimulation may be used to improve leg strength. (de Sousa et al 2018 [74])
Practical Info

Repetitive practice was provided using different types of interventions including: CIMT, cycling, FES (with or without active movement), mirror therapy, robotics/assistive technology, task specific training, whole body vibration (with active movement), Bobath, mixed therapies, video games and water-based exercises. For stroke survivors with arm weakness repetitive practice using CIMT, and robotics/assistive technology, appeared to be most useful for improving arm strength (de Sousa et al 2018 [74]). For stroke survivors with leg weakness task specific training, repetitive practice using cycling, or FES appeared to be most useful for improving leg strength (de Sousa et al 2018).

The duration of therapy sessions ranged from 15 to 360 minutes. The overall dose, ranged from 2.2 hours over 4 weeks to 60 hours over 2 weeks. The number of repetitions participants completed ranged from 5 to 1800 repetitions per exercise.

The person with stroke should be given simple, clear pictorial instructions including the use of any equipment or safety issues if repetitions are required outside of therapy. Progress could be charted to to help motivation but post-stroke fatigue should be monitored.

Evidence To Decision

Benefits and harms

Substantial net benefits of the recommended alternative

There is evidence that repetitive practice improves strength and activity levels of the arm and leg (de Sousa et al 2018 [74]). There is no evidence of harm.

Certainty of the Evidence

Moderate

Evidence quality is moderate overall due to risk of bias but certainty for specific types of interventions ranged from very low to moderate.

Preference and values

No substantial variability expected

No substantial variability expected in the preferences and values of people with stroke.

Resources and other considerations

No important issues with the recommended alternative

Repetitive practice is already part of routine therapy. There are no important issues or additional resources required when providing this intervention.

Rationale

A large systematic review (46 studies, n=1928 participants) found modest improvements in strength with repetitive practice. Some specific interventions were found to be beneficial while others are unclear. Improvements in strength were found to positively impact on arm and leg activity (see various topics in Activity Limitations section and also French et al 2016 [193]).

Clinical Question/ PICO

Population: Adults with stroke with weakness

Intervention: Repetitive practice

Comparator: Control
Summary

de Sousa et al (2018)[74] conducted a review on the effect of repetitive practice. Different types of therapies were included and results for each therapy were reported separately. Additionally, results for arm and leg strength were reported separately. Overall repetitive training combining 46 studies (n=1928) for upper and lower limbs was improved strength (SMD 0.25, 95% CI 0.16-0.34). This effect was robust based on sensitivity analysis on various aspects of risks of biases.

For stroke survivors with arm weakness repetitive practice using assistive technology (SMD 1.02 95%CI 0.26 to 1.78; 2 studies, n=32), CIMT (SMD 1.49 95%CI 0.44 to 2.54; 2 studies, n=22), and robotics (SMD 0.52 95%CI 0.10 to 0.94; 2 studies, n=93) may improve arm strength. Overall the effects of repetitive training translated to an absolute mean increase in 3.1/57 points on the ARAT (upper limb activity). For stroke survivors with leg weakness repetitive practice using cycling (SMD 0.49 95%CI 0.10 to 0.88; 2 studies, n=104), FES (SMD 0.45 95%CI 0.07 to 0.84; 3 studies, n=107) and task specific training (SMD 0.27 95%CI 0.09 to 0.44; 8 studies, n=540) appear to improve leg strength. The evidence is strongest for task specific training for leg strength. Overall the effects of repetitive training translated to an absolute mean increase of 0.13m/s in walking speed.

The effects repetitive practice using Bobath, mixed therapies, mirror therapy, mixed therapies, video-games, whole body vibration and water-based exercises compared to no intervention or sham intervention on strength is unclear based on very low certainty evidence.

There is little evidence on adverse events with repetitive practice.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Strength (lower extremities)</strong>&lt;br&gt;Post intervention (2 to 52 weeks of treatment)</td>
<td>Measured by: Various measures&lt;br&gt;High better&lt;br&gt;Based on data from: 955 patients in 21 studies. ¹ (Randomized controlled) Follow up: 2 - 52 weeks.</td>
<td>Difference: SMD 0.34 higher ( CI 95% 0.22 higher - 0.47 higher )</td>
<td>Moderate&lt;br&gt;Due to serious risk of bias ²</td>
<td>Repetitive practice training probably increases strength (lower extremities) although benefits are modest</td>
</tr>
<tr>
<td><strong>Strength (upper extremities)</strong>&lt;br&gt;Post intervention (2 to 52 weeks of treatment)</td>
<td>Measured by: Various measures&lt;br&gt;High better&lt;br&gt;Based on data from: 973 patients in 25 studies. ³ (Randomized controlled) Follow up: 2 - 52 weeks.</td>
<td>Difference: SMD 0.16 higher ( CI 95% 0.03 higher - 0.29 higher )</td>
<td>Moderate&lt;br&gt;Due to serious risk of bias ⁴</td>
<td>Repetitive practice training probably increases strength (upper extremities) although benefits are small</td>
</tr>
<tr>
<td><strong>Lower limb activity</strong>&lt;br&gt;Post intervention (2 to 52 weeks of treatment)</td>
<td>Measured by: Various measures&lt;br&gt;High better&lt;br&gt;Based on data from: 952 patients in 20 studies. ⁵ (Randomized controlled) Follow up: 2 - 52 weeks.</td>
<td>Difference: SMD 0.25 higher ( CI 95% 0.12 higher - 0.38 higher )</td>
<td>Moderate&lt;br&gt;Due to serious risk of bias ⁶</td>
<td>Repetitive practice training probably increases lower limb activity although benefits are modest</td>
</tr>
</tbody>
</table>
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.
Evidence To Decision

**Benefits and harms**

There are small to moderate benefits for improvements in strength following electrical stimulation and no evidence of harm (Nascimento et al. 2014 [70]; de Sousa et al. 2018 [74]).

**Certainty of the Evidence**

There are important methodological issues with the trials included in the systematic reviews (Nascimento et al. 2014 [70]; de Sousa et al. 2018 [74]) and our overall certainty in the evidence was rated as low.

**Preference and values**

Electrical stimulation is not always tolerated by everyone.

**Resources and other 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 based on low certainty evidence (Nascimento et al. 2014 [70]; de Sousa et al. 2018 [74]). There is an indication that there are improvements in strength regardless of whether electrical stimulation is applied with or without voluntary muscle contraction. However, it is difficult to say with certainty which approach (with or without voluntary muscle contraction) is superior.

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) [70], 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).
Loss of sensation

Approximately 38% of stroke patients are assessed as having sensory deficits on admission (Stroke Foundation 2019 [7]), with impairments in touch sensation, proprioception and kinaesthesia in most cases (de Diego et al. 2013 [76]). Sensation (or somatosensory) deficits can negatively affect motor recovery (Doyle et al. 2010 [79]). 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 [79]).

Doyle et al. (2014) [77] 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 101 out of 120 (84%) Australian hospitals had locally agreed assessment protocols for identifying sensory deficits (Stroke Foundation 2019 [7]). 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 [81]). 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 [82]).

There is a lack of evidence to guide interventions for sensory loss of the lower limb and foot.
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) [78], and 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.

Evidence To Decision

**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 [78]) showed benefits from sensory discrimination training compared to non-specific exposure to sensory stimuli. An earlier Cochrane review (Doyle et al. 2010 [79]) 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**

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

Summary

Turville et al (2019)[86] included 10 studies (2 RCT, 3 Controlled trials, and 5 single case experimental studies) specifically focused sensory function of the arm (n = 199 participants). Sensory-specific training was included in 6/10 studies and combined sensory and motor training in 4/10 studies. The pooled effect sizes ranged from 0.3 to 2.2 (average 0.85) across four different sensory modalities. The controlled groups improved but the effects sizes in all but one outcome were lower than the intervention group. The overall quality of evidence is low. The one RCT of high quality (Carey et al (2011)[78] compared somatosensory discrimination training and non-specific repeated exposure to stimuli (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).

A Cochrane systematic review was conducted by Doyle et al (2010)[77] 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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation 1</td>
<td>Measured by: Improvement from baseline on Standardized Somatosensory Deficit scale. High better (Randomized controlled) Follow up: 10 sessions of treatment, 3 sessions per week.</td>
<td>Conventional treatment: 8 points (Mean) Sensory-specific training: 19.1 points (Mean) Difference: MD 11.1 higher (CI 95% 3 higher - 19.2 higher)</td>
<td>Moderate Due to serious imprecision 3</td>
<td>Sensory-specific treatment probably improves sensation</td>
</tr>
<tr>
<td>After 10 sessions of treatment (approx 3 weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Critical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper limb sensation</td>
<td>Based on data from: 467 patients in 13 studies. (Randomized controlled)</td>
<td></td>
<td>Low Due to serious risk of bias, Due to serious imprecision 4</td>
<td>Sensory-specific training may improve upper limb sensation</td>
</tr>
<tr>
<td>7 Critical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome Timeframe</td>
<td>Study results and measurements</td>
<td>Absolute effect estimates</td>
<td>Certainty of the Evidence (Quality of evidence)</td>
<td>Plain text summary</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Conventional treatment</td>
<td>Sensory-specific training</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CI 0.10 to 0.32, and arm function (Motor Assessment Scale, MD 1.58, 95% CI 0.98 to 2.18)</td>
<td>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)</td>
<td></td>
</tr>
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<td></td>
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</tr>
</tbody>
</table>

1. Composite index of FMT for texture discrimination, WPST for limb position sense, and fTORT for textile object recognition  
2. Primary study[78]. Baseline/comparator: Control arm of reference used for intervention.  
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.

**Clinical Question/ PICO**

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

**Summary**

Turville et al (2019)[86] included 10 studies (2 RCT, 3 Controlled trials, and 5 single case experimental studies) specifically focused on sensory function of the arm (n=199 participants). Sensory specific training was included in 6/10 studies and combined sensory and motor training in 4/10 studies. Six studies reported arm function (n=89) with a narrative analysis suggesting possible improvements after sensory retraining. The one RCT by de Diego et al (2013)[76] compared a sensorimotor stimulation program to standard rehabilitation in a small number of participants (n=21). 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.

Yilmazer et al (2019)[85] included 8 studies (n = 257) focused on the arm. Active somatosensory interventions did not show a significant effect for light touch (SMD 1.52, 95% CI -0.45 to 3.48; 3 studies, n=87; very low certainty).
proprioception (SMD 0.2, 95% CI -0.83 to 1.23; 2 studies, n=58; very low certainty), or higher cortical somatosensation (SMD 0.55, 95% CI -0.01 to 1.12; 1 study, n=50; low certainty). Similarly there was no significant differences found for passive somatosensory interventions for light touch (SMD 0.29, 95% CI -0.43 to 1.01; 3 studies, n=91), proprioception (SMD 0.39, 95% CI -0.26 to 1.04; 2 studies, n=53) or higher cortical somatosensation (MD 1.17, 95% CI -1.04 to 3.37; 2 studies, n=61) all based on very low certainty evidence.

Chia et al [2019]/84 investigated leg somatosensory function and included 16 studies (n=430). Nine studies were RCT, five were controlled trials and two were other designs. A significant positive summary effect size (SES) was found for somatosensory outcomes (SES 0.52, 95% CI 0.04 to 1.01; moderate heterogeneity $I^2 = 74%$; 7 studies). Ten studies were rated as weak and six moderate quality.

A systematic review conducted by Serrada et al [2019]/83 included 38 studies (n = 1093) and investigated the effect of sensory retraining on sensation and sensorimotor function. Most (29) of the studies involved passive training (external application of stimulation such as electrical stimulation) with six studies involved active sensory discrimination training and three studies involving both. Only two studies (n=61) were pooled based on the Nottingham Sensory Assessment comparing passive approach to sham therapy with no significant difference found (MD 0.59, 95% CI -0.75 to 1.93, high heterogeneity $I^2 =84%$). Meta analyses of 13 of the studies (n = 385), mostly of passive approaches, demonstrated a significant effect for several arm and leg activity measures (2-3 studies pooled in each measure).

A Cochrane review by Doyle et al (2010) [77] 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 if any intervention in improving sensory impairment, upper limb function, or participants’ functional status and participation.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement in ADL After 8 weeks of treatment</td>
<td>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.</td>
<td>0.25 (Mean) 9.83 (Mean) Difference: MD 9.58 higher CI 95%</td>
<td>Low Due to very serious imprecision 1</td>
<td>Sensory-specific treatment plus motor function training may improve ADL</td>
</tr>
<tr>
<td>Improvement in upper limb function After 8 weeks of treatment</td>
<td>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.</td>
<td>3 (Mean) 5.1 (Mean) Difference: MD 2.1 higher CI 95%</td>
<td>Moderate Due to serious imprecision 2</td>
<td>Both intervention and control group showed significant improvement from baseline with no significant differences between them.</td>
</tr>
</tbody>
</table>
Loss of cardiorespiratory fitness

The cardiorespiratory fitness of stroke survivors is low (Marsden et al. 2013 [92]; Saunders et al. 2016 [87]), with peak oxygen consumption (VO₂ peak) values ranging from 26 to 87% of those of healthy age- and gender-matched individuals (Smith et al. 2012 [86]). In the meta-analysis examining cardiorespiratory levels after training undertaken by Saunders et al. [87], baseline levels ranged from to 8 to 24 mL O₂/kg/min. This is an issue as everyday physical activities are often undertaken at light (3.5 to 10.4 mL O₂/kg/min) or moderate intensities (10.5 to 21.0 mL O₂/kg/min) (Norton et al. 2010 [93]; ACSM 2010 [86]; Ainsworth et al. 2000 [87]).

For people with stroke these VO₂ 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 (Ivye et al. 2005 [95]). Low levels of cardiorespiratory fitness can increase the risk of recurrent stroke and other cardiometabolic diseases (Billinger et al. 2014 [91]).

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 VO₂ peak required to undertake a task is reduced. This can increase submaximal exercise tolerance and endurance (Billinger et al 2014 [91]). Even modest amounts of aerobic training can improve cardiorespiratory fitness by 10 to 15% (Marsden et al. 2013 [92]).

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 [90]). Inpatient therapy sessions are often below the intensity and duration recommended for providing a cardiovascular challenge (Polese et al. 2014 [96]; Kuys et al. 2006 [98]; Mackay-Lyons et al. 2002 [99]).
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 [91]). 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 [91]). Relative and absolute contraindications to exercise including for people after stroke have been outlined (American College of Sports Medicine 2018 [107]; Mead & van Wijck 2013 [91]). A graded exercise test with ECG monitoring may be included as part of the pre-exercise evaluation (Billinger et al. 2014 [91]).

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) 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$_2$ reserve or HR reserve; 55–80% HR$_{max}$; 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 [91]).

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 [90]).

Evidence To Decision

For stroke survivors, rehabilitation should include individually-tailored exercise interventions to improve cardiorespiratory fitness. (Saunders et al. 2020 [87])

**Benefits and harms**

Cardiorespiratory fitness training can improve cardiorespiratory fitness and walking ability (speed and capacity), and reduce disability (Saunders et al. 2020 [87]). Very few adverse events occur in cardiorespiratory fitness training studies (Saunders et al. 2020 [87]).

**Certainty of the Evidence**

There is moderate to high-quality evidence across the main outcomes. There is low certainty for quality of life and too few deaths to be certain about effect on mortality (Saunders et al. 2020 [87]).

**Preference and values**

No substantial different in preferences is expected. Cardiorespiratory training may enhance social support and the ability to perform daily tasks but will require motivation (Nicholson et al. 2013 [90]).

**Resources and other considerations**

Physical fitness training may improve the quality of life of stroke survivors for an acceptable additional cost (Collins et al...
Rationale
Cardiorespiratory fitness training after stroke can improve level of disability, walking speed and endurance and capacity of cardiorespiratory fitness 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 [92]) and are very sedentary (English et al. 2014 [94]), 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

<table>
<thead>
<tr>
<th>Population:</th>
<th>Adults with stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention:</td>
<td>Cardiorespiratory training</td>
</tr>
<tr>
<td>Comparator:</td>
<td>Control</td>
</tr>
</tbody>
</table>

Summary
A Cochrane review by Saunders et al (2020) [87] included 75 trials of fitness training interventions with a total of n=3017 people with stroke, most of whom were able to walk (32 studies, n=1631 for cardiorespiratory training; 20 studies, n=779 for resistance training; 23 studies, n=1207 for mixed training). To date, there have been very few studies that have measured outcomes after the end of the intervention period, meaning that the sustained benefits of fitness training is unknown. There have been too few deaths reported to assess the impact on fitness training on mortality.

Participants receiving cardiovascular fitness training had improved fitness, walking endurance and ability to perform ADLs based on moderate-certainty evidence. It is unclear what the impact on QOL is. The duration of interventions varied between four weeks and six months. Nine out of the 10 studies reported exercise intensity as 60% to 80% heart rate reserve, 50% to 85% maximum heart rate, or 30% to 50% maximum effort; rate of perceived exertion was reported as 13 to 15 in two of 10 studies.

While most trials included in the Cochrane review included only stroke survivors who were able to walk, a meta-analysis by Lloyd et al (2018)[103] specifically looked at stroke survivors who were non-ambulatory (33 studies [18 RCTs], n=910). Pooling of 3 studies (n=63) showed walking training can improve fitness by 2.7 mL/kg/min (95% CI 0.64 to 4.89). Cycling training did not show any significant difference based on 2 studies with strong heterogeneity (MD 1.84 ml/kg/min, 95% CI −1.06 to 4.73, I² = 73%). Another multicentre trial of 200 subacute (day 5-45) stroke patients with moderate to severe disability (Barthel Index <65) found aerobic fitness training via treadmill with bodyweight support at target heart rate for 25 minutes, 5 times weekly for 4 weeks in addition to usual therapy (Nave et al 2019 [101]). No difference compared to the control group who got relaxation therapy was found for ADL or walking speed (fitness levels was not a primary outcome). Exploratory secondary outcomes were not different apart form 6MWT at 3 months (mean

Implementation considerations.
There are no clinical indicators collected in the National Stroke Audit on fitness training, however, sites are asked about routine fitness training in the organisation survey.
adjusted difference 27m, 95% CI 0 to 54 m) which favoured aerobic fitness group. There were more adverse events noted in the fitness group including higher self reported falls, recurrent stroke (8 v 3), and readmission to acute care (14 v 5) although the reason for readmission was not clear. No serious adverse events occurred during intervention sessions.

Other reviews have looked at various parameters of fitness training. Boyne et al (2017)\[104\] included 20 studies mostly RCTs (15, n=598) for VO2 peak. Overall there was a positive effect of 2.2 mL/kg/min (95% CI 1.3 to 3.1). However there was moderate heterogeneity (I2=67%). Analysis found training intensity was correlated with effect which then reduced the heterogeneity (11 studies of moderate intensity: MD 1.6, 95% CI 0.8 to 2.4 versus 5 studies of high intensity: MD 3.8, 95% CI 2.4-5.2). Fitness levels at baseline was also found to strongly influence effects. The mode of training (seated/cycling vs walking) also impacted the effects with only walking training found to increase walking endurance and speed. Quality of the studies varied with 16/20 RCTs, 2 cross over trials and 2 non randomised studies. No sensitivity analysis was conducted based on trial quality and trials did not specifically keep treatment parameters apart from intensity consistent.

Galloway et al (2019)\[105\] included 9 studies (n=279) of which 4 were RCTs. Most studies were found to have high risk of bias. All included people who were ambulant and were more than 6 months post stroke. Studies that included training at higher intensities (72-85% HRR) demonstrated better improvements in fitness than training at lower intensities irrespective of session lengths or program length. However, length of program needs to ensure physiological adaptation (ie. >12 weeks).

Luo et al (2019)\[106\] included 17 studies (n=707). Eleven studies used treadmill walking and six used cycle ergometer. Sessions ranged from 25 to 50 mins, most occurring 3 times per week for 8-12 weeks. Pooling 15 studies (n = 646) showed fitness training improved VO2peak (SMD 0.56, 95% CI 0.40 to 0.72). No difference was found in subgroup analysis on time since stroke, intensity (< or > 70%), mode, duration of treatment. The effect size was consistent in sensitivity analysis related to quality of studies. Fourteen studies (n=581) also reported overall positive results of high intensity fitness training on walking endurance (6MWT SMD = 0.26, 95% CI 0.09 to 0.42). Subgroup analysis showed effect was found with higher intensities (>70% HRR) and only with treadmill training not cycle ergometer. Effects overall were robust related to quality of studies. There was no overall different in adverse events (falls, pain or skin injuries) based on 5 pooled studies.

Veldema et al (2020)\[102\] assessed the impact on cycling training. Three trials (n=183) compared training to no intervention with no overall effect as measured by load test on ergometer (SMD 0.38; 95% CI, -0.13 to 0.90). Similarly 11 studies (n=454) compared fitness training to other interventions with pooled effect on fitness outcomes (load test on ergometer, treadmill test, spirometer test, pulse oximeter test) with no significant difference and high heterogeneity (SMD 0.49; 95% CI, -0.04 to 0.98; I²=81%).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical fitness - peak VO₂ (ml/kg/min)</td>
<td>Measured by: Peak VO₂ (ml/kg/minute)</td>
<td>High better</td>
<td>Moderate</td>
<td>Cardiorespiratory training improves physical fitness - peak</td>
</tr>
<tr>
<td>Death</td>
<td>Relative risk 1 (CI 95% 0.99 - 1.01) Based on data from 1,631 patients in 32 studies. ¹ (Randomized controlled)</td>
<td></td>
<td>Low</td>
<td>There were too few people in these studies who died to determine whether cardiorespiratory training made a difference to case fatality</td>
</tr>
<tr>
<td>End of intervention</td>
<td></td>
<td></td>
<td>Cl 95%</td>
<td>Due to serious risk of bias ²</td>
</tr>
</tbody>
</table>

¹ Based on data from 1,631 patients in 32 studies.
² Due to serious risk of bias.
³ Due to serious risk of bias.
⁴ Due to serious risk of bias.
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</tr>
</thead>
<tbody>
<tr>
<td><strong>End of intervention</strong></td>
<td>Based on data from: 438 patients in 9 studies. <em>(Randomized controlled)</em></td>
<td>Difference: <strong>MD 33.41 higher</strong> <em>(CI 95% 19.04 higher - 47.78 higher)</em></td>
<td>High</td>
<td><strong>VO₂ (ml/kg/min)</strong></td>
</tr>
<tr>
<td><strong>Mobility - gait endurance</strong></td>
<td>Measured by: 6 Minute Walk Test (metres) High better Based on data from: 882 patients in 16 studies. <em>(Randomized controlled)</em></td>
<td>Difference: <strong>SMD 0.52 higher</strong> <em>(CI 95% 0.19 higher - 0.84 higher)</em></td>
<td>Moderate</td>
<td>Cardiorespiratory training improves walking endurance</td>
</tr>
<tr>
<td><strong>Disability - combined disability scales</strong></td>
<td>Measured by: Various: Functional Independence measurement, Barthel Index, Rivermead Mobility Index High better Based on data from: 462 patients in 8 studies. <em>(Randomized controlled)</em></td>
<td>Difference: <strong>SMD 0.52 higher</strong> <em>(CI 95% 0.19 higher - 0.84 higher)</em></td>
<td>Moderate Due to serious inconsistency</td>
<td>Cardiorespiratory training improves measures of ADL</td>
</tr>
<tr>
<td><strong>HRQoL</strong></td>
<td>Based on data from: 322 patients in 4 studies. <em>(Randomized controlled)</em></td>
<td>Four included studies (294 patients) examined HRQoL at end of intervention. Two used SF36 or SF12 and reported SMD 0.51 (0.20 to0.82). Two others used EuroQol EQ5D which was non-significantly improved MD 6.55 (-1.36 to 14.47)</td>
<td>Low Due to serious risk of bias, Due to serious inconsistency, Due to serious imprecision</td>
<td>We are uncertain whether cardiorespiratory training improves or worsen HRQoL</td>
</tr>
</tbody>
</table>

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.
4. Risk of bias: Serious. Risk mainly from one study (Jin 2013) which if removed effect remains.. Inconsistency: No serious. Indirectness: No serious. Imprecision: No serious. Publication bias: No serious.
5. Systematic review [87]. Baseline/comparator: Control arm of reference used for intervention.
7. Systematic review [87]. Baseline/comparator: Control arm of reference used for intervention.
8. Inconsistency: Serious. The magnitude of statistical heterogeneity was high, with I^2 61%. Indirectness: No serious. Imprecision: No serious. Publication bias: No serious.
9. Systematic review [87].
Visual field loss occurs in approximately 30–35% of stroke survivors (Stroke Foundation 2019 [7]; Stroke Foundation 2020 [8]), 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 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.

**Visual field loss**

Visual field loss occurs in approximately 30–35% of stroke survivors (Stroke Foundation 2019 [7]; Stroke Foundation 2020 [8]), 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).

**Practical Info**

**Before the first screening post-stroke:**

1. The stroke survivor’s current set of glasses should be tagged on masking tape on the arm of the glasses, with the "before the stroke date". This forms the baseline of vision prior to the stroke.
2. Attain the name and address of current eye provider, for the record. This history can be of value to the clinician delivering the first screening post-stroke.

**First screening of visual function post-stroke:**
Health professionals should understand that visual field loss can be very distressing for a patient.

All stroke survivors should have, at a minimum, a comprehensive screening and assessment of visual functions, using a standardised approach, to determine deficits of:

1. past eye history including diagnosed eye conditions
2. visual acuity, with glasses that may be used for reading or distant activities
3. eye movements to determine the presence of strabismus and motility deficits
4. visual fields (e.g. hemianopia).

The stroke survivor could be interviewed to gain an understanding of their average time spent on specific vision intensive applications prior to the stroke, such as:
   a. Time spent on a computer screen
   b. Time spent on a smart phone
   c. Time spent reading newspapers, magazines and books
   d. Time spent going to the movies (big screen)
   e. Time spent driving a vehicle during the day time
   f. Time spent driving a vehicle at night
   g. Time spent reading in the evening
   h. Time spent reading early morning

Screening results should be documented to ensure rehabilitation strategies accommodate deficits to visual function.

**Daily living with visual field loss post stroke:**

If light sensitivity becomes an issue, installing remote controlled solar shades can provide the stroke survivor with much needed additional comfort.

User training and safety needs to be provided for stroke survivors with visual field loss who are using a motorized wheelchair, and needs to cover the special needs of stroke survivors with visual field loss.
Activity limitations

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

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 [117])

**Practical Info**

- Give clear instructions so patient understands and agrees to treatment plans, progression, amount of practice and goals.
- Therapists should consider safety of patients with severe weakness.
- If a patient is to do unsupervised or semi-supervised practice, ensure they can communicate with staff as needed (e.g. the buzzer is near them, and patient/family know where staff are located, and how to contact them)
- 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.

**Evidence To Decision**

**Benefits and harms**

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 [117]. No harms were noted.

**Certainty of the Evidence**

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

**Preference and values**

No variation in preferences was found or expected.

**Resources and other considerations**

**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 [117]). 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) [117] 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) [115] 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) [121] 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) [118] 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) [119] 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 [122]; Chan et al 2015 [116]; Kim et al 2014 [120]). These small trials provide limited evidence for the effects of the interventions on sitting balance.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting while reaching beyond arms length</td>
<td>Measured by: Reach distance, sitting equilibrium test</td>
<td>Difference: SMD 2.47 higher (CI 95% 0.84 higher - 4.11 higher)</td>
<td>Moderate Due to serious imprecision, Due</td>
<td>Sitting balance probably improves sitting while reaching beyond arms</td>
</tr>
</tbody>
</table>
Standing up from sitting

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. 2016 [193]) and general interventions to improve sit-to-stand (Pollock et al. 2014 [126]). Other interventions such as biofeedback can be used to enhance training and improve standing up (Stanton et al. 2011 [136]).

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 or standing frame to enable extensor activity in the person’s affected leg, in preparation for standing from a high plinth or chair. Opportunities to practise standing up throughout the patient’s day should be explored.

If there is any leg paralysis, especially hemiplegia, it can be a shock for the patient to find that standing up needs to be learned with assistance. Depending upon the severity of the paralysis, it may be helpful for the patient's primary physician, physiotherapist and psychologist to collaborate on the timing, strategies and tactics for the patient to attempt sit-to-stand.
A primary fear can be falling. It can be helpful to:
1. Check in with the patient about how safe/secure they feel about their sit-to-stand
2. Avoid additional pressure by ensuring no family observers (if that is the patient’s preference)
3. Use attendant carers and/or professional staff that are well known to the patient
4. Show and explain the purpose of slings, steady-aids and other assistive equipment
5. Ensure small wins, which build confidence. eg. If moving to the edge of the bed is step one, practise this many times before step two of standing.

Evidence To Decision

Benefits and harms
Sit-to-stand training does not seem to increase falls, therefore benefits outweigh harms. A Cochrane review (French et al. 2016 [193]) found moderate benefits for repetitive task practice (SMD 0.35), with another Cochrane review (Pollock et al. 2014 [126]) in agreement.

Certainty of the Evidence
Quality of evidence was moderate to low.

Preference and values
No substantial variability in preference anticipated.

Resources and other considerations

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
Two Cochrane reviews (French et al. 2016 [193], Pollock et al. 2014 [126]) 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) [126] assessed interventions for improving sit-to-stand (STS) ability after stroke. 13 studies (n=603) were included. Interventions used in the trials included repetitive STS training, exercise programs that included STS training, sitting training and augmented feedback. Only 1 study with high risk of bias (N = 48) used ability to STS 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 STS and lateral symmetry, but
insufficient evidence to assess the benefits on standing independently.

Another Cochrane review by French et al (2016[193]) included seven studies (n=346) and found repetitive task-specific training has consistent, moderate benefits on the ability to stand from sitting (SMD 0.35, 95% CI 0.13 to 0.56).

Additional trials published since these reviews provide further evidence for the effectiveness of repetitive practice of sit to stand (STS). These trials compared slightly different ways of training STS and found:

- Compared with STS training with a symmetrical foot position, training STS with the affected leg positioned further back to the unaffected led to faster STS speed and better balance (Liu et al (2016)[129])
- Compared with the same amount of training with a therapist providing manual assistance, use of an assistive device (the neurogym device) to practise STS led to greater independence in STS, and shorter time to complete the 5 x STS measure (indicating better functional leg strength) (Joey and Marc (2020)[128]).

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ability to sit-to-stand independently</strong>&lt;br&gt;Until hospital discharge</td>
<td>Odds Ratio 4.86 (CI 95% 1.43 - 16.5) Based on data from 48 patients in 1 studies. (Randomized controlled) Follow up: Until hospital discharge.</td>
<td>304 per 1000&lt;br&gt;Difference: 376 more per 1000 (CI 95% 80 more - 574 more)</td>
<td>Low&lt;br&gt;Due to serious risk of bias, Due to serious imprecision, single study only</td>
<td>Repetitive task specific training may slightly improve the ability to sit to stand independently</td>
</tr>
<tr>
<td><strong>Falls (number of participants falling)</strong>&lt;br&gt;During intervention</td>
<td>Odds Ratio 0.75 (CI 95% 0.46 - 1.22) Based on data from 319 patients in 5 studies. (Randomized controlled) Follow up: 2 to 12 weeks.</td>
<td>386 per 1000&lt;br&gt;Difference: 66 fewer per 1000 (CI 95% 162 fewer - 48 more)</td>
<td>Moderate&lt;br&gt;Due to serious risk of bias</td>
<td>There is probably little or no difference in falls between those undergoing sit to stand training and controls.</td>
</tr>
<tr>
<td><strong>Time taken to stand or walk - Repetitive sit-to-stand interventions</strong>&lt;br&gt;Post-intervention</td>
<td>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 104 patients in 3 studies. (Randomized controlled) Follow up: 2 to 12 weeks of treatment.</td>
<td>SMD 0.57 lower (CI 95% 0.96 lower - 0.17 lower)</td>
<td>Moderate&lt;br&gt;Due to serious risk of bias and influence of a single low quality study (Cheng)</td>
<td>Repetitive sit-to-stand interventions probably decrease time taken to sit-to-stand or sit-to-walk</td>
</tr>
<tr>
<td><strong>Time taken to stand or walk - Exercise programme interventions</strong>&lt;br&gt;Post-intervention</td>
<td>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 231 patients in 4 studies. (Randomized controlled)</td>
<td>SMD 0.22 lower (CI 95% 0.56 lower - 0.12 higher)</td>
<td>Moderate&lt;br&gt;Due to serious risk of bias in 2 of 4 studies</td>
<td>Exercise programme interventions probably have little or no difference on time taken to sit-to-stand or sit-to-walk</td>
</tr>
<tr>
<td>Outcome Timeframe</td>
<td>Study results and measurements</td>
<td>Absolute effect estimates Control</td>
<td>Interventions for improving sit to stand</td>
<td>Certainty of the Evidence (Quality of evidence)</td>
</tr>
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</tr>
<tr>
<td>7 Critical</td>
<td>Follow up: 2 to 12 weeks of treatment.</td>
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</tr>
<tr>
<td>Lateral symmetry - Repetitive sit-to-stand interventions Post-intervention</td>
<td>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. (Randomized controlled) Follow up: 2 to 12 weeks of treatment.</td>
<td>Difference: SMD 0.62 higher (CI 95% 0.18 higher - 1.07 higher)</td>
<td>Low Due to serious risk of bias and influence of a single low-quality study (Cheng 2001), Due to serious imprecision</td>
<td>Only data from one study, Wide confidence intervals. Publication bias: No serious.</td>
</tr>
<tr>
<td>8 Critical</td>
<td>Time taken to sit-to-stand or sit-to-walk Follow-up after 6 months or more</td>
<td>Measured by: Time taken to sit-to-stand or sit-to-walk Lower better Based on data from: 141 patients in 3 studies. (Randomized controlled) Follow up: &gt; 6 months.</td>
<td>Difference: SMD 0.48 lower (CI 95% 0.88 lower - 0.08 lower)</td>
<td>Low Due to serious risk of bias; a single low quality study (Cheng) significantly influences overall confidence in pooled outcomes.</td>
</tr>
</tbody>
</table>

5. Systematic review [126]. Baseline/comparator: Control arm of reference used for intervention.
7. Systematic review [126]. Baseline/comparator: Control arm of reference used for intervention.
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[145]). Often after stroke, people regain their ability to stand however not always to full capacity, and with ongoing deficits in postural sway, weight transference, and maintaining their balance 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[145]).

Practical Info
Standing balance training should include practice of functional tasks or weight-shifting in standing as well as walking training that challenges balance. A range of approaches may additionally be used to achieve this, such as virtual reality training 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, but safety and prevention of falling is paramount at all times.

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

Evidence To Decision

**Benefits and harms**

The most recent Cochrane review by French et al (2016) [193] reported a small but statistically significant effect of repetitive task training on standing balance (SMD 0.24, 95% CI 0.07 to 0.42; 9 studies, n=504; moderate quality). There were few adverse events reported.

**Certainty of the Evidence**

The quality of the evidence for this recommendation is moderate.
Rationale

The most recent Cochrane review by French et al. (2016) [187] reported a small but statistically significant effect of repetitive task training on standing balance (SMD 0.24, 95% CI 0.07 to 0.42; 9 studies, n=504; moderate quality). Several other systematic reviews (van Duijnhoven et al. 2016 [145], [117] Hugues et al. 2019 [148]) have reported that exercise training that includes either practising functional tasks in standing, weight-shifting or walking training that challenges balance improves standing balance. Such training may also improve balance self-efficacy.

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

Resources and other considerations

No important issues with the recommended alternative

Clinical Question/ PICO

| Population:  | Adults with stroke |
| Intervention: | Repetitive task practice |
| Comparator:   | Control |

Summary

The Cochrane review by French et al (2016) [193] reported a statistically significant effect of repetitive task training on standing balance (SMD 0.24, CI 95% 0.07 to 0.42; 9 studies, n=504; moderate quality). There were few adverse events reported, however, lack of formal reporting in included studies means this finding is inconclusive.

French et al. (2016) also conducted subgroup analyses for dosage, time since stroke, and type of intervention with the outcome of lower limb function [193]. Eight trials of 561 participants providing more than 20 hours of task practice showed a small but statistically significant effect size: SMD 0.33, 95% CI 0.16 to 0.50, and 16 trials of 583 participants providing 20 hours training or less reported a moderate and statistically significant effect: SMD 0.39, 95% CI 0.07 to 0.71. However, the difference in effects between these subgroups was not statistically significant (p=0.77). Similarly, there was no evidence to suggest different effects when interventions were delivered within 15 days, between 16 and 6 months, or more than 6 months after stroke. In terms of type of training, mixed training has a moderate and statistically significant effect (SMD 0.42, 95% CI 0.17 to 0.67), whereas results of single task and whole therapy approach did not reach statistical significance. However, the sample size for single task (n=112) and whole therapy approach (n=138) was comparatively small and there was no statistically significant difference between the three subgroups (p=0.21).

A further review by Hugues et al. (2019) [148] on physical therapy compared to no therapy to improve balance included 37 studies (n=1721). Of these 16 studies (n=386) specifically investigated functional task-training and found a moderate effect on balance post-intervention (SMD 0.54, 95%CI 0.33-0.75; low certainty evidence) which appeared to be maintained at follow up (SMD 0.60, 95% CI 0.23 to 0.96; four studies). Functional task-training included training specifically for balance, walking, sit-to-stand, transfers, or activities of daily living. The most commonly used measure was the Berg Balance Scale. A further 11 studies (n=778) included functional task-training AND musculoskeletal (e.g. strength or active range of movement) or cardiopulmonary interventions (e.g. fitness training). Post-intervention improvements were found (SMD 0.57, 95% CI 0.33 to 0.81, 5 studies) which was non-significant at follow up (SMD 0.22, 95%CI -0.04 to 0.47). The comparisons of physical therapy compared to sham treatment or usual care was similar but with lower effect (SMD 0.39 functional training alone; SMD 0.37 in combination).

A review by Scrivener et al (2020) included 22 studies (n=1,192) that compared a bobath approach to task-specific training. Overall task specific training was superior to Bobath on combined measures of lower limb activity (SMD 0.48, 95%CI 0.01 to 0.95; 9 trials, n=487). Two studies (n=160) with outcomes related to sit-to-stand found no difference in approaches (SMD 0.12, 95%CI -0.36 to 0.59). There was evidence that task specific training was superior to Bobath for walking outcomes.
### 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) [145] 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) and included 43 studies. There was an overall positive benefit of exercise therapy on improving functional measures of balance including the Berg Balance Scale (28 studies, n = 985; MD 2.22, 95% CI 1.26 to 3.17), the Functional Reach Test and the Sensory Organisation Test, with both immediate (post-intervention) and sustained effects (1 to 5 months follow-up). However, this review pooled together studies that had both matched training and additional training compared to the control. 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 or multisensory training. Studies that included treadmill training with body-weight support or robotic training did not show significant improvements in balance.

A systematic review by Tang et al (2015) [146] included 19 RCTs (n=729) 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 to 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 0.68, 95% CI −0.33 to 1.69).

### Table: Outcome, Timeframe, Study results and measurements, Absolute effect estimates, Certainty of the Evidence, Plain text summary

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing balance/reach Post-intervention</td>
<td>Measured by: various scales e.g. Upright Equilibrium Index, Berg Balance Scale, and Functional Reach High better Based on data from: 504 patients in 9 studies. (Randomized controlled)</td>
<td>Difference: SMD 0.24 higher ( CI 95% 0.07 higher - 0.42 higher )</td>
<td>Moderate Due to serious risk of bias</td>
<td>Repetitive task practice probably improves standing balance/reach</td>
</tr>
<tr>
<td>Balance Post-intervention</td>
<td>Measured by: Berg Balance Scale</td>
<td>Difference: MD 2.22 higher</td>
<td>Moderate Due to serious</td>
<td>Exercise training probably improves</td>
</tr>
</tbody>
</table>

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1. **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.**
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.

### Evidence To Decision

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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</tr>
</thead>
<tbody>
<tr>
<td>7 Critical</td>
<td>High better</td>
<td></td>
<td>inconsistency (significant heterogeneity). Subgroup analyses showed significant improvements following balance, weight-shifting and gait training interventions but not high intensity aerobic training.</td>
<td>balance</td>
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<tr>
<td></td>
<td>Based on data from: 985 patients in 28 studies.</td>
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<td>(Randomized controlled)</td>
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<td>1.26 higher - 3.17 higher</td>
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<td></td>
<td>( CI 95% 1.26 higher - 3.17 higher )</td>
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</tbody>
</table>

1. Systematic review [145]. **Baseline/comparator:** Control arm of reference used for intervention.
2. **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^2: 52%.. **Indirectness:** No serious. **Imprecision:** No serious. **Publication bias:** No serious.

**Strong recommendation**

For stroke survivors who have difficulty standing, task-specific practice of standing balance should be provided (French et al. 2016 [193]). Strategies could include:

- practising functional tasks while standing (van Duijnhoven et al. 2016 [145]);
- walking training that includes challenge to standing balance (e.g. overground walking, obstacle courses) (van Duijnhoven et al. 2016 [145]);
- providing visual or auditory feedback (Veerbeek et al. 2014 [117]; Stanton et al. 2011 [136]).

Existing recommendation to be updated by draft updated recommendations.

### 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.

### Benefits and harms

Modest benefits have been reported in a large meta-analysis (Veerbeek et al. 2014 [117]) 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 [145]). 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 [139]), 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 [136]; Veerbeek et al. 2014 [117]). There are no reported harms of balance training.

### Rationale

Several systematic reviews (van Duijnhoven et al. 2016 [145]; Verbeek et al. 2014 [117], English et al. 2010 [126]) 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 [139]), 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) [152] 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) [117] 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) [145] 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 [140]; Youkhana et al 2016 [144])

### Clinical Question/ PICO

| Population: | Adults with stroke |
| Intervention: | Repetitive task practice |
| Comparator: | Control |

### Summary

The Cochrane review by French et al (2016) [193] reported a statistically significant effect of repetitive task training on
standing balance (SMD 0.24, CI 95% 0.07 to 0.42; 9 studies, n=504; moderate quality). There were few adverse events reported, however, lack of formal reporting in included studies means this finding is inconclusive.

French et al. (2016) also conducted subgroup analyses for dosage, time since stroke, and type of intervention with the outcome of lower limb function [193]. Eight trials of 561 participants providing more than 20 hours of task practice showed a small but statistically significant effect size: SMD 0.33, 95% CI 0.16 to 0.50, and 16 trials of 583 participants providing 20 hours training or less reported a moderate and statistically significant effect: SMD 0.39, 95% CI 0.07 to 0.71. However, the difference in effects between these subgroups was not statistically significant (p=0.77). Similarly, there was no evidence to suggest different effects when interventions were delivered within 15 days, between 16 and 6 months, or more than 6 months after stroke. In terms of type of training, mixed training has a moderate and statistically significant effect (SMD 0.42, 95% CI 0.17 to 0.67), whereas results of single task and whole therapy approach did not reach statistical significance. However, the sample size for single task (n=112) and whole therapy approach (n=138) was comparatively small and there was no statistically significant difference between the three subgroups (p=0.21).

A further review by Hugues et al. (2019) [148] on physical therapy compared to no therapy to improve balance included 37 studies (n=1721). Of these 16 studies (n=386) specifically investigated functional task-training and found a moderate effect on balance post-intervention (SMD 0.54, 95%CI 0.33-0.75; low certainty evidence) which appeared to be maintained at follow up (SMD 0.60, 95% CI 0.23 to 0.96; four studies). Functional task-training included training specifically for balance, walking, sit-to-stand, transfers, or activities of daily living. The most commonly used measure was the Berg Balance Scale. A further 11 studies (n=778) included functional task-training AND musculoskeletal (e.g. strength or active range of movement) or cardiopulmonary interventions (e.g. fitness training). Post-intervention improvements were found (SMD 0.57, 95% CI 0.33 to 0.81, 5 studies) which was non-significant at follow up (SMD 0.22, 95%CI -0.04 to 0.47). The comparisons of physical therapy compared to sham treatment or usual care was similar but with lower effect (SMD 0.39 functional training alone; SMD 0.37 in combination).

A review by Scrivener et al (2020) included 22 studies (n=1,192) that compared a bobath approach to task-specific training. Overall task specific training was superior to Bobath on combined measures of lower limb activity (SMD 0.48, 95%CI 0.01 to 0.95: 9 trials, n=487). Two studies (n=160) with outcomes related to sit-to-stand found no difference in approaches (SMD 0.12, 95%CI -0.36 to 0.59). There was evidence that task specific training was superior to Bobath for walking outcomes.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing balance/reach Post-intervention</td>
<td>Measured by: various scales e.g. Upright Equilibrium Index, Berg Balance Scale, and Functional Reach High better Based on data from: 504 patients in 9 studies. (Randomized controlled)</td>
<td><strong>Difference: SMD 0.24 higher</strong> ( CI 95% 0.07 higher - 0.42 higher )</td>
<td>Moderate Due to serious risk of bias ¹</td>
<td>Repetitive task practice probably improves standing balance/reach</td>
</tr>
</tbody>
</table>

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) [145] 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) and included 43 studies. There was an overall positive benefit of exercise therapy on improving functional measures of balance including the Berg Balance Scale (28 studies, n = 985; MD 2.22, 95% CI 1.26 to 3.17), the Functional Reach Test and the Sensory Organisation Test, with both immediate (post-intervention) and sustained effects (1 to 5 months follow-up). However, this review pooled together studies that had both matched training and additional training compared to the control. 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 or multisensory training. Studies that included treadmill training with body-weight support or robotic training did not show significant improvements in balance.

A systematic review by Tang et al (2015) [146] included 19 RCTs (n=729) 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 to 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 0.68, 95% CI −0.33 to 1.69).

### Outcome

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
</table>
| **Balance**  
Post-intervention | Measured by: Berg Balance Scale  
High better  
Based on data from: 985 patients in 28 studies.  
(Randomized controlled) | Difference: **MD 2.22 higher**  
(CI 95% 1.26 higher - 3.17 higher) | Moderate  
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.  
| Exercise training probably improves balance |

---

1. Systematic review [145]. **Baseline/comparator:** Control arm of reference used for intervention.
2. **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^2: 52%. **Indirectness:** **No serious.** **Imprecision:** **No serious.** **Publication bias:** No serious.
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) [139] (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)

<table>
<thead>
<tr>
<th>Outcome</th>
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<th>Plain text summary</th>
</tr>
</thead>
</table>
| Balance Post intervention | Measured by: Berg Improvement from baseline on Balance Scale  
Scale: 0-56  High better  
Based on data from: 40 patients in 1 studies. (Randomized controlled)  
Follow up: 3 weeks of treatment. | 5 points (Median)  
Difference: 7 higher CI 95% | Moderate  
The difference between groups was significant.  
Due to serious imprecision- low sample size and single study only. | 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). |
| Mobility Post intervention | Measured by: Improvement from baseline in six minute walk test (6MWT)  
High better  
Based on data from: 40 patients in 1 studies. (Randomized controlled)  
Follow up: 3 weeks of treatment. | 75 metres (Mean)  
Difference: MD 60 higher CI 95% | Moderate  
The difference between-groups was not significant. Due to serious imprecision- low sample size and single study only. | Balance training on a dynamic surface probably has little or no difference in mobility |
| ADL Post intervention | Measured by: Improvement from baseline in Barthel Index  
Scale: 0-20  High better  
Based on data from: 40 patients in 1 studies. (Randomized controlled)  
Follow up: 3 weeks of treatment. | 13 points (Mean)  
Difference: 7 higher CI 95% | Moderate  
The difference between groups was not significant. Due to serious imprecision- due to low sample size and single study only. | Balance training on a dynamic surface probably has little or no difference on ADLs |

1. Balance measured with Berg Balance Scale  
2. Primary study[139]. Baseline/comparator: Control arm of reference used for intervention[139].  
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, Low number of patients. **Publication bias: No serious.**

4. **Primary study**[139]. **Baseline/comparator:** Control arm of reference used for intervention[139].

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**[139]. **Baseline/comparator:** Control arm of reference used for intervention. **Supporting references:** [139],

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.**

### Clinical Question/ PICO

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

### Summary

An update of a previous systematic review by Stanton et al. (2017)[147] included 18 studies (n=429). Unlike the previous review (Stanton et al. 2011 [136]) only studies with higher quality (PEDro score >4/10) were included hence there were slightly less studies overall (18 vs 22). Biofeedback interventions used in the trials included giving visual or auditory feedback on ground reaction force using a force platform or foot sensor (14 studies), visual or auditory feedback on muscle activity using EMG (three studies), and joint position via an electrogoniometer (1 study). Visual feedback was used in seven trials; auditory in seven trials; and a combination of both in four trials. The mean duration of intervention sessions was 33 minutes (SD 17), occurring with a mean frequency of 3.7 days per week (SD 1.6), and a mean duration of 5.2 weeks (SD 2.2). Control groups mostly received usual therapy (presumably with therapist communication as feedback) and amount of practice was matched between intervention and control. The mean time after stroke ranged from < 1 month to 10 years, with 53% of the trials carried out <6 months after stroke and outcomes included measures of walking, standing balance and standing up. Pooling 17 studies (n=417) showed that lower limb activities were significantly improved following biofeedback (SMD 0.50, 95% CI 0.30 to 0.70).

Another systematic review with meta-analysis by Veerbeek et al. (2014) [117] 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.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
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<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower limb activity measures</td>
<td>Measured by: Various measures e.g. functional reach, Berg Balance Scale, walking speed, step/stride length</td>
<td>Difference: SMD 0.5 higher ( CI 95% 0.3 higher - 0.7 higher )</td>
<td>Moderate Due to risk of bias</td>
<td>Biofeedback improves lower limb activity measures</td>
</tr>
</tbody>
</table>
Virtual reality may be 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). Examples of interventions include treadmill training with virtual reality and training with a Wii Balance Board. Ideally, virtual reality training would focus on activities that relate to the stroke survivor's goals, in order to keep them motivated and engaged.

Some stroke survivors may experience motion sickness on using a treadmill.

As with all hard surfaced equipment, cleaning between patient use should involve a wipe down with alcohol wipes or spray.

While few adverse events are reported in the literature, care should be taken to minimise the risk of falls during balance training, and additional vigilance is required during telehealth balance training.

### Evidence To Decision

<table>
<thead>
<tr>
<th>Benefits and harms</th>
<th>Small net benefit, or little difference between alternatives</th>
</tr>
</thead>
</table>

### Outcome

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Study results and measurements</th>
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<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>High better Based on data from: 417 patients in 17 studies. (Randomized controlled) Follow up: 2-8 weeks.</td>
<td>Control, Biofeedback</td>
<td>No serious.</td>
<td></td>
</tr>
</tbody>
</table>
Several interventions have been found to improve balance. Most have been provided in addition to standard, active practice. Studies either reported no or very minor adverse events (e.g. dizziness, headache or pain) using virtual reality training (Laver et al. 2017 [191]).

Certainty of the Evidence

Certainty of evidence varies from low (robotics) to moderate (biofeedback, virtual reality therapy).

Preference and values

The working group felt people with stroke who have difficulty with balance would likely want the option to trial additional interventions to improve their balance.

Resources and other considerations

No literature to understand or describe the potential economic implications of this recommendation was identified. Not all sites will have access to some forms of VR training or robotics/electromechanically assisted training.

Rationale

Several meta-analysis (Corbetta et al. 2015 [134]; Laver et al. 2017 [191]; Mohammadi et al. 2019 [149]) consistently reported improved standing balance with the use of virtual reality training in addition to conventional therapy (including treadmill training with virtual reality and training with a Wii Balance Board). Similarly, visual or auditory feedback led to a moderate improvement (SMD 0.50) in balance (Stanton et al. 2017 [147]) and was also found to improve measures of postural sway (Veerbeek et al. 2014 [117]). Electromechanically assisted training was also found to improve balance (Zheng et al. 2019 [150]). Finally, several recent meta-analysis of water-based exercises reported a small improvement in balance when directly compared to land-based training (Chae et al. 2020 [154]; Iliescu et al. 2020 [151]; Nascimento et al. 2020 [153]). However, improvements were under the minimal clinically important difference thresholds reported for stroke and as such no recommendation has been made.

Clinical Question/ PICO

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

Summary

The meta-analysis by Corbetta et al. (2015)[134] found a positive effect of virtual reality (VR) training compared with a matched control intervention on the BBS (MD 2.1, 95% CI 1.8 to 2.5; 5 studies, n=130) and the Timed Up and Go (MD 2.3s, 95% CI 1.2 to 3.4s; 5 studies, n=114). A systematic review by Cheok et al (2015)[135] specifically examined the use of VR training provided through use of Wii Balance Board with Wii Fit software in addition to standard care (i.e. extra therapy time). This significantly improved TUG scores (SMD 0.81, 95%CI 0.29 to 1.33) but did not significantly improve other balance outcomes such as BBS or postural sway.

A Cochrane review by Laver et al (2017)[191] included 72 studies (n=2470). Three studies (n=72) comparing VR training to conventional therapy failed to show statistical improvements in balance (SMD 0.39, 95%CI -0.09 to 0.86) although numbers were small and confidence intervals wide. When VR training plus conventional therapy was compared to
conventional therapy alone there was a moderate effect on the BBS (SMD 0.59, 95%CI 0.28 to 0.90; 7 studies, n=173).

Another review by Mohammadi et al. (2019) [149] included 14 studies. Most of the studies were in people more than 6 months after stroke (11/14 studies). Pooling 13 studies (n=348), including both those with additional and matched intervention times, found improved balance based on the BBS (SMD 0.64, 95%CI 0.36 to 0.92).

There were very few adverse events reported.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Balance</td>
<td>Post-intervention (2-6 weeks of treatment)</td>
<td>Measured by: Berg Balance Scale Scale: 0-56 High better Based on data from: 130 patients in 5 studies. (Randomized controlled) Follow up: 2-6 weeks of treatment.</td>
<td>Difference: <strong>MD 2.1 higher</strong> ( CI 95% 1.8 higher - 2.5 higher )</td>
<td>Moderate Due to serious risk of bias. ²</td>
<td>Virtual reality based training probably improves balance</td>
</tr>
<tr>
<td>Mobility</td>
<td>Post-intervention (2-6 weeks of treatment)</td>
<td>Measured by: Timed Up and Go (seconds) Lower better Based on data from: 114 patients in 5 studies. (Randomized controlled) Follow up: 2-6 weeks of treatment.</td>
<td>Difference: <strong>MD 2.3 lower</strong> ( CI 95% 1.2 lower - 3.4 lower )</td>
<td>Low Due to serious risk of bias, Due to serious inconsistency ⁴</td>
<td>Virtual reality based training may improve mobility</td>
</tr>
<tr>
<td>Adverse events</td>
<td>Based on data from: 341 patients in 15 studies. (Randomized controlled) Follow up: up to 3 months.</td>
<td></td>
<td>Studies did not explicitly report adverse events, but some implied that they were monitored and would have been reported if they occurred.</td>
<td>Moderate Due to serious risk of bias ⁷</td>
<td>There were no reported adverse events</td>
</tr>
</tbody>
</table>

1. Systematic review [134]. **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. I²=0%. Indirectness: No serious. Imprecision: No serious. Publication bias: No serious. 
3. Systematic review [134]. **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 I²=84%. When 2 studies with large estimated effect were excluded heterogeneity reduced to I²= 0%. . Indirectness: No serious. Imprecision: No serious. Publication bias: No serious. 
5. There were no reported adverse events  
6. Systematic review Supporting references: [167].  
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.
Clinical Question/ PICO

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

**Summary**

An update of a previous systematic review by Stanton et al. (2017) included 18 studies (n=429). Unlike the previous review (Stanton et al. 2011) only studies with higher quality (PEDro score >4/10) were included hence there were slightly less studies overall (18 vs 22). Biofeedback interventions used in the trials included giving visual or auditory feedback on ground reaction force using a force platform or foot sensor (14 studies), visual or auditory feedback on muscle activity using EMG (three studies), and joint position via an electrogoniometer (1 study). Visual feedback was used in seven trials; auditory in seven trials; and a combination of both in four trials. The mean duration of intervention sessions was 33 minutes (SD 17), occurring with a mean frequency of 3.7 days per week (SD 1.6), and a mean duration of 5.2 weeks (SD 2.2). Control groups mostly received usual therapy (presumably with therapist communication as feedback) and amount of practice was matched between intervention and control. The mean time after stroke ranged from < 1 month to 10 years, with 53% of the trials carried out <6 months after stroke and outcomes included measures of walking, standing balance and standing up. Pooling 17 studies (n=417) showed that lower limb activities were significantly improved following biofeedback (SMD 0.50, 95% CI 0.30 to 0.70).

Another systematic review with meta-analysis by Veerbeek et al. (2014) 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.

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</tr>
</thead>
</table>
| Lower limb activity measures  
Post-intervention (3 to 8 weeks treatment)  
8 Critical | Measured by: Various measures e.g. functional reach, Berg Balance Scale, walking speed, step/stride length  
High better  
Based on data from: 417 patients in 17 studies.  
(Randomized controlled)  
Follow up: 2-8 weeks. | Difference: **SMD 0.5 higher**  
( CI 95% 0.3 higher - 0.7 higher )  
**Moderate**  
Due to risk of bias  
**Biofeedback improves lower limb activity measures** |

1. Various measures used for balance and walking  
2. Systematic review [147]. **Baseline/comparator:** Control arm of reference used for intervention.  
3. **Risk of bias:** Serious. **Inconsistency:** No serious. **Indirectness:** No serious. Differences between the outcomes of interest and those reported (e.g short-term/surrogate, not patient-important). **Imprecision:** No serious. **Publication bias:** No serious. The Systematic review used did not search for gray literature.

Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Mechanical-assisted therapy / robotics
Zheng et al. (2019) [150] included 31 studies (n=1249) that compared robot or mechanical-assisted therapy to usual care. The duration of intervention ranged from three to twelve weeks (Mean 6 weeks). 23 studies (n=929) included the Berg Balance Score which improved in the intervention arm (MD 4.64, 95%CI 3.22 to 6.06, P<0.01; I²>50%). Subgroup and sensitivity analysis was reassuring with no change to the effect for different types of robotic devices, if therapy was combine with other interventions, or by differences in duration and intensity.

<table>
<thead>
<tr>
<th>Outcomes/Timeframe</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Balance</strong> 1 End of intervention (3-12 weeks)</td>
<td>Measured by: Berg Balance Scale: 0-54 High better Based on data from: 929 patients in 23 studies. 2 (Randomized controlled) Follow up: mean 6 weeks.</td>
<td><strong>Difference:</strong> MD 4.64 higher (CI 95% 3.22 higher - 6.06 higher)</td>
<td>Low Due to serious risk of bias, Due to serious inconsistency 3</td>
<td>Mechanical-assisted therapy may improve balance</td>
</tr>
<tr>
<td>8 Critical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Berg Balance Scale
2. Systematic review [150]. **Baseline/comparator:** Control arm of reference used for intervention.
3. **Risk of bias:** Seriouse. Various major ROB. **Inconsistency:** Serious. The magnitude of statistical heterogeneity was high, with I²>50%. **Indirectness:** No serious. **Imprecision:** No serious. **Publication bias:** No serious.

### Clinical Question/ PICO

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

### Summary

Several systematic reviews have been published all noting a potentially small effect which is below minimal clinical important difference and potentially even below minimal detectable change values.

Chae et al. (2020)[154] included 11 studies (n=325). The intervention ranged from 2 to 5 sessions, 30–60 mins each per week over 2 to 8 weeks. Most (7/10) studies involved participants in the chronic phase with 3/10 in subacute phase. Hydrotherapy was added to land-based exercise in two studies, but mainly compared to land-based and matched for duration and intensity. Pooled data from 10 studies (n=264) found a small but statistically significant difference with hydrotherapy (Berg Balance Scale [BBS] MD 1.59 points, 95%CI 1.00 to 2.19). This is not considered a clinically meaningful difference. Subgroup analysis found this effect was only significant in the 7 chronic phase trials (BBS MD = 1.61, 95%CI 1.00 to 2.21), not a clinically meaningful difference but there was no significant effect of hydrotherapy compared to land-based therapy in the subacute studies (BBS MD = 1.04, 95%CI −2.62 to 4.70). No adverse events were reported in the water-based groups but two events were noted in the land-based group.
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 [134]). Examples of interventions include treadmill training with virtual reality and training with Wii Balance Board.

Some stroke survivors may experience motion sickness on using a treadmill.
### Evidence To Decision

#### Benefits and harms

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 [134]).

Studies either reported no adverse events (Corbetta et al. 2015 [134]) or minor adverse events only (e.g. dizziness, headache, pain or increases in spasticity) (Laver et al. 2015 [127]; Cheok et al. 2015 [135]).

#### Certainty of the Evidence

In the systematic review with meta-analysis (Corbetta et al. 2015 [134]) 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

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

#### Resources and other considerations

**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 [134]) 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)[134] found a positive effect of virtual reality (VR) training compared with a matched control intervention on the BBS (MD 2.1, 95% CI 1.8 to 2.5; 5 studies, n=130) and the Timed Up and Go (MD 2.3s, 95% CI 1.2 to 3.4s; 5 studies, n=114). A systematic review by Cheok et al (2015)[135] specifically examined the use of VR training provided through use of Wii Balance Board with Wii Fit software in addition to standard care (i.e. extra therapy time). This significantly improved TUG scores (SMD 0.81, 95%CI 0.29 to 1.33) but did not significantly improve other balance outcomes such as BBS or postural sway.

A Cochrane review by Laver et al (2017)[191] included 72 studies (n=2470). Three studies (n=72) comparing VR training to conventional therapy failed to show statistical improvements in balance (SMD 0.39, 95%CI -0.09 to 0.86) although numbers were small and confidence intervals wide. When VR training plus conventional therapy was compared to conventional therapy alone there was a moderate effect on the BBS (SMD 0.59, 95%CI 0.28 to 0.90; 7 studies, n=173).

Another review by Mohammadi et al. (2019)[149] included 14 studies. Most of the studies were in people more than 6 months after stroke (11/14 studies). Pooling 13 studies (n=348), including both those with additional and matched
intervention times, found improved balance based on the BBS (SMD 0.64, 95%CI 0.36 to 0.92).

There were very few adverse events reported.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
</table>
| **Balance**
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. ¹
(Randomized controlled)
Follow up: 2-6 weeks of treatment. | Difference: **MD 2.1 higher**
( CI 95% 1.8 higher - 2.5 higher ) | **Moderate**
Due to serious risk of bias. ² | Virtual reality based training probably improves balance |
| **Mobility**
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. ³
(Randomized controlled)
Follow up: 2-6 weeks of treatment. | Difference: **MD 2.3 lower**
( CI 95% 1.2 lower - 3.4 lower ) | **Low**
Due to serious risk of bias, Due to serious inconsistency ⁴ | Virtual reality based training may improve mobility |
| **Adverse events** ⁵ | Based on data from: 341 patients in 15 studies. ⁶
(Randomized controlled)
Follow up: up to 3 months. | Studies did not explicitly report adverse events, but some implied that they were monitored and would have been reported if they occurred. | **Moderate**
Due to serious risk of bias ⁷ | There were no reported adverse events |

1. Systematic review [134]. **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. **Indirectness**: No serious. **Imprecision**: No serious. **Publication bias**: No serious.
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**: [167],
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.
Walking difficulty is common after stroke, with 56% of patients reported as unable to mobilise independently on admission to hospital (Stroke Foundation 2019 [7]). 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 [193])

The following modalities may be used:

- Circuit class therapy (with a focus on overground walking practice) (Veerbeek et al. 2014 [117]);
- Treadmill training with or without body weight support (Mehrholz et al. 2014 [160]).

**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 [173], English et al. 2014 [94]), and overestimation of time spent on activity in therapy is common (Kaur et al. 2013 [32]). Therefore, objective measurement of time spent practising walking using activity monitors, or auditing therapy sessions using video analysis can be useful.

**Evidence To Decision**

**Benefits and harms**

Circuit class therapy improves walking endurance and independence with mobility following stroke (Veerbeek et al. 2014 [22]; English et al. 2010 [?]; van de Port et al. 2012 [159]).

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 (Mehrholz et al. 2014 [160]). 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 (Mehrholz et al. 2014 [160]).

**Certainty of the Evidence**

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
Rationale

One previous high-quality review (French et al. 2007 [142]) 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.

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.

Clinical Question/ PICO

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

Summary

A systematic review by Veerbeek et al (2014) [22] 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) [126] 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) [159] 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 [21]) 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.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
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<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking speed</td>
<td>Measured by: 10 metre walk test, Walking speed gait analysis High better Based on data from: 181 patients in 8 studies. (Randomized controlled)</td>
<td>Difference: <strong>SMD 0.48 higher ( CI 95% 0.01 lower - 0.96 higher )</strong></td>
<td>High</td>
<td>No statistically significant difference was found. Circuit training did not appear to improve walking speed.</td>
</tr>
</tbody>
</table>
### 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) [160] 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 [22]) 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

<table>
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<tr>
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</tr>
</thead>
</table>
| Walking endurance | Measured by: 6MWT - 6 minute walk test (walking distance)  
High better  
Based on data from: 208 patients in 8 studies. (Randomized controlled) | Difference: SMD 0.57 higher  
( CI 95% 0.3 higher - 0.84 higher ) | High | Pooling resulted in significant homogeneous positive SESs for walking distance. |
| Mobility | Measured by: RMI, TUG  
Lower better  
Based on data from: 259 patients in 8 studies. (Randomized controlled) | Difference: SMD 0.28 lower  
( CI 95% 0.04 lower - 0.52 lower ) | High | Pooling resulted in significant homogeneous positive SESs for walking ability. |
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 [161]; Charalambous et al 2013 [162]; Ada 2010 [163]).

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking Endurance</td>
<td>Measured by: Six Minute Walk Test High better Based on data from: 1,388 patients in 20 studies. (Randomized controlled)</td>
<td>Usual care Treadmill (with or without body weight support)</td>
<td>Moderate</td>
<td>Treadmill training (with or without body weight support) significantly improved walking endurance.</td>
</tr>
<tr>
<td>Walking Speed</td>
<td>Measured by: Walking speed High better Based on data from: 1,891 patients in 35 studies. (Randomized controlled)</td>
<td>Usual care Treadmill (with or without body weight support)</td>
<td>High</td>
<td>Treadmill training (with or without body weight support) significantly improved walking speed by a small to moderate amount.</td>
</tr>
</tbody>
</table>

**Clinical Question/ PICO**

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

**Summary**

A systematic review by Corbetta et al (2015) [167] 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 [168]; Laver et al 2015 [?]) 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...
Evidence To Decision

Benefits and harms

Virtual reality training improves walking speed following stroke (Corbetta et al. 2015 [167]; Rodrigues-Baroni et al. 2014 [168]), although the certainty of effect varies with different reviews (Laver et al. 2015 [?]).

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 with in combination with usual physiotherapy improves independence with mobility after stroke and had low incidence of harm (Mehrholz et al. 2013 [164]).

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

Cueing of cadence may improve walking speed after stroke (Nascimento et al. 2015 [165]).
Electrical stimulation when applied functionally may improve walking speed by a small amount (Howlett et al. 2015 [166]).

**Certainty of the Evidence**

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**

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

**Resources and other considerations**

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

**Summary**

Mehrholz et al (2013) [164] 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) [22] 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.
### Absolute effect estimates

<table>
<thead>
<tr>
<th><strong>Outcome</strong></th>
<th><strong>Study results and measurements</strong></th>
<th><strong>Absolute effect estimates</strong></th>
<th><strong>Certainty of the Evidence</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physiotherapy (or Electromechanical assisted gait training and physiotherapy)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>
| **Ability to walk independently** 1  
   **At end of intervention phase** | Odds Ratio 2.39  
   (CI 95% 1.67 - 3.43)  
   Based on data from 999 patients in 23 studies.  
   (Randomized controlled)  
   Follow up: Varied: 10 days to 8 weeks. | 446 per 1000  
   Difference: 212 more per 1000  
   (CI 95% 127 more - 288 more) | Moderate  
   Due to serious risk of bias 3 |
| **Adverse events - death (risk difference)** 4  
   **End of intervention** | 0  
   (CI 95% -0.02 - 0.02)  
   Based on data from 999 patients in 23 studies.  
   (Randomized controlled)  
   Follow up: Varied: 10 days to 8 weeks. | | High |
| **Walking speed** 6  
   **End of followup** | Measured by: Walking speed (m/s)  
   High better  
   Based on data from: 690 patients in 17 studies.  
   (Randomized controlled)  
   Follow up: Varied: 10 days to 8 weeks. | Difference: MD 0.04 higher  
   (CI 95% 0.03 lower - 0.11 higher) | Moderate |

### Clinical Question/ PICO

**Population:**  
Adults with stroke

---

1. Independent walking at the end of intervention phase, all electromechanical devices used
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.
6. Walking velocity (metres per second) at the end of followup
Intervention: Electrical stimulation
Comparator: Control (walking training alone)

Summary
A systematic review by Howlett et al (2015) [166] 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.

<table>
<thead>
<tr>
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<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking speed</td>
<td>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.</td>
<td>Difference: MD 0.08 higher (CI 95% 0.02 higher - 0.15 higher)</td>
<td>Moderate</td>
<td>FES significantly improves walking speed by a small amount (MD 0.08 m/s).</td>
</tr>
</tbody>
</table>

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.

Clinical Question/ PICO

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

Summary
Nascimento et al (2015) [165] 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.

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Walking speed</td>
<td>Measured by: Gait speed m/s</td>
<td></td>
<td>Low Due to serious</td>
<td>Cueing of cadence does appear to significantly</td>
</tr>
</tbody>
</table>
**Clinical Question/ PICO**

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

**Summary**

An update of a previous systematic review of randomised trials of biofeedback by Stanton et al (2017) [147] included 18 studies (n=429). Unlike the previous review (Stanton et al 2011 [134]), only studies with higher quality (PEDro score >4/10) were included hence there were slightly less studies overall (18 vs 22). Biofeedback interventions used in the trials included giving visual or auditory feedback on ground reaction force using a force platform or foot sensor (14 studies), visual or auditory feedback on muscle activity using EMG (three studies), and joint position via an electrogoniometer (1 study). Visual feedback was used in seven trials; auditory in seven trials; and a combination of both in four trials. The mean duration of intervention sessions was 33 minutes (SD 17), occurring with a mean frequency of 3.7 days per week (SD 1.6), and a mean duration of 5.2 weeks (SD 2.2). Control groups mostly received usual therapy (presumably with therapist communication as feedback) and amount of practice was matched between intervention and control. The mean time after stroke ranged from < 1 month to 10 years, with 53% of the trials carried out <6 months after stroke and outcomes included measures of walking, standing balance and standing up. Pooling 17 studies (n=417) a meta-analysis that pooled various standing and balance measures showed that lower limb activities were significantly improved following biofeedback (SMD 0.50, 95% CI 0.30 to 0.70). A systematic review of biofeedback interventions for improving lower limb activities after stroke included randomised trials (Stanton et al 2011 [134]). 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).

<table>
<thead>
<tr>
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<th>Plain text summary</th>
</tr>
</thead>
</table>
| Timeframe | Measures: various measures e.g. functional reach, Berg Balance Scale, walking speed, step/stride length  
Post-intervention (3 to 8 weeks) | Difference: MD 0.23 higher  
(95% CI 0.18 higher - 0.27 higher) | Moderate  
Due to risk of bias | Biofeedback (various modes) improves lower limb activity measures (including walking speed, stride length, base of support) |

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.
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.

Evidence To Decision

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Placebo or usual therapy</td>
<td>Joint position feedback</td>
<td>support, step length etc</td>
</tr>
<tr>
<td></td>
<td>High better</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on data from: 417 patients in 17 studies. ² (Randomized controlled) Follow up: 2-8 weeks.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Various measures e.g. functional reach, Berg Balance Scale, walking speed, step/stride length
2. Systematic review [147]. Baseline/comparator: Control arm of reference used for intervention.

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 [170])

Benefits and harms

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 [170]). No harms were reported (Tyson et al. 2013 [170]).

Certainty of the Evidence

The certainty of the effect estimates was moderate (Tyson et al. 2013 [170]).

Preference and values

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

<table>
<thead>
<tr>
<th>Population:</th>
<th>Adults with stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention:</td>
<td>Orthosis</td>
</tr>
<tr>
<td>Comparator:</td>
<td>No orthosis</td>
</tr>
</tbody>
</table>

Summary

A systematic review of randomised trials of ankle-foot orthosis included 13 randomised controlled trials with 334 total participants (Tyson et al 2013 [170]). 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) [22] 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.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking ability</td>
<td>Measured by: Functional Ambulation Categories High better Based on data from: 65 patients in 3 studies. (Randomized controlled) Follow up: 1 day.</td>
<td>Difference: SMD 1.34 higher ( CI 95% 0.95 higher - 1.72 higher )</td>
<td>Moderate Only included studies with low risk of bias, but no data reported.</td>
<td>The use of an orthosis probably improves walking ability.</td>
</tr>
<tr>
<td>Walking speed</td>
<td>Measured by: Walking speed (m/sec) High better Based on data from: 282 patients in 11 studies. (Randomized controlled) Follow up: 1 day.</td>
<td>Difference: MD 0.06 higher ( CI 95% 0.03 higher - 0.08 higher )</td>
<td>Moderate Only included studies with low risk of bias, but no data reported.</td>
<td>The use of an orthosis probably improves walking speed by a small amount.</td>
</tr>
</tbody>
</table>
Arm activity

Seventy-two percent of acute stroke patients have upper limb impairment on admission (Stroke Foundation 2020 [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 [193]).

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.

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.

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 [201]). There is no evidence for the use of restraint alone (Kwakkel et al. 2015 [201]). Likewise trunk restraint may also be incorporated into the active therapy sessions to achieve greater focus on task-specific practice (Zhang et al 2020 [206]; Wee et al. 2014 [190]).

Evidence To Decision

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 [197])

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 [197]).

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.
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 [197]). 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 [197]).

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.

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

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 [197]). 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 [197]).

Clinical Question/ PICO

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

Summary

Corbetta et al (2015) [197] is the most recent Cochrane review 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.

Etoom et al (2016) [224] identified 38 studies and pooled 36 studies (n=1473). Arm function was measured at level of impairment (e.g. Fugl-Meyer Assessment) or activity (Wolf Motor Function Test, Action Research Arm Test, Motor Activity Log). Overall there was a moderate effect size (SMD 0.56, 95%CI 0.30 to 0.81; high heterogeneity $I^2=79.8\%$).

Liu et al (2017) [213] included 16 trials in acute and sub-acute phase. Pooling 6 studies resulted in significant improvement in the Action Research Arm Test (MD 8.35, 95%CI 1.98 to 14.71; extremely high heterogeneity $I^2=94.1\%$). Motor Activity Log quality of movement was also significantly higher (MD 0.81, 95%CI 0.33 to 1.29; 4 studies; moderate heterogeniety $I^2=56.7\%$).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm Motor Function - Constraint</td>
<td>Measured by: Various e.g. Wolf Motor Function Test, Action Research Arm Test, Motor</td>
<td>Difference: <strong>SMD 1.04 higher</strong> ( CI 95% 0.31 lower - 2.4 higher )</td>
<td>Moderate: Due to serious risk of bias $^2$</td>
<td>Constraint induced movement therapy probably improves arm motor function</td>
</tr>
<tr>
<td>Outcome</td>
<td>Timeframe</td>
<td>Study results and measurements</td>
<td>Absolute effect estimates</td>
<td>Certainty of the Evidence</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Control</td>
<td>Constraint-induced movement therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effect Estimate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Difference: MD 0.65 higher (CI 95% 0.44 higher - 0.86 higher)</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Difference: MD 0.75 higher (CI 95% 0.44 higher - 1.05 higher)</td>
<td>Moderate Due to serious inconsistency</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Difference: MD 6.54 higher (CI 95% 1.2 lower - 14.28 higher)</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Difference: SMD 0.42 higher (CI 95% 0.04 higher - 0.79 higher)</td>
<td>High</td>
</tr>
</tbody>
</table>

1. Critical
2. Measured by: Motor Activity Log
3. High better
4. Based on data from: 865 patients in 22 studies. (Randomized controlled)
5. Follow up: 2 to 10 weeks of treatment.
6. Constraint induced movement therapy.
7. Measured by: Stroke Impact Scale
8. Functional
9. Based on data from: 113 patients in 4 studies. (Randomized controlled)
10. Follow up: 2 to 10 weeks of treatment.
11. Constraint induced movement therapy.
12. Constraint-induced
<table>
<thead>
<tr>
<th>Outcome</th>
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</tr>
</thead>
</table>
| Post intervention      | 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: SMD 0.24 higher  
( CI 95% 0.05 lower - 0.52 higher ) | Due to serious risk of bias 9  
movement therapy probably has little or no difference on disability post-intervention |
| Disability 3 to 6 month follow-up | 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: SMD 0.21 lower  
( CI 95% 0.57 lower - 0.16 higher ) | Moderate Due to serious risk of bias 10  
Constraint-induced movement therapy probably has little or no difference on disability at 3 to 6 month follow-up |
| Arm Motor Function - Constraint therapy versus usual care Post intervention | Measured by: Various e.g. Wolf Motor Function Test, Action Research Arm Test, Motor Assessment Scale High better Based on data from: 816 patients in 25 studies. (Randomized controlled) Follow up: 2 to 10 weeks of treatment. | Difference: SMD 0.31 higher  
( CI 95% 0.09 higher - 0.52 higher ) | Low Due to serious risk of bias, Due to serious inconsistency 12  
Constraint induced movement therapy may improve arm motor function compared to usual care |

2. **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.
4. **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.
6. **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.
7. Systematic review [197] with included studies: Dahl 2008, Lin 2009a, Wu 2007c. **Baseline/comparator:** Control arm of
reference used for intervention.


9. 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.


12. 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.

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. 2018 [184])

Evidence To Decision

Benefits and harms
Mechanically assisted arm training improved arm impairment measures and activities of daily living. (Mehrholz et al. 2018 [184]) There was no difference on measures of arm activity (Veerbeek et al. 2017 [217]; Chieng et al. 2020 [218]). There are no reported harms associated with the interventions.

Certainty of the Evidence
Quality of the evidence is moderate to high.

Preference and values
Patients are unlikely to have strong preferences for or against the use of mechanically assisted arm training.

Resources and other considerations

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.
There is evidence from recent studies that robotic therapy is less costly than conventional therapy in patients with severe impairment after stroke (Lo et al. 2019[202]). Evidence has been provided from a systematic review, whereby the cost of robotic stroke rehabilitation for lower and upper limbs was compared to usual care in five studies (pooled sample size n=213) conducted in four different countries (Germany, Italy, Mexico and United States of America). In four studies, the cost per patient in the robotic therapy arm was more than 50% less when compared to conventional therapy. Robotic therapy was more cost saving in patients with severe stroke due to these patients requiring more one-on-one therapist time if receiving conventional therapy. Robotic therapy was less costly if more patients were treated in a given time period. However, variability in the therapy dosage, types of robotic devices used, therapist costs and small sample sizes were sources of uncertainty for the economic outcomes.

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 45 trials (Mehrholz et al. 2018 [184]) found evidence that mechanically assisted arm training modestly improves arm impairment and activities of daily living, particularly when provided earlier (less than 3 months) after stroke. The strength of the evidence is moderate to high but there was variation in trial intensity, duration, and types of treatment 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 45 trials with 1619 total participants (Mehrholz et al. 2018 [184]). Meta-analysis showed significant improvements in activities of daily living (ADL) scores (SMD 0.31, 95% CI 0.09 to 0.52) as well as arm impairment and arm muscle strength. Effects were found for studies in acute and subacute phase (ADL SMD 0.4, 95%CI 0.1 to 0.7; 13 studies, n=523) but not during the chronic phase (ADL SMD 0.56, -0.23 to 1.35; 11 studies, n=425).

Veerbeek et al (2017) [217] identified 44 studies (n=1362) on robot-assisted therapy. Pooling 28 studies (n=884) found a very small improvement in arm impairment (Fugl-Meyer Assessment MD 2.62, 95%CI 1.48 to 3.76). No difference in measures of arm activity were found (SMD 0.04, 95%CI -0.12 to 0.19; 20 studies, n=682).

Chien et al (2020) [218] included 11 trials. No difference was found for measures of arm activity (SMD 0.01, 95%CI -0.28 to 0.3; 4 studies, n=219).

Chen et al (2020) [219] included 35 studies (n=2,241) of robot-assisted training. No significant improvement was found for measures of arm activity (SMD 0.109, 95%CI -0.07 to 0.28; moderate heterogeneity I²=54.6%; 26 studies, n=1557). Authors reported that robotic-assisted training was non-inferior to therapist led training based on pre-defined non-inferiority margins. This review included data from the RATULS trial (Rogers et al 2019 [288]) which compared robot-assisted training, enhanced functional training and usual care. There was no significant difference in arm activity between any of the groups at three months, however, the dose of therapy (45mins, 3 times per week for 12 weeks) is likely under the threshold needed to produce significant improvement.
<table>
<thead>
<tr>
<th>Outcome / Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptability: drop-outs during intervention period</td>
<td>Relative risk 1 (CI 95% 0.98 - 1.03) Based on data from 1,619 patients in 45 studies.</td>
<td>57 per 1000 56 per 1000</td>
<td>Moderate Due to serious risk of bias 6</td>
<td>Electromechanical and robotic assisted training has little or no difference on acceptability: drop-outs during intervention period</td>
</tr>
<tr>
<td>Activities of daily living End of intervention phase</td>
<td>Measured by: Various, e.g. Barthel Index, Functional Independence Measure High better Based on data from: 957 patients in 24 studies.</td>
<td>Difference: SMD 0.31 higher (CI 95% 0.09 higher - 0.52 higher)</td>
<td>High</td>
<td>Electromechanical and robot-assisted training slightly improves activities of daily living</td>
</tr>
<tr>
<td>Arm impairment End of intervention phase</td>
<td>Measured by: Fugl-Meyer score High better Based on data from: 1,452 patients in 41 studies.</td>
<td>Difference: SMD 0.32 higher (CI 95% 0.18 higher - 0.46 higher)</td>
<td>High</td>
<td>Electromechanical and robot-assisted training slightly improves arm impairment</td>
</tr>
</tbody>
</table>

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.

Evidence To Decision

<table>
<thead>
<tr>
<th>Benefits and harms</th>
<th>Small net benefit, or little difference between alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of wrist and hand orthoses have no effect on either range of motion of the wrist, or hand function (Tyson et al. 2011 [189]). Few adverse events were reported in the literature and tolerance was generally high.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certainty of the Evidence</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preference and values</th>
<th>Substantial variability is expected or uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splints can be uncomfortable to wear and carry a risk of pressure areas and other skin issues. Compliance may vary.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources and other considerations</th>
<th>Factor not considered</th>
</tr>
</thead>
</table>

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) [189] 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.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm function</td>
<td>Measured by: Motor Assessment Scale: 0-18 High better Based on data from: 91 patients in 2 studies. Follow up: 4 weeks of treatment.</td>
<td>Difference: MD 0.37 higher (CI 95% 0.19 lower - 0.93 higher)</td>
<td>Moderate Due to serious imprecision 2</td>
<td>Use of hand and wrist orthosis probably has little or no difference on arm function</td>
</tr>
<tr>
<td>Range of motion of the wrist</td>
<td>Measured by: Joint range of motion at the wrist Scale: 0-70 High better Based on data from: 121 patients in 3 studies. Follow up: 4 to 13 weeks of treatment.</td>
<td>Difference: MD 0.04 higher (CI 95% 5.21 lower - 5.3 higher)</td>
<td>High While sample sizes are small results are consistent in finding no effect 4</td>
<td>Use of hand and wrist orthosis has no effect on range of motion of the wrist</td>
</tr>
</tbody>
</table>

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.

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)

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.
Evidence To Decision

Benefits and harms

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. 2017 [244]). There were few reported adverse events and those that were reported were mild (Laver et al. 2017 [244]).

Certainty of the Evidence

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

Preference and values

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

Resources and other considerations

Factor not considered

Rationale

A Cochrane review (Laver et al. 2015 [?]) [ICE - should this be deleted?] 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

A Cochrane Review by Laver et al (2017) [244] found 10 studies (n=466) that measured ADL abilities within the 72 studies included in their review comparing virtual reality (VR) to conventional therapy. A small difference in ADL ability was found, favouring the intervention compared to same dose of conventional therapy (SMD 0.25) but in sensitivity analysis removing four studies at unclear or high risk of bias the results were smaller and non-significant (SMD 0.20, 95% CI -0.01 to 0.40).

However, when comparing the addition of VR plus routine therapy there was a moderate effect size (SMD 0.44, 95% CI 0.11 to 0.76; low certainty evidence) for improving ADL ability based on eight studies (n=153). Sensitivity analysis of two trials deemed at low risk of bias found stronger effects but wider confidence intervals (SMD 0.92, 95% CI 0.04 to 1.81). However, there was no evidence that effects were sustained long-term. This intervention is relatively safe.
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.

Evidence To Decision

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ADL 1</td>
<td>Measured by: Various e.g. Functional Independence Measure, Barthel Index High better Based on data from: 466 patients in 10 studies. (Randomized controlled)</td>
<td>Difference: SMD 0.25 higher (Cl 95% 0.06 higher - 0.43 higher)</td>
<td>Moderate Due to serious risk of bias in some studies 3</td>
<td>Virtual reality probably improves ADL slightly</td>
</tr>
</tbody>
</table>

1. Measures of ADL, such as Barthel Index, Functional Independence Measure, and modified Rankin Scale
2. Systematic review [244]. Baseline/comparator: Control arm of reference used for intervention.
3. Risk of bias: Serious. Risk of bias was unclear in a number of studies. Inconsistency: No serious. Indirectness: No serious. Imprecision: No serious. small total population size. Publication bias: No serious.

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 [166]; Yang et al. 2019 [227])

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.

Evidence To Decision

Benefits and harms

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 [166]).

Certainty of the Evidence

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

Patients are unlikely to have strong preferences in relation to electrical stimulation. Some patients may dislike or refuse the stimulation.
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. There is some conflicting evidence but electrical stimulation may also improve arm activity.

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) [166] 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).

Monte-Silva et al (2019)[216] included 26 studies (n=782). EMG triggered/controlled neuromuscular electrical stimulation improved arm impairment but there was no evidence on measures of activity (SMD 0.20, 95%CI -0.03 to 0.42; 19 studies, n=562) or participation (SMD 0.44, -0.08 to 0.96; 6 studies, n=208).

Yang et al (2019)[227] included 59 studies of which 48 contributed to the meta-analysis comparing electrical stimulation to placebo/control. Studies were grouped into three types of electrical stimulation (sensory, cyclic, and EMG-triggered electrical stimulation). There was no difference found between these three types of intervention. Electrical stimulation had moderate to large effects both immediately after treatment and at follow up on arm activity (Action Research Arm Test post treatment SMD 0.70, 95%CI 0.39 to 1.02; 10 studies, n=411; moderate heterogeneity $I^2=56\%$). At follow up SMD 0.93, 95%CI 0.34 to 1.52; 8 studies, n=289; high heterogeneity $I^2=81\%$). But it appears the included studies were a mix of active and passive approaches.

### Outcome Timeframe
<table>
<thead>
<tr>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
</table>
| **Upper limb activity**  
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, | **Difference: SMD 0.69 higher**  
( CI 95% 0.33 higher - 1.05 higher ) | **Low**  
Due to serious inconsistency, Due to serious imprecision, Due to serious risk of bias, Due to | Electrical stimulation provided with motor training may improve upper limb activity |
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.

Similarly action observation requires assistance to set up the person to observe the activity either directly in person or via recording. Feedback on what to look for and steps to undertake before practice are needed and again the capacity of the patient to participate in the intervention needs to be considered.

Evidence To Decision

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper Extremity Function Test and Wolf Motor Function Test</td>
<td>High better</td>
<td>Serious imprecision 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on data from: 192 patients in 8 studies. (Randomized controlled) Follow up: 2 to 12 weeks of treatment.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

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. (Barclay-Goddard et al. 2020 [186]; Borges et al. 2018 [204])

**Benefits and harms**

Mental practice or similar strategies (e.g. action observation) appear to improve arm activity. (Barclay-Goddard et al. 2020 [186]; Borges et al. 2018 [204]). There are no reported harms.

**Certainty of the Evidence**

Moderate
Several systematic reviews have shown consistent moderate effects for the use of mental imagery to improve arm activity. [185] 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. Action observation has a similar positive effect on arm function.

Outcomes were rated as moderate certainty with some outcomes of low certainty.

Preference and values
Some patients will not be able or willing to learn how to do mental practice.

Resources and other considerations

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

Rationale

Several systematic reviews have shown consistent moderate effects for the use of mental imagery to improve arm activity. [185] 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. Action observation has a similar positive effect on arm function.

Clinical Question/ PICO

Population: Adults with stroke
Intervention: Mental practice in addition to other treatment
Comparator: Other treatment

Summary

Barclay-Goddard et al (2020)[186] included 25 studies (n=676). Pooling 15 studies (n=397) found mental practice in combination with other treatment improved arm activity compared to other treatment alone (SMD 0.66, 95%CI 0.39 to 0.94; moderate certainty of evidence). Similarly impairment level outcomes were improved (SMD 0.59, 95%CI 0.30 to 0.87; moderate certainty of evidence). Mental practice was not found to be different to conventional treatment on measures of arm impairment (SMD 0.34, 95% CI -0.33 to 1.00; 3 studies, n=50; low certainty evidence). Subgroup analyses of time post stroke, dosage, or comparison type for the mental practice in combination with other rehabilitation treatment showed no differences. No outcomes for economics or adverse events were found.

Another Cochrane review by Borges et al (2018)[204] included 12 studies (n=478) and found action observation improved measures of arm function (SMD 0.36, 95%CI 0.13 to 0.60; 8 studies, n=314; low-quality evidence), improved hand function (Box and Block test MD 2.90, 95% CI 1.13 to 4.66; 3 studies, n=132; moderate-quality evidence), and improved ADL (SMD 0.86, 95% CI 0.11 to 1.61; 4 studies, n=226; low-quality evidence).

Results are similar for other reviews. Stockley et al (2020)[221] included 15 trials (n=486) and pooled 12 studies (n=328) in analysis which found moderate improvements in measures of arm activity (SMD 0.60, 95%CI 0.32 to 0.88). Subgroup analysis suggested mental practice was most effective within first 3 months and for those with more severe arm deficits. Song et al (2019)[203] included 12 studies (n=268) and found improvement in Action Research Arm Test [ARAT] (MD 4.09, 95%CI 1.99 to 6.20) and impairment using the Fugl-Meyer assessment (MD 2.07, 95%CI 1.24 to 2.91). Guerra et al (2017)[205] found 21 studies related to arm activity and reported motor imagery improved ARAT scores (MD 4.80, 95%CI 2.47 to 7.13, four trials) and combined scores of motor function (SMD 0.36, 95%CI, 0.16 to 0.55; 11 studies). Kho et al (2014) [185] found mental practice in addition to other therapy lead to improvement in arm function (MD 6.8 for Action Research Arm Test; 5 RCTs and 1 CCT). Braun et al (2013) [169] 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, Verbeeck et al (2014) [22] 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).
Practical Info

In the trials, mirror therapy was provided three to seven times a week, between 15 and 60 minutes for each session for two to eight weeks (on average five times a week, 30 minutes a session for four weeks). (Thieme et al. 2018 [188])

Based on the trials specific to upper limb included in the Cochrane review mirror therapy protocols should consider:

- use of a large mirror rather than a small mirror
- unilateral practice is better than bilateral execution
- Manipulation of objects during practice (compared to representation of body positions) did not lead to greater effect. (Morkisch et al 2019 [208])

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.

Evidence To Decision

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm activity measures</td>
<td>Measured by: Action Research Arm Test or Arm Functional Test High better Based on data from: 397 patients in 15 studies. (Randomized controlled) Follow up: 3 to 12 weeks of treatment.</td>
<td>Difference: SMD 0.66 higher ( CI 95% 0.39 higher - 0.94 higher )</td>
<td>Moderate Due to serious risk of bias 2</td>
<td>Mental practice in addition to other treatment probably improves arm activity</td>
</tr>
</tbody>
</table>


Updated evidence, no change in recommendation

For stroke survivors with mild to moderate weakness, mirror therapy may be used as an adjunct to routine therapy to improve arm function after stroke. (Thieme et al. 2018 [188])

Benefits and harms

There are no reported adverse events associated with mirror therapy (Thieme et al. 2018 [188]). 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. 2018 [188]).

Certainty of the Evidence

Most trials included in the meta-analysis were of high quality.
Preference and values
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
Resources considerations
No literature to understand or describe the potential economic implications of this recommendation was identified.

Rationale
A Cochrane review involved 31 trials specifically focused on arm function (Theime et al. 2018 [188]) and found moderate effects for mirror therapy improving measures of arm activity and ADL. There was no overall difference in effects when mirror therapy was used in people in the subacute or chronic stage post-stroke.

Clinical Question/ PICO
Population: Adults with stroke
Intervention: Mirror therapy for improving motor function after stroke
Comparator: All other interventions

Summary
A Cochrane review by Thieme et al 2018 [188] included 62 studies (n=1982) comparing mirror therapy with other interventions. Mirror therapy significantly improved arm motor function (SMD 0.46, 95%CI 0.23 to 0.69; 31 studies, n=1048; moderate certainty evidence). Mirror therapy also improved ADL (SMD 0.48, 95%CI 0.30 to 0.65; 28 studies, n=898; moderate certainty evidence).

Saavedra-Garcia et al (2021)[220] included 8 studies of which 7 (n=314) were pooled that compared mirror therapy plus electrical stimulation to conventional care or individual therapy. Results were mixed with no difference on arm motor function (using the Fugl-Meyer Assessment) or activity (Box and Block test) but there was improvements in Action Research Arm Test (MD 3.54, 95%CI 0.18 to 6.90). The quality of the evidence was rated as high overall by the authors.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Arm activity</strong></td>
<td><strong>End of intervention</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Critical</td>
<td>Measured by: Various (e.g., ARAT, WMFT, MAS, BBT)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>High better based on data from: 1,048 patients in 31 studies. 1 (Randomized controlled)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Follow up: 2 to 6 weeks of treatment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference: SMD 0.46 higher ( CI 95% 0.23 higher - 0.69 higher )</td>
<td></td>
<td>Moderate 2</td>
<td>Mirror therapy probably improves upper limb motor function</td>
</tr>
</tbody>
</table>

1. Randomized controlled study.
### Evidence To Decision

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activities of Daily Living</strong></td>
<td>Measured by: Functional Independence Measure, Barthel Index High better Based on data from: 622 patients in 19 studies. (Randomized controlled) Follow up: 2 to 6 weeks of treatment.</td>
<td>Difference: <strong>SMD 0.48 higher</strong> (CI 95% 0.3 higher - 0.65 higher)</td>
<td>Moderate 3</td>
<td>Mirror therapy probably improves activities of daily living</td>
</tr>
</tbody>
</table>

1. Systematic review [188]. **Baseline/comparator:** Control arm of reference used for intervention.
2. **Inconsistency:** No serious. **Indirectness:** No serious. **Imprecision:** No serious. Low number of patients. **Publication bias:** No serious.
3. **Inconsistency:** No serious. **Indirectness:** No serious. **Imprecision:** No serious. Low number of patients. **Publication bias:** No serious.

### 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 [193])

### Practical Info

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

Trunk restraint in addition to task-specific practice may be useful to focus practice efforts in the early (<6 months) stages of recovery (Zhang et al 2020 [206]).

### Evidence To Decision

**Benefits and harms**

A Cochrane review by French et al. (2016 [193]) found small but consistent benefits for repetitive task-specific training for improving arm and hand function. Few adverse events have been reported.

**Certainty of the Evidence**

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

**Preference and values**

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

A recent Cochrane review (French et al. 2016 [193]) 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.

Clinical Question/ PICO

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

Summary

Zhang et al (2020) [206] identified 10 studies. Pooling nine studies (n = 255) which involved trunk restraint added to task training improved Motor Activity Log (amount MD 0.39, 95% CI 0.25 to 0.54; and quality of movement MD 0.45, 95%CI, 0.27 to 0.63; six studies, n=143), improved scores on the Actional Research Arm test (MD 4.51, 95%CI 2.49 to 6.54; 3 trials, n=81) and improved ADL (SMD 0.98, 95%CI, 0.19 to 3.21; 5 studies, n=163). Subgroup analysis found trials in subacute stage improved outcomes whereas, trials in chronic phase (>6months) had no significant benefits.

Wee et al (2014) [190] included 6 randomised trials (n=187). All trials were rated 6 or higher on the PEDro scale. Three 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.

Overall controlling trunk to focus on isolating arm practice should be considered alongside interventions for repetitive task practice.
### Clinical Question/ PICO

**Population:** Adults with stroke  
**Intervention:** Task specific practice  
**Comparator:** Control

### Summary

A Cochrane systematic review by French et al. (2016) pooled results from interventions of repetitive task training [193]. There was low-quality evidence of improvement in arm and hand function. Effects remained statistically significant up to 6 months post intervention (SMD 0.92, 95% CI 0.58 - 1.26) but not between 6 to 12 months. There were few adverse events reported, however, lack of formal reporting in included studies means this finding is inconclusive. Treatment effects do not appear to be modified by duration of task practice, type of intervention, or time since stroke. On the other hand, the amount and heterogeneity of evidence did not allow for subgroup analysis of the optimal delivery methods, intensity (measured as numbers of repetitions), and patients’ pre-intervention disability level.

da Silva et al (2020)[207] included 36 studies (n=814) involving task-specific practice plus stimulation priming via brain stimulation (17 studies), sensory priming (12 studies), movement priming (4 studies), or action observation priming (3 studies). All studies were >6 months after stroke onset. Sensory priming increased scores for the Action Research Arm Test (MD 7.47, 95%CI 4.52 to 10.42; 2 studies, n=56). Other activity measures were mixed but all were based on very small patient/study numbers and further robust evidence is needed.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Practice without trunk restraint</td>
<td>Practice with trunk restraint</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>Due to serious risk of bias from trials of low numbers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Critical</td>
<td>patients in 6 studies. (Randomized controlled) Follow up: 1 day to 5 weeks of treatment.</td>
<td>Measured by: Motor Activity Log - Quality of movement High better Based on data from: 143 patients in 6 studies. (Randomized controlled) Follow up: 1 day to 5 weeks of treatment.</td>
<td>Difference: MD 0.45 higher ( CI 95% 0.27 higher - 0.63 higher )</td>
<td>Low</td>
<td>Practice with trunk restraint may increase self reported use (motor activity log quality of movement)</td>
</tr>
</tbody>
</table>
### Outcome Timeframe | Study results and measurements | Absolute effect estimates | Certainty of the Evidence | Plain text summary
--- | --- | --- | --- | ---
Arm function | Measured by: Various (ARAT, WMFT, MAS, BBT, FTHUE, SMGA) High better Based on data from: 749 patients in 11 studies. (Randomized controlled) | Difference: SMD 0.25 higher (CI 95% 0.01 higher - 0.49 higher) | Low Due to serious risk of bias, Due to serious inconsistency | Task specific practice may improve arm function
end of treatment | 7 Critical | | |
Hand function | Measured by: Various (9HPT, 10HPT & MAS) High better Based on data from: 619 patients in 8 studies. (Randomized controlled) | Difference: SMD 0.25 higher (CI 95% 0 higher - 0.51 higher) | Low Due to serious risk of bias, Due to serious inconsistency | Task specific practice may improve hand function
end of treatment | 7 Critical | | |
Both repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS) are safe interventions (Elsner et al. 2016 [238]; Hao et al. 2013 [180]). Adverse events are rare and transient. There is little evidence of the beneficial effects of brain stimulation on arm activity.

**Certainty of the Evidence**

The quality of the evidence is moderate.

**Preference and values**

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

**Resources and other considerations**

No cost effectiveness studies were identified. Brain stimulation is not readily available in clinical practice.

**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 activity. Two Cochrane reviews found no significant benefit of either tDCS (Elsner et al. 2020 [176]) or rTMS (Hao et al. 2013 [180]) on arm motor function. However, there may be beneficial effects on measures of impairment and ADL but equipment is not readily available in clinical practice and so brain stimulation is most relevant within a research framework.

**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 67 trials with 1729 total participants (Elsner et al 2020 [176]). tDCS compared to sham stimulation or passive control reported improvements in activities of daily living (ADL) at the end of the intervention (SMD 0.24, 95% CI 0.03 to 0.44; 19 studies, n=686) along with the end of follow-up (SMD 0.31, 95% CI 0.01 to 0.62; 6 studies, n=269). However, neither of these effects remained significant when analysis was restricted to studies with adequate allocation concealment, suggesting a high risk of bias. There was no significant effects on arm activity at the end of intervention (SMD 0.17, 95% CI -0.05 to 0.38; 24 studies, n=792; moderate-quality evidence) or after follow-up (SMD -0.00, 95% CI -0.39 to 0.39; 5 studies, n=211; moderate-quality evidence). There was no significant difference in adverse events or drop outs (RR 1.25, 95% CI 0.74 to 2.13; 47 studies, n=1330; moderate-quality evidence).

Marquez et al (2015) [179] 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, 95%CI -0.25 to 0.31; cathodal: SMD 0.39, 95%CI -0.05 to 0.82; bihemispheric: SMD 0.24, 95%CI -0.3 to 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, 95%CI 0.09 to 0.80) but not those with subacute stroke (SMD 0.01, 95%CI -0.39 to 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, 95%CI 0.05 to 0.70) but not those with severe impairments (SMD - 0.05, 95%CI -0.38 to 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.

Tedesco et al (2016) pooled results of 9 studies of tDCS in combination with therapy but revealed no significant benefit of tDCS.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dropouts, adverse events and deaths (risk difference) During intervention period (3 months)</td>
<td>Relative risk 1.25 (CI 95% 0.74 - 2.13) Based on data from 1,330 patients in 47 studies. Follow up: Intervention completion, 3 months.</td>
<td>34 per 1000 42 per 1000</td>
<td>Moderate</td>
<td>tDCS poses low risk to people with stroke</td>
</tr>
<tr>
<td>Upper extremity function at the end of the intervention period Up to 6 weeks of treatment</td>
<td>Measured by: Various - ARAT, JTT, FM-UE, NHPT High better Based on data from: 792 patients in 24 studies. Follow up: Up to 6 weeks of treatment.</td>
<td>Difference: SMD 0.17 higher (CI 95% 0.05 lower - 0.38 higher)</td>
<td>Moderate</td>
<td>tDCS may have little or no difference on upper extremity function at the end of the intervention period</td>
</tr>
<tr>
<td>Upper extremity function to the end of follow-up At least 3 months post intervention</td>
<td>Measured by: Various - ARAT, JTT, FM-UE, NHPT High better Based on data from: 211 patients in 5 studies. Follow up: at least 3 months.</td>
<td>Difference: SMD 0 higher (CI 95% 0.39 lower - 0.39 higher)</td>
<td>Moderate</td>
<td>tDCS may have little or no difference on upper extremity function by the end of follow-up</td>
</tr>
</tbody>
</table>

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 are were not pooled with these results.


Clinical Question/ PICO

Population: Adults with stroke

Intervention: Repetitive transcranial magnetic stimulation

Comparator: Usual care

Summary

A Cochrane review of trials of rTMS included 19 trials with a total of 588 participants (Hao et al 2013 [180]). 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 (MD 0.51, 95% CI -0.99 to 2.01).

van Lieshout et al (2019)[209] included 38 studies (n=1,074). Repetitive transcranial magnetic stimulation (rTMS) improved measures of impairment (SMD 0.43, 95%CI 0.21 to 0.65; moderate heterogeneity (I²=60%). However, there was no difference in arm activity measures (SMD 0.17, 95%CI -0.009 to 0.44). Early (<1 month) treatment may lead to better outcomes compared to subacute and chronic phases based on the FMugl-Meyer arm scale. Subgroup analysis found effect sizes were largest for studies with >10 number of treatment sessions but there was no difference found for rTMS frequency (high/low) or studies that included additional therapy vs rTMS alone.

Xiang et al (2019)[210] included 42 studies (n=1,168) involving the upper and lower limb. ADL was found to improve significantly (SMD 0.82, 95%CI 0.59 to 1.05; 7 studies, n=370). Motor function was also improved (SMD 0.50) but was a mix of impairment and activity scales and it is unclear the effect on activity alone. O'Brien et al (2018)[211] included 22 studies (n=351) of non-invasive brain stimulation specifically assessing hand function. Based on 11 comparisons rTMS may improve hand activity (hedges’ g 0.46, 95%CI 0.00 to 0.92) but in studies at low risk of bias the result was non-significant (hedges’ g 0.08, 95%CI -0.25 to 0.41; six comparisons). Zhang et al (2017)[212] included 22 studies of low-frequency rTMS. Pooling 10 studies (n=299) found a small effect on measures of arm activity directly after treatment (SMD 0.32, 95%CI 0.09 to 0.55) which was no longer significant after 1 month or more follow up (SMD 0.14, 95%CI -0.22 to 0.49).

Overall the evidence demonstrates rTMS may improve measures of impairment but does not appear to improve measures of arm activity.

<table>
<thead>
<tr>
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<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm activity</td>
<td>Post intervention</td>
<td>Measured by: Jebsen Taylor Test, Action Research Arm Test, and Wolf Motor Function Test.</td>
<td>Usual effect estimates</td>
<td>rTMS</td>
<td>Moderate Due to serious inconsistency, Due to serious risk of bias</td>
</tr>
<tr>
<td>6 Important</td>
<td></td>
<td>Difference: SMD 0.17 higher</td>
<td>( CI 95% 0.09 lower - 0.44 higher )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. (Randomized controlled)
<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Usual care rTMS</td>
<td></td>
<td>Follow up: Post intervention.</td>
</tr>
</tbody>
</table>

1. Systematic review [209]. **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. **Inconsistency:** Serious. The magnitude of statistical heterogeneity was high, with $I^2:49\%$. The direction of the effect is not consistent between the included studies. **Indirectness:** No serious. **Imprecision:** No serious. Wide confidence intervals. **Publication bias:** No serious.
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 focuses 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 [235]).

Around 87% of stroke survivors in Australia were considered to have difficulties with ADL (Stroke Foundation 2020 [8]). The majority of stroke survivors receive some intervention and ADL training in hospitals, including task-specific practice (94%) and training in use of appropriate aids and equipment (66%) (Stroke Foundation 2020 [8]).

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). Ensure all sessions engage the stroke survivor in the process and respect their dignity.

Further information can be found in the Driving, Community transport and Return to work guidelines in Chapter 8 of these guidelines.

Evidence To Decision

**Strong recommendation**

- Community-dwelling stroke survivors who have difficulties performing daily activities should be assessed by a trained clinician. (Legg et al. 2017 [230])
- Community-dwelling stroke survivors with confirmed difficulties in personal or extended activities of daily living 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. 2017 [230])

**Benefits and harms**
Based on a Cochrane review (Legg et al. 2017 [230]), ADL performance was improved, and the odds of a poor outcome were reduced (127 fewer death, dependent or deterioration in ADL per 1000 patients treated) when occupational therapy intervention was provided to stroke survivors living in the community.

**Certainty of the Evidence**
The methodological quality of evidence (9 trials) was low.
Rationale

The 2017 Cochrane review included 9 trials of low to moderate quality, which demonstrated improvements in ADL performance when ADL training was provided at home (Legg et al. 2017 [230]). Furthermore, there was a reduction in the odds of a poor outcome (death, dependency or deterioration in ADL). Overall the data supports the provision of occupational therapy but the confidence in the data is limited. Therefore, performance of daily activities should be assessed and managed by a trained clinician, but the optimal approach is yet to be determined.

Surprisingly little research has been conducted with hospital inpatients, therefore no recommendation can be made about the effect of interventions to improve ADL performance for this group. All RCTs in the 2017 Cochrane Review recruited community-dwelling stroke survivors. There was one excluded (feasibility/pilot) RCT which may be of interest to clinicians evaluated dressing retraining with inpatients (Walker et al 2012[234]). Further studies are needed before a recommendation can be made.

Clinical Question/ PICO

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

Summary

Legg et al (2017) [230] assessed the effectiveness of occupational therapy-led interventions in a Cochrane review, specifically focussing on personal activities of daily living. Nine (RCTs) were included (8 from previous version and one new trial), 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 [231]; Rotenberg-Shpigelman et al 2012 [201]; Shinohara et al 2012 [201]; Liu et al 2014 [201]; Walker et al 2012 [234]). Some of these RCTs involved stroke inpatients (Lui et al. 2014 [201]; Walker et al 2012 [234]). 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 [232]) 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.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death or poor outcome</td>
<td>Odds Ratio 0.71 (CI 95% 0.52 - 0.96) Based on data from 771 patients in 5 studies.</td>
<td>440 per 1000</td>
<td>Low</td>
<td>Occupational therapy may decrease death or poor outcome</td>
</tr>
<tr>
<td>Activities of daily living</td>
<td>Measured by: Various e.g. Barthel Index, Rivermead ADL scale High better</td>
<td>313 per 1000</td>
<td>Due to serious risk of bias, Due to serious imprecision</td>
<td>Occupational therapy may improve activities of daily living slightly.</td>
</tr>
<tr>
<td>Extended activities of daily living</td>
<td>Measured by: Various e.g. Nottingham Extended Activities of Daily Living High better</td>
<td>0.17 higher</td>
<td>Low</td>
<td>Occupational therapy may increase extended activities of daily living</td>
</tr>
</tbody>
</table>

1. death, dependence (mRS >2), deterioration (lower ADL scores)
3. Risk of bias: Serious. Due to serious risk of bias, Due to serious imprecision. 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, Low number of patients. Publication bias: No serious.
5. Risk of bias: Serious. Risk of selection, performance bias. 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, Low number of patients. **Publication bias:** No serious.


7. **Risk of bias:** Serious. Risk of selection, performance bias. **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, Low number of patients. **Publication bias:** No serious.

**Weak recommendation against**

For older stroke survivors living in a nursing home, routine occupational therapy is not recommended to improve activities of daily living function. (Sackley et al. 2015 [229])

**Practical Info**

Although some stroke survivors in a nursing home may receive tailored occupational therapy for specific reasons, routine occupational therapy directed at ADL training is not recommended. Some, but not all stroke survivors may have received active rehabilitation prior to being discharged to a nursing home.

**Evidence To Decision**

**Benefits and harms**

There was little benefit in ADL function but also no harms (Sackley et al. 2015 [229]). 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 [229]).

**Certainty of the Evidence**

Although the Sackley study [229] was well-designed, this is the only trial on this topic and the participants had a high level of disability.

**Preference and values**

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**

The intervention involved a mean of 5 visits x 30 minutes of occupational therapy time which is an additional cost. Given the lack of effect on ADL, this intervention is not considered cost effective.

**Rationale**

To date, only one large trial by Sackley et al (2015) [229] 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) [229] 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.

Braun et al (2012) [169] conducted a multicenter randomised trial assessing the impact of mental practice instruction in addition to usual care in Dutch nursing homes. The study was of good methodological quality. It showed no effect or benefit on any outcome from embedding mental practice into usual therapy for stroke patients during rehabilitation.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADL (3 months) 1</td>
<td>3 months</td>
<td>5.29 points (Mean)</td>
<td>Low Due to serious indirectness, Due to serious imprecision</td>
<td>occupational therapy may have little or no difference on ADL (3 months)</td>
</tr>
<tr>
<td></td>
<td>8 Critical</td>
<td>5.47 points (Mean)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Measured by: Barthel Index (reported difference is covariate-adjusted)</td>
<td>Difference: MD 0.19 higher ( CI 95% 0.33 lower - 0.7 higher )</td>
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<tr>
<td></td>
<td>Scale: 0-20 High better</td>
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<tr>
<td></td>
<td>Based on data from: 976 patients in 1 studies. 2</td>
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<td></td>
<td>(Randomized controlled)</td>
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<tr>
<td></td>
<td>Follow up: 3 months.</td>
<td></td>
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<tr>
<td>ADL (6 months) 4</td>
<td>6 months</td>
<td>4.78 (Mean)</td>
<td>Low Due to serious indirectness, Due to serious imprecision</td>
<td>occupational therapy may have little or no difference on ADL (6 months)</td>
</tr>
<tr>
<td></td>
<td>8 Critical</td>
<td>4.78 (Mean)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measured by: Barthel Index (reported difference is covariate-adjusted)</td>
<td>Difference: MD 0 higher ( CI 95% 0.52 lower - 0.53 higher )</td>
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<tr>
<td></td>
<td>Scale: 0-20 High better</td>
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<tr>
<td></td>
<td>Based on data from: 973 patients in 1 studies. 5</td>
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<td></td>
<td>(Randomized controlled)</td>
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<tr>
<td></td>
<td>Follow up: 3 months.</td>
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<tr>
<td>ADL (12 months) 7</td>
<td>12 months</td>
<td>3.77 (Mean)</td>
<td>Low Due to serious indirectness, Due to serious imprecision</td>
<td>occupational therapy may have little or no difference on ADL (12 months)</td>
</tr>
<tr>
<td></td>
<td>8 Critical</td>
<td>3.93 (Mean)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measured by: Barthel Index (reported difference is covariate-adjusted)</td>
<td>Difference: MD 0.16 higher ( CI 95% 0.4 lower - 0.72 higher )</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Scale: 0-10 High better</td>
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<tr>
<td></td>
<td>Based on data from: 942 patients in 1 studies. 8</td>
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<td></td>
<td>(Randomized controlled)</td>
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<tr>
<td></td>
<td>Follow up: 3 months.</td>
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</tbody>
</table>

1. ADL measured by Barthel index. Participants who died were given a BI score of 0.
While some stroke survivors may want to purchase acupuncture, the evidence suggests there is unlikely to be consistent benefits. However, there do not appear to be any harms, risks or safety concerns if stroke survivors choose to pursue this treatment independently. Measures of ADL outcomes should be obtained before and after treatment by treating therapists to determine if acupuncture is improving (or reducing) ADL performance. Most Australian hospitals do not permit acupuncture therapists to deliver treatment to stroke inpatients in their facilities.

**Evidence To Decision**

**Benefits and harms**

Acupuncture is an intervention that appears to lead to little or no harm, but results in no worthwhile benefits compared to other treatments. Therefore, acupuncture cannot be recommended routinely to improve ADL. The evidence on which this recommendation is based is very low quality (Yang et al 2016).

**Certainty of the Evidence**

The quality of evidence is very low, with most published RCTs included in the 2016 Cochrane review reporting very brief methods and results (2 pages or less) (Yang et al 2016).

---

**Weak recommendation against**

**DRAFT FOR PUBLIC CONSULTATION MARCH 2021**

Acupuncture is not routinely recommended to improve activities of daily living. (Yang et al. 2016 [255])

*Draft update which has moved from a STRONG (against) to WEAK (against) recommendation.*
Rationale

There is very low quality evidence showing that acupuncture may improve ADL measures, but uncertainty and poor study reporting has led to this recommendation being a weak recommendation against acupuncture (Yang et al 2016 [255]). Previous data with sham control showed little or no difference to ADL performance, irrespective of time post-stroke (Kong et al. 2010 [239]). Until more quality evidence is available, acupuncture is not recommended as part of routine care in Australia.

Preference and values

Some patients may prefer or value acupuncture and other traditional Chinese treatments due to perceived benefits beyond ADL. This type of treatment is rarely available in Australian hospital settings, and is not recommended to improve ADL at this time. Acupuncture to improve ADL has not yet been shown to result in benefits.

Resources and other considerations

No cost-effective studies were identified. Acupuncture requires skills and experience to perform and access to those with this experience is likely to be limited outside of major urban areas.

Clinical Question/ PICO

<table>
<thead>
<tr>
<th>Population:</th>
<th>Adults with stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention:</td>
<td>Acupuncture</td>
</tr>
<tr>
<td>Comparator:</td>
<td>Control</td>
</tr>
</tbody>
</table>

Summary

A Cochrane review included 11 studies that reported changes in ADL ability (Yang et al 2016 [255]). Nine of the studies were pooled (n=616) with an increase in ADL reported ability found, however, this finding was based on very low quality evidence. The methods and results in many RCTs were very brief (often two pages in length) limiting interpretation and critical appraisal.

An earlier (non-Cochrane) other older systematic review of 10 studies (Kong et al 2010 [239]) 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 had 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.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADL 1</td>
<td>Measured by: Barthel Index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 months</td>
<td>High better</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on data from: 616 patients in 9 studies. 2 (Randomized controlled)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Follow up: 3 months.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Difference: MD 9.19 higher</td>
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</tr>
<tr>
<td></td>
<td>( CI 95% 4.34 higher - 14.05 higher )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Dependency on Barthel Index (<60)
2. Systematic review [255]. **Baseline/comparator:** Control arm of reference used for intervention.
3. **Risk of bias:** Serious. **Inconsistency:** Serious. The magnitude of statistical heterogeneity was high, with I^2:57%.
   **Indirectness:** No serious. **Imprecision:** No serious. **Publication bias:** No serious.

### Evidence To Decision

**Strong recommendation against**

For stroke survivors in the acute, sub-acute or chronic phase post-stroke, acupuncture should not be used to improve activities of daily living. (Kong et al. 2010 [239])

*This existing recommendation has a draft update as above.*

**Benefits and harms**

- There were no benefits for ADL performance or known harms (Kong et al. 2010 [239]).

**Certainty of the Evidence**

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

**Preference and values**

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

**Resources and other considerations**

- Factor 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 [239]). Therefore a strong recommendation against this practice is made.

### Clinical Question/ PICO

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

### Summary

A Cochrane review included 11 studies that reported changes in ADL ability (Yang et al 2016 [255]). Nine of the studies were pooled (n=616) with an increase in ADL reported, however, this finding was based on very low quality...
evidence. The methods and results in many RCTs were very brief (often two pages in length) limiting interpretation and critical appraisal.

An earlier (non-Cochrane) other older systematic review of 10 studies (Kong et al 2010 [239]) 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 had 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.

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<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADL 1 3 months</td>
<td>Measured by: Barthel Index</td>
<td>Difference: MD 9.19 higher</td>
<td>Very Low Due to serious risk of bias, Due to serious inconsistency 3</td>
<td>We are uncertain whether acupuncture increases or decreases ADL</td>
</tr>
<tr>
<td></td>
<td>Early better</td>
<td>(CI 95% 4.34 higher - 14.05 higher)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on data from: 616 patients in 9 studies. 2</td>
<td>(Randomized controlled) Follow up: 3 months.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Dependency on Barthel Index (<60)
2. Systematic review [255], Baseline/comparator: Control arm of reference used for intervention.
3. Risk of bias: Serious. Inconsistency: Serious. The magnitude of statistical heterogeneity was high, with I^2:57%.

Indirectness: No serious. Imprecision: No serious. Publication bias: No serious.

Strong recommendation against
Administration of amphetamines to improve activities of daily living is not recommended. (Martinsson et al. 2007 [242])

Evidence To Decision

**Benefits and harms**

The Cochrane review by Martinsson et al. (2007) [242] 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) [243] suggested modest benefits in ADL following amphetamine intervention combined with usual physiotherapy, but has a high risk of bias.

**Certainty of the Evidence**

The Cochrane review provided low quality of evidence due to small sample size and imbalances in baseline prognostic factors [242]. A more recent RCT by Lokk et al. (2011) had high risk of bias, partly due to lack of assessor blinding [243].

142 of 234
Preference and values
Given the lack of benefits and potential harms, stroke survivors are unlikely to want to receive amphetamines for the purpose of improving ADL.

Resources and other considerations
No cost-effective studies were identified.

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

<table>
<thead>
<tr>
<th>Population:</th>
<th>Adults with stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention:</td>
<td>Amphetamine</td>
</tr>
<tr>
<td>Comparator:</td>
<td>Placebo</td>
</tr>
</tbody>
</table>

Summary
Martinsson et al (2007) [242] 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 baseline equivalence, meaning further research may change these conclusions.

In a more recent trial of an amphetamine-like drug, Lokk et al (2011) [243] 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.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
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<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death or dependency</td>
<td>End of follow-up</td>
<td>Odds Ratio 1.45 (CI 95% 0.64 - 3.27) Based on data from 106 patients in 3 studies.</td>
<td>Placebo 311 per 1000, Amphetamine 396 per 1000</td>
<td>Low Due to serious imprecision, Due to serious indirectness</td>
</tr>
</tbody>
</table>

Placebo 311 more per 1000, Amphetamine 396 more per 1000 | Low Due to serious imprecision, Due to serious indirectness | Amphetamine may increase death or dependency |
<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 Critical</td>
<td>Follow up: 3-12 months post stroke.</td>
<td>Odd ratio 2.82 (CI 95% 0.92 - 8.6)</td>
<td>Based on data from 287 patients in 10 studies. <em>(Randomized controlled)</em> Follow up: 1 day to 12 months.</td>
<td>22 per 1000 60 per 1000 Difference: 38 more per 1000 (CI 95% 2 fewer - 140 more )</td>
</tr>
<tr>
<td>9 Critical</td>
<td>Measured by: Barthel Index High better Based on data from: 113 patients in 4 studies. <em>(Randomized controlled)</em> Follow up: 10 days to 12 months.</td>
<td>Difference: MD 3.87 lower (CI 95% 13.49 lower - 5.75 higher)</td>
<td>Low Due to serious risk of bias (intention to treat analysis showed almost significant effect in favour of placebo), Due to serious imprecision. Amphetamines may have little or no difference on activities of daily living</td>
<td></td>
</tr>
</tbody>
</table>

1. Dependency classified as scores < 60 on the Barthel Index or score of 3-6 on the Oxford Handicap scale.
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.
5. 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. Wide confidence intervals, few events. Publication bias: No serious.
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.
Evidence To Decision

**Benefits and harms**

Selective serotonin reuptake inhibitors have no beneficial effects on independence or disability (although may prevent or reduce depression) and can lead to increased falls and bone fractures.

**Certainty of the Evidence**

Quality of evidence from three higher quality RCTs is moderate. Two further large trials of high quality are also noted.

**Preference and values**

Given the potential harms and lack of benefits regarding reduced disability there are no expected differences in preferences and values of SSRIs.

**Resources and other 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 prevention and treatment of mood disorders such as depression (covered in Chapter Six), not specifically with the aim of reducing disability. Moderate to high quality of evidence from a Cochrane review (Legg et al. 2019 [249]) and subsequent large RCTs (AFFINITY 2020 [252]; EFFECTS collaborators 2020 [251]) has shown no benefits in reducing disability with SSRIs. Side effects such as falls, bone fractures, seizures or gastrointestinal harms may occur and as such SSRIs are not routinely recommended.

The primary outcome of the main trials was reduction in disability, rather than activities of daily living. However, the working group have maintained this recommendation within this section because global measures of disability are closely related to measures of activities of daily living.

Clinical Question/ PICO

<table>
<thead>
<tr>
<th>Population:</th>
<th>Adults with stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention:</td>
<td>Selective serotonin reuptake inhibitor</td>
</tr>
<tr>
<td>Comparator:</td>
<td>Control</td>
</tr>
</tbody>
</table>

Updated

Selective serotonin reuptake inhibitors should not be used to reduce disability. (Legg et al. 2019 [249]; AFFINITY collaborators 2020 [252]; EFFECTS collaborators 2020 [251]).

**Draft recommendation changed from Weak FOR to Weak AGAINST based on new evidence. We have also updated Evidence to decision, Rationale and have clarified outcomes (reduced disability rather than just ADL).**

**DRAFT FOR PUBLIC CONSULTATION MARCH 2021**

**Weak recommendation against**

Selective serotonin reuptake inhibitors should not be used to reduce disability. (Legg et al. 2019 [249]; AFFINITY collaborators 2020 [252]; EFFECTS collaborators 2020 [251]).

**Evidence to decision, Rationale and have clarified outcomes (reduced disability rather than just ADL).**

**Weak recommendation against**

Selective serotonin reuptake inhibitors should not be used to reduce disability. (Legg et al. 2019 [249]; AFFINITY collaborators 2020 [252]; EFFECTS collaborators 2020 [251]).
Summary

Legg et al (2019) [249] conducted a Cochrane review on the effects of selective serotonin reuptake inhibitors in stroke patients. 63 studies were identified (n=9168), half of which required participants to have depression to enter the trial. Of the 63 included studies, 32 used fluoxetine, eight studies used sertraline, 11 used paroxetine, eight used citalopram, two used escitalopram, one used either sertraline or fluoxetine, and one used citalopram or fluoxetine. Only three of the 63 included studies were rated as low risk of bias across the key domains and were included in the meta-analysis. All three studies compared fluoxetine to placebo and they did not require participants to have depression on enrolment. The duration, drug, and dose varied between studies. The pooled data of three studies (n=3249) found no difference in odds of being independent (modified Rankin Score 0–2) (RR 1.00 95% CI 0.91 to 1.09). However, there was significant heterogeneity (I²=78%). Combining two trials (n=2829) at low risk of bias, there was also no change to disability measured by the Stroke Impact Scale or Barthel Index (SMD -0.01 95% CI -0.09 to 0.06). There was a higher number of people with gastrointestinal side effects (RR 2.19, 95% CI 1.00 to 4.76) based on 2 studies (n=148). One large trial (FOCUS) reported no difference in quality of life or fatigue measures.

Including all trials irrespective of study quality found no impact on independence (mRS 0–2; RR 0.97, 95% CI 0.91 to 1.03; I² = 74%; 5 studies, 4002 participants). However, there was a small increase in measures of disability but with high heterogeneity (SMD 0.23, 95% CI 0.18 to 0.29; P < 0.001; I² = 92%; 26 studies, 5334 participants).

Two additional trials published in July 2020 strengthen the results of the Cochrane review. The AFFINITY trial (2020)[252] was a multicentre trial done in 43 hospital units (n=1280) across Australia (29), New Zealand (4) and Vietnam (10). Patients were in the acute phase and had mRS of 1 or more. Fluoxetine or placebo was given for mean 167 days. At 6 months there was no difference in distribution of mRS categories (OR 0.94, 95% CI 0.76 to 1.15). There was also no difference between groups in the stroke impact scale domains for daily activity, participation or recovery. The intervention group were more likely to experience falls, bone fractures and epileptic seizures. The EFFECTS trial (2020)[251] had almost identical design to the AFFINITY trial and included people in acute stroke and compared fluoxetine to placebo. The trial was conducted across 35 centres in Sweden (n=1500). Similar to the AFFINITY trial, there was no difference in the distribution across mRS categories at 6 months (OR 0·94, 95% CI 0·78 to 1·13). There was no difference between groups in the stroke impact scale domains for daily activity, participation or recovery, but an increase in bone fractures.

Overall there is no effect of SSRIs on global measures of disability based on good quality studies.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>mRS 0–2 1</td>
<td>Relative risk 1</td>
<td><strong>367</strong> per 1000</td>
<td>Moderate Due to serious inconsistency 3</td>
<td>Selective serotonin reuptake inhibitor probably has little or no difference on level of disability</td>
</tr>
<tr>
<td>8 Critical</td>
<td>(CI 95% 0.91 - 1.09)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on data from 3,249 patients in 3 studies. ² (Randomized controlled)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities of daily living 4</td>
<td>Measured by: Disability (SIS or BI)</td>
<td>Difference: SMD 0.01 lower ( CI 95% 0.09 lower - 0.06 higher )</td>
<td>Moderate Due to serious imprecision 5</td>
<td>Selective serotonin reuptake inhibitor probably has little or no difference on activities of daily living</td>
</tr>
<tr>
<td>8 Critical</td>
<td>High better</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on data from: 2,829 patients in 2 studies. (Randomized controlled)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. modified Rankin Scale 3-5
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[249]) 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.

Evidence To Decision

**Benefits and harms**

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[249]).

**Certainty of the Evidence**

Quality of evidence from a meta-analysis of 22 RCTs is moderate due to some inconsistency across studies.

**Preference and values**

Given the potential harms, stroke survivors would have varied preferences and should be assisted to make informed decisions.

**Resources and other 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[249]) 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

Legg et al (2019) [249] conducted a Cochrane review on the effects of selective serotonin reuptake inhibitors in stroke patients. 63 studies were identified (n=9168), half of which required participants to have depression to enter the trial. Of the 63 included studies, 32 used fluoxetine, eight studies used sertraline, 11 used paroxetine, eight used citalopram, two used escitalopram, one used either sertraline or fluoxetine, and one used citalopram or fluoxetine. Only three of the 63 included studies were rated as low risk of bias across the key domains and were included in the meta-analysis. All three studies compared fluoxetine to placebo and they did not require participants to have depression on enrolment. The duration, drug, and dose varied between studies. The pooled data of three studies (n=3249) found no difference in odds of being independent (modified Rankin Score 0–2) (RR 1.00 95% CI 0.91 to 1.09). However, there was significant heterogeneity (I²=78%). Combining two trials (n=2829) at low risk of bias, there was also no change to disability measured by the Stroke Impact Scale or Barthel Index (SMD -0.01 95% CI -0.09 to 0.06). There was a higher number of people with gastrointestinal side effects (RR 2.19, 95% CI 1.00 to 4.76) based on 2 studies (n=148). One large trial (FOCUS) reported no difference in quality of life or fatigue measures. Including all trials irrespective of study quality found no impact on independence (mRS 0–2: RR 0.97, 95% CI 0.91 to 1.03; I² = 74%; 5 studies, 4002 participants). However, there was a small increase in measures of disability but with high heterogeneity (SMD 0.23, 95% CI 0.18 to 0.29; P < 0.001; I² = 92%; 26 studies, 5334 participants).

Two additional trials published in July 2020 strengthen the results of the Cochrane review. The AFFINITY trial (2020)[252] was a multicentre trial done in 43 hospital units (n=1280) across Australia (29), New Zealand (4) and Vietnam (10). Patients were in the acute phase and had mRS of 1 or more. Fluoxetine or placebo was given for mean 167 days. At 6 months there was no difference in distribution of mRS categories (OR 0.94, 95% CI 0.78 to 1.13). There was also no difference between groups in the stroke impact scale domains for daily activity, participation or recovery. The intervention group were more likely to experience falls, bone fractures and epileptic seizures. The EFFECTS trial (2020)[251] had almost identical design to the AFFINITY trial and included people in acute stroke and compared fluoxetine to placebo. The trial was conducted across 35 centres in Sweden (n=1500). Similar to the AFFINITY trial, there was no difference in the distribution across mRS categories at 6 months (OR 0·94, 95% CI 0·78 to 1·13). There was no difference between groups in the stroke impact scale domains for daily activity, participation or recovery, but an increase in bone fractures.

Overall there is no effect of SSRIs on global measures of disability based on good quality studies.

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</thead>
<tbody>
<tr>
<td>mRS 0-2 1</td>
<td>Relative risk 1 (CI 95% 0.91 - 1.09) Based on data from 3,249 patients in 3 studies 2 (Randomized controlled)</td>
<td>367 per 1000 367 per 1000</td>
<td>Moderate Due to serious inconsistency 3</td>
<td>Selective serotonin reuptake inhibitor probably has little or no difference on level of disability</td>
</tr>
<tr>
<td>8 Critical</td>
<td>Difference: 0 fewer per 1000 ( CI 95% 33 fewer - 33 more )</td>
<td>Moderate Due to serious inconsistency 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities of daily living 4</td>
<td>Measured by: Disability (SIS or BI) High better Based on data from:</td>
<td>SMD 0.01 lower ( CI 95% 0.09 lower - 0.06 higher )</td>
<td>Moderate Due to serious imprecision 5</td>
<td>Selective serotonin reuptake inhibitor probably has little or no difference on activities</td>
</tr>
</tbody>
</table>
Brain stimulation (transcranial direct stimulation or repetitive transcranial magnetic stimulation) should not be used in routine practice to improve activities of daily living and only used as part of a research framework. (Elsner et al. 2020 [176]; Hao et al. 2013 [180])

Practical Info

Most health services will not have this type of equipment or be able to offer this treatment, except in a research framework. When tDCS or TMS are offered as part of a research project, measures of ADL performance should be taken before and after treatment.

Evidence To Decision

**Benefits and harms**

In the 2020 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. 2020 [176]).

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 [180]). One additional RCT by Liu et al 2020 [290], did report significant improvements in ADL (FIM score) following four weeks of TMS alongside cognitive training on a computer, compared to a group receiving sham TMS and cognitive training. No harms were reported.

**Certainty of the Evidence**

The quality of evidence overall is moderate for tDCS but low for rTMS.
In the updated Cochrane review of tDCS, there was a small improvement in ADL 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. 2020 [176]). Evidence is evolving and may be more effective with cathodal tDCS (Elsner et al. 2017 [254]).

In the 2013 Cochrane review of rTMS, no significant benefits in ADL performance were observed based on two studies, 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 [180]). However, when combined with a subsequent study (Liu et al. 2020 [290]) there was a large and significant effect found but serious imprecision and inconsistency. Hence, rTMS shows promise as an intervention but further trials are required.

Given the evolving evidence base and uncertainty we suggest it is not appropriate to recommend brain stimulation as routine practice but encourage ongoing research into these interventions.

### Clinical Question/ PICO

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

### Summary

A Cochrane review of transcranial direct current stimulation (tDCS) trials included 67 trials with 1729 total participants (Elsner et al 2020 [168]). Nineteen studies compared tDCS to sham stimulation or passive control reported improvements in activities of daily living (ADL) at the end of the intervention outcomes found a small significant improvement (SMD 0.24, 95% CI 0.13 to 0.44; 19 studies, n=686) along with the end of follow-up (SMD 0.31, 95% CI 0.01 to 0.62; 6 studies, n=269). However, neither of these effects remained significant when analysis was restricted to studies with adequate allocation concealment, suggesting a high risk of bias.

Another meta-analysis by the same group (Elsner et al 2017 [254]) included 26 studies (n=754) and conducted a network meta-analysis (12 RCTs, n=284) that demonstrated tDCS improved ADL ability (SMD 0.42, 95% CI 0.14 to 0.70). No differences in adverse events or drop outs were noted. Authors reported cathodal tDCS appears to improve ADL ability more than dual or anodal application.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADL</td>
<td>Measured by: Various: e.g.</td>
<td>Transcranial direct-current stimulation</td>
<td>Moderate</td>
<td>Transcranial direct-</td>
</tr>
<tr>
<td>Outcome Timeframe</td>
<td>Study results and measurements</td>
<td>Absolute effect estimates</td>
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<td>Plain text summary</td>
</tr>
<tr>
<td>-------------------</td>
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<td>---------------------------</td>
<td>-----------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Until end of follow-up: mean 3 months</td>
<td>Barthel Index, modified Rankin Score, Functional Independence Measure</td>
<td>Difference: SMD 0.31 higher (CI 95% 0.01 higher - 0.62 higher)</td>
<td>Due to serious risk of bias</td>
<td>Current stimulation may improve ADL until the end of follow-up</td>
</tr>
<tr>
<td>ADL End of intervention</td>
<td>Measured by: Various: e.g. Barthel Index, modified Rankin Score, Functional Independence Measure</td>
<td>Difference: SMD 0.28 higher (CI 95% 0.13 higher - 0.44 higher)</td>
<td>Moderate Due to serious risk of bias</td>
<td>Transcranial direct-current stimulation may improve ADL at the end of intervention</td>
</tr>
</tbody>
</table>

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. Systematic review [176]. **Baseline/comparator:** Control arm of reference used for intervention.
5. **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.**

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### Clinical Question/ PICO

- **Population:** Adults with stroke
- **Intervention:** Repetitive transcranial magnetic stimulation (rTMS)
- **Comparator:** Control

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### Summary

A Cochrane review showed a non-significant increase in the Barthel Index score from two heterogeneous trials with a total of 183 participants comparing repetitive transcranial magnetic stimulation (rTMS) treatment with and control interventions (Hao et al, 2013 [180]). The certainty of evidence was very low. 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. Three other studies included in the review were not included in the data analysis due to very short treatment duration.

Xiang et al (2019)[210] included 42 studies (n=1,168) involving the upper and lower limb studies. ADL was found to improve significantly (SMD 0.82, 95%CI 0.59 to 1.05; 7 studies, n=370). Motor function was also improved (SMD 0.50) but was a mix of impairment and activity scales and it is unclear the effect on activity alone.

Liu et al. (2020) undertook a RCT in an inpatient rehabilitation setting (n=62). Patients were on average 9 months post-
stroke had attention dysfunction and were randomised to 4 weeks of TMS or sham TMS in addition to comprehensive cognitive training which included attention training, orientation training, visual spatial training and logical reasoning training via touch screen computer. The intervention group had significantly improved total FIM scores at the end of the treatment compared to controls (83.9 vs 69.55). Their study methods were rated as high quality (PEDro 8/10). Combining three studies in an updated meta-analysis resulted in a significant improvement in ADL function (SMD 1.16, 95%CI 0.17 to 2.15). However, there was high heterogeneity (I^2=91%) serious imprecision and overall there was a low certainty of evidence. All three trials were conducted in China.

Further trials with larger sample sizes, different settings and long-term outcomes are needed to inform clinical practice.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ADL 1 Post intervention 8 Critical</td>
<td>Measured by: Barthel Index or FIM High better Based on data from: 241 patients in 3 studies. (Randomized controlled) Follow up: End of intervention (2-4 weeks).</td>
<td>Difference: SMD 1.16 higher ( CI 95% 0.17 higher - 2.15 higher )</td>
<td>Low Moderate risk of bias, serious inconsistency, serious imprecision 2</td>
<td>Repetitive transcranial magnetic stimulation may improve ADL</td>
</tr>
</tbody>
</table>

1. Measures of ADL, such as Barthel Index, Functional Independence Measure
2. Risk of bias: No serious. Unclear concealment in two trials. One trial had unblinded participants/personnel. Inconsistency: Serious. The magnitude of statistical heterogeneity was high, with I^2:91%. Indirectness: No serious. Imprecision: Serious. Wide confidence intervals, Low number of patients. Publication bias: No serious. Asymmetrical funnel plot noted in Cochrane Review. One additional trial now identified and included..

Weak recommendation

For stroke survivors, virtual reality technology may be used to improve activities of daily living in addition to usual therapy. (Laver et al. 2017 [244])

Practical Info

Clinicians may consider purchasing, learning to use, and embedding some virtual reality (VR) 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. As some people with stroke can find VR overwhelming it is important to firstly trial it face to face and ensure there are no hypersensitive reactions or problems with balance.

Clinicians will need to learn how to use and administer VR technologies, maintain and repair equipment. Some clinicians may find this process time consuming and prefer to deliver standard practice.
Evidence To Decision

Benefits and harms
A Cochrane review showed that the use of virtual reality in conjunction with usual care improved activities of daily living (Laver et al. 2017). There were no reported harms or adverse events such as increased incidence of falls.

Certainty of the Evidence
The quality of evidence was moderate.

Preference and values
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 therapies involving virtual reality technology. Some older people may be hesitant to try this technology due to an unfamiliarity with technology in general.

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

Rationale
The 2017 Cochrane review included 10 trials that investigated the effect of virtual reality technology on ADL (Laver et al. 2017 [244]). Virtual reality was found to have a small benefit when compared to the same dose of conventional therapy, however, when used in addition to standard care virtual reality therapy improved ADL outcomes (moderate effect size). Virtual reality is becoming more common and can aide patient motivation and impact on ADL outcomes.

Clinical Question/ PICO
- **Population:** Adults with stroke
- **Intervention:** Virtual reality
- **Comparator:** Conventional therapy

Summary
A Cochrane Review by Laver et al (2017) [244] found 10 studies (n=466) that measured ADL abilities within the 72 studies included in their review comparing virtual reality (VR) to conventional therapy. A small difference in ADL ability was found, favouring the intervention compared to same dose of conventional therapy (SMD 0.25) but in sensitivity analysis removing four studies at unclear or high risk of bias the results were smaller and non-significant (SMD 0.20, 95% CI -0.01 to 0.40).

However, when comparing the addition of VR plus routine therapy there was a moderate effect size (SMD 0.44, 95% CI 0.11 to 0.76; low certainty evidence) for improving ADL ability based on eight studies (n=153). Sensitivity analysis of two trials deemed at low risk of bias found stronger effects but wider confidence intervals (SMD 0.92, 95% CI 0.04 to 1.81). However, there was no evidence that effects were sustained long-term. This intervention is relatively safe.
<table>
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<tbody>
<tr>
<td>ADL Post intervention 8 Critical</td>
<td>Measured by: Various e.g. Functional Independence Measure, Barthel Index High better Based on data from: 466 patients in 10 studies. (Randomized controlled)</td>
<td>Difference: SMD 0.25 higher (CI 95% 0.06 higher - 0.43 higher)</td>
<td>Moderate Due to serious risk of bias in some studies</td>
<td>Virtual reality probably improves ADL slightly</td>
</tr>
</tbody>
</table>

1. Measures of ADL, such as Barthel Index, Functional Independence Measure, and modified Rankin Scale
2. Systematic review [244]. Baseline/comparator: Control arm of reference used for intervention.
3. **Risk of bias: Serious.** Risk of bias was unclear in a number of studies. **Inconsistency:** No serious. **Indirectness:** No serious. **Imprecision:** No serious. small total population size. **Publication bias:** No serious.
Communication difficulties

In Australia, communication and speech problems occur in approximately 620% of stroke patients on admission (Stroke Foundation 2014 [7]). UK data suggest that one-third of people are left with communication disability after stroke (Bowen et al. 2012 [277]). Considering its impacts on stroke survivors’ functional performance and psychological wellbeing, appropriate assessments and treatments should be provided.

Assessment of communication deficits

### 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.

### Evidence To Decision

#### 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.

### 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 [258]). 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 [258]). The National Stroke Audit showed that around a third of stroke patients (34%) had aphasia on admission (Stroke Foundation 2019 [7]).

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 [258]).
### 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 [258])

### 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).

### Evidence To Decision

#### Benefits and harms

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 [258]) 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.

#### Certainty of the Evidence

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.
Rationale

The Cochrane review (Brady et al. 2016 [258]) 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) [258] 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) [258] 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

<table>
<thead>
<tr>
<th>Functional communication</th>
<th>Post intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study results and measurements</strong></td>
<td>Measured by: Various, e.g. WAB, ANELT, AAT, FCP</td>
</tr>
<tr>
<td></td>
<td>High better</td>
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</tbody>
</table>

**Difference:** SMD 0.28 higher (CI 95% 0.06 higher - 0.49 higher)
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeframe</td>
<td>Control</td>
<td>Speech and language therapy</td>
<td>(Quality of evidence)</td>
<td></td>
</tr>
<tr>
<td>8 Critical</td>
<td>Based on data from: 376 patients in 10 studies. ¹ (Randomized controlled) Follow up: various - 1 session to 12 months of treatment.</td>
<td><strong>Difference:</strong> <strong>SMD 1.28 higher</strong> (CI 95% 0.38 higher - 2.19 higher)</td>
<td>Low</td>
<td>Speech and language therapy may improve general expressive language outcomes in aphasia.</td>
</tr>
<tr>
<td>General expressive language</td>
<td>Measured by: PICA (verbal subtest), Chinese Language Impairment Examination High better Based on data from: 248 patients in 7 studies. ³ (Randomized controlled) Follow up: various - 1 session to 12 months of treatment.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Post intervention</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7 Critical</td>
<td></td>
<td></td>
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<tr>
<td>Mood</td>
<td>Based on data from: 137 patients in 1 studies. ⁵ (Randomized controlled) Follow up: 24 weeks.</td>
<td>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).</td>
<td>Low</td>
<td>Speech and language therapy may have little or no difference on mood (anxiety, depression or hostility)</td>
</tr>
<tr>
<td>Post intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Critical</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

1. Systematic review [258]. **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 [258]. **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 [258].
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.
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.

Evidence To Decision

**Benefits and harms**

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 [258]).

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).

**Certainty of the Evidence**

While individual studies were of high methodological quality, the numbers were relatively small and trials were heterogeneous.

**Preference and values**

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**

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) [258] 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) [26] 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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functional communication</strong></td>
<td>Post intervention</td>
<td>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.</td>
<td><strong>Low intensity language and speech therapy</strong> <strong>High intensity speech and language therapy</strong> Difference: MD 11.75 higher ( CI 95% 4.09 higher - 19.4 higher )</td>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>High intensity speech and language therapy may improve functional communication</td>
</tr>
<tr>
<td><strong>Severity of language impairment</strong></td>
<td>Post intervention</td>
<td>Measured by: Various - WAB Aphasia Quotient, AAT, BDAE High better Based on data from: 187 patients in 5 studies. (Randomized controlled)</td>
<td>Difference: SMD 0.38 higher ( CI 95% 0.07 higher - 0.69 higher )</td>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>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).</td>
</tr>
<tr>
<td><strong>Mood</strong></td>
<td>Post intervention</td>
<td>Measured by: Stroke Aphasia Depression Questionnaire High better Based on data from: 25 patients in 1 studies. (Randomized controlled) Follow up: 12 months.</td>
<td>Difference: MD 7 higher ( CI 95% 2.61 lower - 16.61 higher )</td>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>High intensity language and speech therapy may have little or no difference on mood</td>
</tr>
</tbody>
</table>

### Notes

1. **Risk of bias: Serious.** Inadequate sequence generation/ generation of comparable groups, resulting in potential for
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.

Evidence To Decision

**Benefits and harms**

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 [260]). 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 [260]).

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 [259]). There is insufficient evidence to determine if low-frequency rTMS improves or worsens written expression and auditory comprehension (Ren et al. 2014 [259]). No severe adverse effects were reported in these seven studies and no patient reported that language impairment worsened after treatment (Ren et al. 2014 [259]).

**Certainty of the Evidence**

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
Factor 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[259]; Elsner et al. 2015[260]). 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

| Population: | Adults with stroke with aphasia |
| Intervention: | Repetitive Transcranial Magnetic Stimulation |
| Comparator: | 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[259]). 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 individuals 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.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity of language impairment ¹</td>
<td>Measured by: Various - Aachen Aphasia Test (AAT), Boston Diagnostic Aphasia Examination</td>
<td>Difference: <strong>SMD 1.26 higher</strong> (CI 95% 0.8 higher - 1.71 higher)</td>
<td>Moderate Due to serious imprecision ³</td>
<td>rTMS probably decreases severity of language impairment</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Timeframe</td>
<td>Study results and measurements</td>
<td>Absolute effect estimates</td>
<td>Certainty of the Evidence (Quality of evidence)</td>
<td>Plain text summary</td>
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<tr>
<td>Post intervention</td>
<td>8 Critical</td>
<td>(BDAE) High better Based on data from: 96 patients in 5 studies. (Randomized controlled) Follow up: Post intervention.</td>
<td>Difference: SMD 0.52 higher (CI 95% 0.18 higher - 0.87 higher)</td>
<td>Low Due to serious inconsistency, Due to serious imprecision</td>
<td>rTMS may improve naming</td>
</tr>
<tr>
<td>Naming</td>
<td>0 - 12 months</td>
<td>Measured by: Various: Boston Naming Test, BDAE naming subtests, AAT naming subtests, Computerized Picture Naming Test High better Based on data from: 139 patients in 6 studies. (Randomized controlled) Follow up: 0-12 months.</td>
<td>Difference: SMD 0.7 higher (CI 95% 0.19 higher - 1.22 higher)</td>
<td>Very Low Due to serious risk of bias, Due to serious indirectness, Due to serious imprecision</td>
<td>We are uncertain whether rTMS improves written expression</td>
</tr>
<tr>
<td>Writing</td>
<td>Post intervention</td>
<td>Measured by: AAT and BDAE writing subtests High better Based on data from: 63 patients in 3 studies. (Randomized controlled) Follow up: Post intervention.</td>
<td>Difference: SMD 0.32 higher (CI 95% 0.08 lower - 0.72 higher)</td>
<td>Very Low Due to serious inconsistency, Due to serious indirectness, Due to serious imprecision</td>
<td>We are uncertain if rTMS improves or worsens receptive language/auditory comprehension</td>
</tr>
<tr>
<td>Comprehension</td>
<td>8 0-15 weeks</td>
<td>Measured by: AAT and BDAE comprehension subtests High better Based on data from: 101 patients in 4 studies. (Randomized controlled) Follow up: 0-15 weeks.</td>
<td>Difference: SMD 0.32 higher (CI 95% 0.08 lower - 0.72 higher)</td>
<td>Very Low Due to serious inconsistency, Due to serious indirectness, Due to serious imprecision</td>
<td>We are uncertain if rTMS improves or worsens receptive language/auditory comprehension</td>
</tr>
</tbody>
</table>

1. Only three trials reported the effect of rTMS on follow up after treatment. Two trials followed up with patients 2.8 and 12 months after treatment. One study showed improvement in overall severity at 15 weeks.
3. 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, (I2 = 0%, p=0.44)”. The direction of the effect is not consistent between the included studies.

163 of 234
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.

4. Outcomes include: AAT naming test, Boston naming Test, BDAE naming subtest, CPNT accuracy of naming test

6. 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
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). [260] 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 individuals 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.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy of naming</td>
<td>Measured by: Picture naming accuracy</td>
<td>Sham tDCS plus SLT for improving aphasia</td>
<td>Very Low Due to serious indirectness, Due to serious imprecision, Due to serious risk of bias 2</td>
<td>We are uncertain whether tDCS plus speech and language therapy (SLT) improves or worsens accuracy of naming</td>
</tr>
<tr>
<td>At end of intervention phase</td>
<td>Based on data from: 66 patients in 6 studies. 1 (Randomized controlled) Follow up: 1-4 weeks post intervention.</td>
<td>Difference: SMD 0.37 higher (CI 95% 0.18 lower - 0.92 higher)</td>
<td></td>
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</tr>
</tbody>
</table>

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.

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.
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 [272]). 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 [272]). It is predominantly a disorder of articulation and prosody, though it can involve all speech subsystems (Ballard et al. 2015 [272]). Currently, there is no randomised controlled trial in AOS, possibly due to its rarity (Ballard et al. 2015 [272]). 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 [272]).

For stroke survivors with apraxia of speech, individually tailored interventions incorporating articulatory-kinematic and rate/rhythm approaches may be used. (Ballard et al. 2015 [272])

In addition, therapy may incorporate (Ballard et al. 2015 [272]):

- 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 [272]). 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.

Evidence To Decision

<table>
<thead>
<tr>
<th>Benefits and harms</th>
<th>Substantial net benefits of the recommended alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>The systematic review seems to support a strong effect for both articulatory-kinematic and rate/rhythm-based interventions (Ballard et al. 2015 [272]; Wambaugh et al. 2006 [273]). Harm was not reported in this review.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certainty of the Evidence</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>The overall quality of evidence is low due to small sample size and high risk of bias.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preference and values</th>
<th>No substantial variability expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke survivors with apraxia of speech would want to receive appropriate therapies, although the optimal approach remains unclear.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources and other considerations</th>
<th>No important issues with the recommended alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources considerations</td>
<td></td>
</tr>
<tr>
<td>No literature to understand or describe the potential economic implications of this recommendation was identified.</td>
<td></td>
</tr>
</tbody>
</table>

Rationale

The quality of evidence from a systematic review (Ballard et al. 2015 [272]) with 26 studies (evidence from 2004–2012) was added to the existing review (Wambaugh et al. 2006 [273]). 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 [272]) 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 [273]) 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.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved communication</td>
<td>Based on data from: 95 patients in 24 studies.</td>
<td>There is some supporting evidence for the articulatory-kinematic approach to apraxia of speech treatment, but the evidence is weak.</td>
<td>Very Low</td>
<td>Supporting evidence for articulatory-kinematic approach to apraxia treatment, but evidence is weak.</td>
</tr>
</tbody>
</table>

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.**

**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 [272]) 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 >= 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.
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 [277]). 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 [277]). 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 [277]).

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.

### 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 [277]). 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 [277]). 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 [277]).

**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 [261])

### 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 [277]), 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.

Evidence To Decision

Benefits and harms

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 [277]). No harm was reported in this study.

Certainty of the Evidence

Overall quality of evidence is low as this is based on a study with small sample size.

Preference and values

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) [277], patients reported they felt targeted intervention caused improvements in mood, confidence and being able to recognise their own progress.

Resources and other considerations

Bowen et al. (2012) [277] 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 [277]). 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) [261] 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
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[277]. Baseline/comparator: Control arm of reference used for intervention.


<table>
<thead>
<tr>
<th>Outcome</th>
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<th>Certainty of the Evidence</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Improved communication</td>
<td>Measured by: TOM. Reported means are raw data, reported difference is covariate adjusted. Scale: 0-5 High better Based on data from: 153 patients in 1 studies. (Randomized controlled) Follow up: 6 months after randomisation.</td>
<td>3 points (Mean)</td>
<td>Moderate Due to serious imprecision</td>
<td>Early communication therapy probably results in improved communication.</td>
</tr>
<tr>
<td>Carer burden</td>
<td>Measured by: Carer COAST scale. Scale: 0-100 High better Based on data from: 129 patients in 1 studies. (Randomized controlled) Follow up: 6 months after randomisation.</td>
<td>62 percent (Mean)</td>
<td>Moderate Due to serious imprecision</td>
<td>There was probably no difference in carer burden as reported on carer COAST and COPE scales</td>
</tr>
</tbody>
</table>

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.

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<table>
<thead>
<tr>
<th>Practical issues</th>
<th>Attention control</th>
<th>Early, well-resourced communication therapy</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional well-being</td>
<td>Experience of patients and carers</td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>
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 [276]), 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 [276]).

People with severe dysarthria can benefit from using augmentative and alternative communication devices in everyday activities.

Evidence To Decision

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 [276])

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 [276])
Cognitive communication deficits

Right hemisphere brain damage, most often caused by stroke, results in a range of cognitive communication difficulties.

Right hemisphere and/or cognitive communication disorders can be described as an impairment in the exchange of communicative intent through nonverbal and verbal means, often at a conversational level represented by the following features (Lehman Blake et al. 2013 [278]):

- 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 difficulties in communication following right hemisphere damage 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 [278]; Ferre et al. 2011 [279])

Management may include:

- Motoric-imitative, cognitive-linguistic treatments to improve use of emotional tone in speech production. (Rosenbek et al. 2006 [280])
- Semantic-based treatment connecting literal and metaphorical senses to improve comprehension of conversational and metaphorical concept. (Lungren et al. 2011 [281])

**Practical Info**

An assessment of communication can be very personal and potentially confronting for a patient. Taking the time to get to know a patient (including their cultural background, interests, age, level of education etc) prior to assessing them, and keeping it in mind during the assessment, can make it a more comfortable process for them.

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 [280]). However, it is unclear which treatment was more efficacious generally, with the treatment delivered first having a slightly larger effect size.

- **Receptive language**: Lungren et al. (2011) [281] demonstrated that a semantic-based treatment connecting literal and metaphorical senses of concepts significantly improved the comprehension of metaphors in four participants with right stroke, 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.
Cognition and perception difficulties

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 59–60% of patients reported as having cognitive deficit on admission to rehabilitation (Stroke Foundation 2014 [8]). Cognitive impairment may be missed in those who present with mild stroke and this type of impairment and can have a significant impact on life after stroke.

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.

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 strongly suggested cognitive and perceptual screening should occur prior to discharge from the acute hospital.

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 [282]). 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 36% of stroke patients have a perceptual deficit on admission (Stroke Foundation...
2019 [7]). Perceptual rehabilitation includes functional training, sensory stimulation, strategy training and task repetition (Bowen et al. 2011 [282]), 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.

**Practical Info**

It is recommended that assessment for perceptual difficulties also occurs through the observation of functional performance to determine the functional implications for stroke survivors, and aspects that may promote independence, including environmental, verbal and physical cues.

**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).

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, Potter, Wong et al 2019 [287]).
Evidence To Decision

Rationale

It is unclear whether cognitive rehabilitation (including both restorative and compensatory approaches) 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

Three systematic reviews (Loetscher et al 2019 [287]; Virk et al 2015 [283]; Rogers et al 2018 [288]), found 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 (2019) 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.

Rogers et al (2018) included 22 RCTs (n=1098). Meta-analysis of 10 studies with attention outcomes found a small effects due to cognitive remediation (ES 0.40; 95% CI 0.22-0.59).

The systematic review by Virk et al (2015) included 12 RCTs (n=584) but this included studies with mixed populations including 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 (Hedges’ g 0.67; 95%CI 0.35 to 0.98). Sustained attention, selective attention and alternating attention were not significantly improved in any ABI population. Follow-up data showed no evidence of long-term benefit.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Timeframe</th>
<th>Study results and measurements</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Sustained attention</td>
<td>Immediately after intervention</td>
<td>Measured by: Various e.g.IVA-CPT, TAP, Konzentrations-Verlaufs-Test</td>
<td>Difference: SMD 0.39 higher (CI 95% 0.16 lower - 0.94 higher)</td>
<td>Moderate Due to serious risk of bias</td>
<td>Cognitive rehabilitation probably has little or no difference on sustained attention</td>
</tr>
<tr>
<td>Divided attention</td>
<td>Immediately after intervention</td>
<td>Measured by: Various e.g. PASAT, TAP divided attention, Trail Making B</td>
<td>Difference: SMD 0.67 higher (CI 95% 0.35 higher - 0.98 higher)</td>
<td>Moderate Due to serious risk of bias</td>
<td>Cognitive rehabilitation probably improves divided attention</td>
</tr>
<tr>
<td>Alertness</td>
<td>At follow up</td>
<td>Measured by: Various e.g. assessed with TAP phasic alertness, Wiener Reaktionsgerat Visual RT, Simple RT &amp; Tempo-Lern Test</td>
<td>Difference: SMD 0.26 lower (CI 95% 0.97 lower - 0.45 higher)</td>
<td>Very Low Due to serious risk of bias, Due to very serious imprecision</td>
<td>We are uncertain whether cognitive rehabilitation increases or decreases alertness</td>
</tr>
<tr>
<td>Outcome Timeframe</td>
<td>Study results and measurements</td>
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<tr>
<td>Sustained attention</td>
<td>At follow up</td>
<td>Follow up: 6 months.</td>
<td>Difference: SMD 0.05 higher (CI 95% 0.44 lower - 0.53 higher)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divided attention</td>
<td>At follow up</td>
<td>Follow up: 3 to 6 months.</td>
<td>Difference: SMD 0.36 higher (CI 95% 0.04 lower - 0.76 higher)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alertness Immediately after intervention</td>
<td></td>
<td>Follow up: 3 to 11 weeks of treatment.</td>
<td>Difference: SMD 0.14 higher (CI 95% 0.2 lower - 0.48 higher)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selective attention Immediately after intervention</td>
<td></td>
<td></td>
<td>Difference: SMD 0.08 lower (CI 95% 0.35 lower - 0.18 higher)</td>
<td></td>
<td></td>
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</tbody>
</table>

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<thead>
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</thead>
<tbody>
<tr>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>Cognitive rehabilitation may have little or no difference on selective attention</td>
</tr>
<tr>
<td>Very Low Due to serious risk of bias, Due to very serious imprecision</td>
<td>We are uncertain whether cognitive rehabilitation increases or decreases sustained attention</td>
</tr>
<tr>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
<td>Cognitive rehabilitation may have little or no difference on divided attention</td>
</tr>
<tr>
<td>Moderate Due to serious risk of bias</td>
<td>Cognitive rehabilitation probably has little or no difference on alertness</td>
</tr>
<tr>
<td>Moderate Due to serious risk of bias</td>
<td>Cognitive rehabilitation probably has little or no difference on selective attention</td>
</tr>
</tbody>
</table>

- Measured by: Various e.g. PASAT, TAP divided attention, Trail Making B
- High better
- Based on data from: 99 patients in 2 studies.
- (Randomized controlled) Follow up: 3 to 6 months.

- Measured by: Various e.g. PASAT, TAP divided attention, Trail Making B
- High better
- Based on data from: 99 patients in 2 studies.
- (Randomized controlled) Follow up: 3 to 6 months.

- Measured by: Various e.g. PASAT, TAP divided attention, Trail Making B
- High better
- Based on data from: 99 patients in 2 studies.
- (Randomized controlled) Follow up: 3 to 6 months.

- Measured by: Various e.g. PASAT, TAP divided attention, Trail Making B
- High better
- Based on data from: 99 patients in 2 studies.
- (Randomized controlled) Follow up: 3 to 6 months.
Weak recommendation

For stroke survivors with attention and concentration deficits, exercise training and leisure activities may be provided. (Liu-Ambrose et al. 2015 [284])
**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 [284]) 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.

**Evidence To Decision**

<table>
<thead>
<tr>
<th>Benefits and harms</th>
<th>Substantial net benefits of the recommended alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 [284]). 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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certainty of the Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>This was a small single trial (N = 28), so our confidence in the effect estimates is low.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preference and values</th>
</tr>
</thead>
<tbody>
<tr>
<td>The target population for exercise training would need to be carefully selected, given the wide variation in mobility and preferences for physical activity.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources and other considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>No literature to understand or describe the potential economic implications of this recommendation was identified.</td>
</tr>
</tbody>
</table>

**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 [284]). 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**

| Population: Adults with chronic stroke | Intervention: Exercise training | Comparator: Usual care |

**Summary**

Liu-Ambrose and Eng (2015) [284] 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.

A RCT by Kongkasuwan et al. (2016) [295] with 118 stroke patients who were older than 50 years investigated the effect of creative art therapy plus conventional physical therapy, compared with physical therapy only, in improving cognitive ability. Abreviated mental test was used to assess cognition. No difference was found between groups on this measure. Patients in the experimental group self-reported greater concentration. Intervention made no difference (objectively) to attention.

Park et al. (2018) [298] conducted a RCT (n=30) comparing the effect of cognitive-motor dual-task training (CMDT) combined with auditory motor synchronization training (AMST) versus CMDT alone in chronic stroke patients. Changes in cognitive function were evaluated using the trail making test (TMT), digit span test (DST), and stroop test (ST). Performance speed on the TMT-A was faster in the CMDT+AMST group than in the CMDT group. Moreover, DST-forward and DST-backward scores were higher in the CMDT+AMST group than in the CMDT group. The authors concluded that the combined therapy CMDT and AMST can be used to increase attention, memory, and executive function for people with stroke.

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selective attention and conflict resolution</td>
<td>Measured by: Improvement over 6 months on Stroop test. Based on data from: 24 patients in 1 studies. (Randomized controlled) Follow up: 6 months of treatment.</td>
<td>6.7 seconds (Mean) for Usual care, 24.6 seconds (Mean) for Exercise training</td>
<td>Low</td>
<td>Exercise training and leisure/recreation activities may improve selective attention and conflict resolution. The difference between groups was significant. Due to very serious imprecision.</td>
</tr>
</tbody>
</table>

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 [284], 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.

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.

**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 90% of stroke patients are assessed by an occupational therapist and 57% within one day (Stroke Foundation 2019 [7]). They also showed that 83% of hospitals have locally agreed assessment protocols for executive function (Stroke Foundation 2019 [7]).

There is very little evidence for executive functioning and 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 notebooks, diaries, audio, and audio alarms;
- 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.

**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 [318]; Skidmore et al. 2015 [322])
Practical Info

Meta-cognitive strategy training (hereafter referred to as strategy training) is an intervention designed to harness a person's ability to monitor, regulate, and positively adapt one's own behavior. Strategy training teaches individuals to identify and prioritise problematic daily activities, identify problems impeding performance, generate and evaluate strategies addressing these problems, 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. Explaining to patients about the way the brain functions, may also help their understanding of their own situation.

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 [322]).

It is important that the person's grief surrounding their changed situation is also addressed.

Evidence To Decision

<table>
<thead>
<tr>
<th>Benefits and harms</th>
<th>Small net benefit, or little difference between alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 [318]; Skidmore et al, 2015 [322]). No harms are anticipated from this intervention.</td>
<td></td>
</tr>
</tbody>
</table>

Certainty of the Evidence

Low quality due to serious risk of bias, imprecision and inconsistency.

Preference and values

Client and family preference should be considered when providing meta-cognitive strategy and/or cognitive training.

Resources and other considerations

<table>
<thead>
<tr>
<th>Resources considerations</th>
<th>Important issues, or potential issues not investigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>No literature to understand or describe the potential economic implications of this recommendation was identified.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementation considerations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>There is an organisational indicator collected in the National Stroke Audit to determine whether hospitals have locally agreed assessment protocols for executive function.</td>
<td></td>
</tr>
</tbody>
</table>

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 [318]; Skidmore et al. 2015 [322]).
Clinical Question/ PICO

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

**Summary**

A Cochrane review by Chung et al (2013) [320] 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 no 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) [319] 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.

Zucchella et al (2014) [318] conducted a randomised trial of cognitive rehabilitation involving 92 stroke patients with cognitive deficits. Patients randomised to the intervention group completed 16 x 1 hour sessions over four weeks of therapist-guided computer exercises whereas control group had a sham intervention matched for amount of contact. Neuropsychological domains were assessed with various tools with only significant differences found for domains of memory and visual attention.

Poulin et al (2017) [328] reported the feasibility and effects of an adapted version of the Cognitive Orientation to daily Occupational Performance (CO-OP) approach versus Computer-based EF training (COMPUTER training). Participants received 16 hours of either CO-OP or COMPUTER training and outcomes were assessed post-intervention and at one-month follow-up. Both groups improved but this very small study (n=11) needs to be reproduced before any firm conclusions can be made.

Van de Ven et al (2017) [330] in a RCT investigated whether computer-based cognitive flexibility training can improve subjective cognitive functioning and quality of life in 97 stroke patients. The patients were randomly assigned to three groups: Intervention group, active control (i.e., mock training), or a waiting list control. All groups improved on the subjective executive functioning and the improvements remained stable 4 weeks after training completion but there was no between group differences.

Park and Lee (2019) [329] in a RCT investigated the effectiveness of dual-task training using various cognitive tasks (intervention) versus conventional occupational therapy (control) in 30 stroke patients. Outcomes were assessed for attention, executive function, and motor function. Interventions were conducted for 6 weeks. The intervention group showed a significantly stronger effect than the control group in ST-Color (p = 0.023) assessment.

Faria et al (2020) [327] conducted a RCT with 36 stroke patients comparing Reh@City v2.0 (adaptive cognitive training through everyday tasks VR simulations) with Task Generator (TG: content equivalent and adaptive pencil-and-paper training). Outcome measures included general cognitive functioning (assessed by the Montreal Cognitive Assessment - MoCA), Trail Making Test A and B (TMT), Digit Span (WMS-III) & Symbol search, but did not use activity measures. The Reh@City v2.0 group improved significantly more than the TG group in terms of general cognitive functioning, memory retention and recognition. The Reh@City v2.0 group also showed improvements in the Digit Symbol Coding codification task post-intervention. While promising, these results are further studies are needed to confirm the findings.
<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive functioning (FAB)</td>
<td>Measured by: Frontal Assessment Battery (FAB) High better Based on data from: 87 patients in 1 studies. ¹ (Randomized controlled) Follow up: 4 weeks after baseline.</td>
<td>Control: 13.8 points (Median) Cognitive training: 13.9 points (Median) Difference: 0.1 higher</td>
<td>Low 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. ²</td>
<td>Cognitive training may have little or no difference on executive functioning (FAB)</td>
</tr>
<tr>
<td>Executive functioning (TMT-B)</td>
<td>Measured by: Trail Making Test B Lower better Based on data from: 87 patients in 1 studies. ³ (Randomized controlled) Follow up: 4 weeks after baseline.</td>
<td>Control: 318 (Median) Cognitive training: 259 (Median) Difference: 59 lower</td>
<td>Low 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. ⁴</td>
<td>Cognitive training may increase executive functioning (TMT-B) slightly</td>
</tr>
</tbody>
</table>

1. Primary study[318]. 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[318]. Baseline/comparator: Primary study.

**Clinical Question/ PICO**

Population: Adults with stroke
Intervention: Strategy training
Comparator: Attention control
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 [331]). Estimates of the prevalence of apraxia in people with left hemisphere stroke range from 28% to 51% (Lindsten-McQueen et al. 2014 [331]).
McQueen et al. 2014 ([331]). 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.

Practical Info
If a patient is being screened for apraxia, explain why they're being screened, what apraxia is, any implications for the patient, and what the next steps will be.

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 [331])

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.

Evidence To Decision

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 [331]). People participating in the therapy are at low risk of harm.

Certainty of the 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: | Strategy training |
| Comparator: | Control |

Summary

A systematic review of treatments for apraxia (Lindsten-McQueen et al 2014 [331]) 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) [332] 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.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADL</td>
<td>8 Critical</td>
<td>Based on data from: 113 patients in 1 studies. (Randomized controlled) Follow up: post intervention.</td>
<td>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.</td>
<td>Low</td>
<td>Strategy training may improve ADL slightly</td>
</tr>
<tr>
<td>Motor function</td>
<td>7 Critical</td>
<td>Based on data from: 113 patients in 1 studies. (Randomized controlled) Follow up: post intervention.</td>
<td>No significant difference between groups on the Motricity Index or Functional Motricity Index</td>
<td>Low</td>
<td>Strategy training may have little or no difference on motor function</td>
</tr>
<tr>
<td>Apraxia</td>
<td></td>
<td>Based on data from: 113 patients in 1 studies.</td>
<td>No significant difference between groups on The Apraxia Test</td>
<td>Low</td>
<td>Strategy training may have little or no effect on apraxia</td>
</tr>
</tbody>
</table>
### 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 [331]) 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) [332] 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, Certainty of the Evidence, Plain text summary

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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<th>Certainty of the Evidence (Quality of evidence)</th>
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</tr>
</thead>
</table>
| ADL activities    | Based on data from: 15 patients in 1 studies. (Observational (non-randomized)) Follow up: Post intervention. | One pre-post test study reported that training resulted in a decrease in errors but that training did not generalise | Very Low  
Due to serious risk of bias, Due to serious imprecision ¹ | We are uncertain whether error-less learning increases performance of ADL activities |
| 8 Critical        |                                |                           |                                               |                   |

1. **Risk of bias:** Serious. Inconsistency: No serious. Indirectness: No serious. Imprecision: Serious. Low number of patients. Publication bias: No serious.
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 27% of stroke survivors in Australia (Stroke Foundation 2020[8]). Management strategies used included visual scanning with sensory stimulation (72%), eye patching (4%), simple cues (87%), mental imagery training (18%) and other therapies.
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.

**Evidence To Decision**

**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 [344])

**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.

Consideration should also be given to “adaptive cueing” which is individualised, consists of internal and external cues, and is based on neglect severity. No adverse outcomes or contraindications were reported in the literature.

**Benefits and harms**
Cognitive rehabilitation should be considered to decrease symptoms of unilateral neglect (Bowen et al. 2013 [344]). It is not clear if cognitive rehabilitation improves ADL performance of patients with unilateral neglect (Bowen et al. 2013 [344]; Liu et al 2019 [356]).

**Certainty of the Evidence**
Methodological limitations and small sample sizes impacted the quality of evidence available.

**Preference and values**
Stroke survivors with unilateral neglect would want to receive appropriate treatments, although the optimal approach...
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).

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) [344] conducted a Cochrane review involving 23 RCTs (n=628) 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) [345] 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.

Svaerke et al. (2018) [355] in a systematic review assessed the effects of computer based cognitive rehabilitation (CBCR) on visuospatial neglect after stroke. Studies were included if at least 50% of the included patients had a stroke. Seven studies were identified and three were RCTs and the others were CCTs. Results were presented narratively due to heterogeneity in study design and methodological limitations. Six of the seven studies suggested positive effects of CBCR on neglect after stroke.
Liu et al. (2019) [356] conducted a systematic review containing RCTs published between 2006 to 2016 evaluating the effectiveness of activity-based (i.e. computer-based training for visual scanning training and optokinetic stimulation, mental practice, mirror therapy, voluntary trunk rotation, and vestibular rehabilitation), nonactivity-based, and combined activity- and nonactivity-based rehabilitative interventions (i.e. electrical somatosensory stimulation with visual scanning training; hemifield eye-patching combined with cognitive-based rehabilitation, optokinetic stimulation; prismatic glasses with visual target training; and transcutaneous nerve stimulation with visual scanning training). Twenty RCTs (n=594) were included. Pooling data from 9 trials found activity based interventions reduced neglect (SMD 0.96, 95%CI 0.09 to 1.82; >80% heterogeneity) and improved ADL (SMD 0.49, 95% CI 0.01 to 0.97). Combined activity and non-activity interventions were not significant for ADL measures.

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>During treatment: 4 weeks</td>
<td>Odds Ratio 1.21 (CI 95% 0.26 - 5.76) Based on data from 39 patients in 1 studies.</td>
<td><strong>190</strong> per 1000</td>
<td><strong>221</strong> per 1000</td>
<td>Low Due to serious risk of bias, Due to serious imprecision</td>
</tr>
<tr>
<td></td>
<td>7 Critical</td>
<td>(Randomized controlled) Follow up: 4 weeks of treatment.</td>
<td>Difference: <strong>31 more</strong> per 1000 (CI 95% 133 fewer - 385 more)</td>
<td>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</td>
<td></td>
</tr>
<tr>
<td>Activities of daily living</td>
<td>Post intervention</td>
<td>Measured by: Barthel Index, Functional Impairment Measure, Catherine Bergego Scale High better Based on data from: 343 patients in 10 studies.</td>
<td><strong>SMD 0.23 higher</strong> (CI 95% 0.02 lower - 0.48 higher)</td>
<td>Low Due to serious risk of bias</td>
<td>Cognitive rehabilitation may have little or no difference on level of disability/activities of daily living immediately following intervention</td>
</tr>
<tr>
<td></td>
<td>8 Critical</td>
<td>(Randomized controlled) Follow up: 1 to 12 weeks of treatment.</td>
<td>Difference: <strong>SMD 0.35 higher</strong> (CI 95% 0.09 higher - 0.62 higher)</td>
<td>Cognitive rehabilitation probably decreases neglect slightly/slightly improves neglect symptoms</td>
<td></td>
</tr>
<tr>
<td>Neglect</td>
<td>Post intervention</td>
<td>Measured by: Target cancellation, line bisection, BIT subtests High better Based on data from: 437 patients in 16 studies.</td>
<td><strong>SMD 0.35 higher</strong> (CI 95% 0.09 higher - 0.62 higher)</td>
<td>Moderate Due to serious risk of bias</td>
<td>Cognitive rehabilitation probably decreases neglect slightly/slightly improves neglect symptoms</td>
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<tr>
<td></td>
<td>8 Critical</td>
<td>(Randomized controlled) Follow up: 1 to 12 weeks of treatment.</td>
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</tr>
</tbody>
</table>

1. Systematic review [344]. **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.
4. **Risk of bias**: Serious. Incomplete data and/or large loss to follow up, Inadequate/lack of blinding of outcome assessors,

5. Systematic review [344]. Baseline/comparator: Control arm of reference used for intervention.

Weak recommendation

For stroke survivors with symptoms of unilateral neglect, mirror therapy may be used to improve arm function and ADL performance. (Thieme et al. 2018 [188])

Evidence To Decision

Benefits and harms
Mirror therapy improves performance in ADLs, but it is unclear if it improves neglect. (Thieme et al. 2018 [188]). No adverse outcomes relating to this intervention have been reported in studies.

Certainty of the Evidence
Moderate quality for ADL measures. Low quality for neglect.

Preference and values
Patients' preferences may vary due to unclear evidence of benefits for neglect.

Resources and other considerations

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

Thieme et al 2018[188] included 62 studies (n=1982) but only 5 studies were pooled related to visuospatial neglect. There was no clear effect found (SMD 1.06, 95% CI −0.10 to 2.23; 5 studies, n=175; low certainty evidence). Mirror therapy did improve ADL (SMD 0.48, 95%CI 0.30 to 0.65; 28 studies, n=898; moderate certainty evidence). But it is unclear how many participants had problems with neglect on enrollment to studies.

### Outcome

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
<th>Plain text summary</th>
</tr>
</thead>
</table>
| **Activities of daily living**  
Post intervention: 4 to 6 weeks  
7 Critical | Measured by: ADL (FIM, BI)  
High better  
Based on data from: 622 patients in 19 studies.  
(Randomized controlled) | Control  
*points (Mean)*  
Difference: SMD 0.48 higher  
( CI 95% 0.3 higher - 0.65 higher ) | Moderate  
Due to serious risk of bias 1 |
| **Visuospatial neglect**  
Post intervention: 6 weeks  
7 Critical | Measured by: Various measures  
High better  
Based on data from: 175 patients in 5 studies.  
(Randomized controlled) | Control  
*points (Mean)*  
Difference: SMD 1.06 higher  
( CI 95% 0.1 lower - 2.23 higher ) | Low  
Mirror therapy may decrease visuospatial neglect at the end of intervention |

2. Systematic review [188]. Baseline/comparator: Control arm of reference used for intervention.

### 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.
Evidence To Decision

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

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) [344] conducted a Cochrane review involving 23 RCTs (n=628) 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) [345] 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.

Svaerke et al. (2018) [355] in a systematic review assessed the effects of computer based cognitive rehabilitation (CBCR) on visuospatial neglect after stroke. Studies were included if at least 50% of the included patients had a stroke. Seven studies were identified and three were RCTs and the others were CCTs. Results were presented narratively due to heterogeneity in study design and methodological limitations. Six of the seven studies suggested positive effects of CBCR on neglect after stroke.

Liu et al. (2019) [356] conducted a systematic review containing RCTs published between 2006 to 2016 evaluating the effectiveness of activity-based (i.e. computer-based training for visual scanning training and optokinetic stimulation, mental practice, mirror therapy, voluntary trunk rotation, and vestibular rehabilitation), nonactivity-based, and combined activity- and nonactivity-based rehabilitative interventions (i.e. electrical somatosensory stimulation with visual scanning training; hemifield eye-patching combined with cognitive-based rehabilitation, optokinetic stimulation; prismatic glasses with visual target training; and transcutaneous nerve stimulation with visual scanning training). Twenty RCTs (n=594) were included. Pooling data from 9 trials found activity based interventions reduced neglect (SMD 0.96, 95%CI 0.09 to 1.82; >80% heterogeneity) and improved ADL (SMD 0.49, 95% CI 0.01 to 0.97). Combined activity and non-activity interventions were not significant for ADL measures.
<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Falls During treatment: 4 weeks</td>
<td>Odds Ratio 1.21 (CI 95% 0.26 - 5.76) Based on data from 39 patients in 1 studies. ¹ (Randomized controlled) Follow up: 4 weeks of treatment.</td>
<td>190 per 1000 221 per 1000 Difference: 31 more per 1000 (CI 95% 133 fewer - 385 more)</td>
<td>Low Due to serious risk of bias, Due to serious imprecision ²</td>
<td>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.</td>
</tr>
<tr>
<td>Activities of daily living Post intervention</td>
<td>Measured by: Barthel Index, Functional Impairment Measure, Catherine Bergego Scale High better Based on data from: 343 patients in 10 studies. ³ (Randomized controlled) Follow up: 1 to 12 weeks of treatment.</td>
<td>Difference: SMD 0.23 higher (CI 95% 0.02 lower - 0.48 higher)</td>
<td>Low Due to serious risk of bias ⁴</td>
<td>Cognitive rehabilitation may have little or no difference on level of disability/activities of daily living immediately following intervention.</td>
</tr>
<tr>
<td>Neglect Post intervention</td>
<td>Measured by: Target cancellation, line bisection, BIT subtests High better Based on data from: 437 patients in 16 studies. ⁵ (Randomized controlled) Follow up: 1 to 12 weeks of treatment.</td>
<td>Difference: SMD 0.35 higher (CI 95% 0.09 higher - 0.62 higher)</td>
<td>Moderate Due to serious risk of bias ⁶</td>
<td>Cognitive rehabilitation probably decreases neglect slightly/slightly improves neglect symptoms.</td>
</tr>
</tbody>
</table>

5. Systematic review [344]. 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, 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.
**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).

**Evidence To Decision**

### Benefits and harms

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.

### Certainty of the Evidence

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

Patients’ preferences are likely to vary due to unclear evidence of benefits.

### Resources and other considerations

**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:** repetitive transcranial magnetic stimulation (rTMS)

**Comparator:** Control

### Summary

Fan et al. (2018) [351] evaluated the effect of noninvasive brain stimulation (NIBS) techniques in the recovery of unilateral neglect in poststroke patients. Twelve studies (11 RCTs) were included. Patients who received active repetitive transcranial magnetic stimulation improved unilateral neglect compared to the control group (Effect size -1.76; 95% CI -2.40 to -1.12).

Similarly, Salazar et al. (2018) [354] evaluated the effectiveness of NIBS i.e. repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS) on hemispatial neglect and performance in activities of daily living (ADL) after stroke. The review included 10 trials with 226 patients and found that NIBS combined with other therapies significantly improved hemispatial neglect (SMD 1.91; 95% CI -2.57 to -1.25). Subgroup analysis of rTMS interventions versus sham controls also reported positive effect on hemispatial neglect (SMD -2.16; 95% CI -3.00 to -1.33).

### Outcome Timeframe

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Study results and measurements</th>
<th>Absolute effect estimates</th>
<th>Certainty of the Evidence (Quality of evidence)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Spatial awareness (Line bisection test) ¹</td>
<td>Measured by: Line bisection test Lower better Based on data from: 34 patients in 1 studies. ² (Randomized controlled) Follow up: 1 day or 2 weeks of treatment.</td>
<td>Repetitive transcranial magnetic stimulation (rTMS)</td>
<td>Moderate</td>
<td>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. ³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>39.26 mm from midline (Mean)</td>
<td>rTMS may improve spatial awareness as tested by the line bisection test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>14.45 mm from midline (Mean)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Difference: MD 24.81 lower CI 95%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spatial awareness (Letter cancellation test) ⁴</td>
<td>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.</td>
<td></td>
<td>Moderate</td>
<td>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 &amp; associated maintenance effects. ⁵</td>
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<tr>
<td></td>
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<td>16.63 points (Mean)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>17 points (Mean)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Difference: MD 0.37 higher CI 95%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Critical
2. Discrepancy in timing of follow-up measures across groups may have impacted conclusions around maintenance effects.
3. Discrepancy in timing of follow-up measures across groups may have impacted conclusions around maintenance effects.
4. Issues with discrepancy in timing of outcome measures across groups may impact findings/direct comparisons of groups & associated maintenance effects.
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<tbody>
<tr>
<td><strong>Unilateral neglect (Line bisection test)</strong>&lt;br&gt;4 weeks post-intervention&lt;br&gt;8 Critical</td>
<td>Measured by: Line bisection test&lt;br&gt;High better&lt;br&gt;Based on data from: 30 patients in 1 studies.&lt;br&gt;(Randomized controlled)</td>
<td>34.6 (Mean)&lt;br&gt;Difference: MD 10.5 lower&lt;br&gt;Ci 95%&lt;br&gt;19.33 (Mean)</td>
<td>Low&lt;br&gt;Due to very serious imprecision</td>
<td>rTMS may improve unilateral neglect as tested by the line bisection test.</td>
</tr>
<tr>
<td><strong>Unilateral neglect (Albert test)</strong>&lt;br&gt;4 weeks post-intervention&lt;br&gt;8 Critical</td>
<td>Measured by: Albert test&lt;br&gt;High better&lt;br&gt;Based on data from: 30 patients in 1 studies.&lt;br&gt;(Randomized controlled)</td>
<td>27.33 (Mean)&lt;br&gt;Difference: MD 7.1 higher&lt;br&gt;Ci 95%&lt;br&gt;35.55 (Mean)</td>
<td>Low&lt;br&gt;Due to very serious imprecision</td>
<td>rTMS may improve unilateral neglect as tested by the albert test.</td>
</tr>
<tr>
<td><strong>Spatial awareness (Ota's task)</strong>&lt;br&gt;Group 1: same day; Group 2: 2 weeks&lt;br&gt;7 Critical</td>
<td>Based on data from: 34 patients in 1 studies.&lt;br&gt;(Randomized controlled)&lt;br&gt;Follow up: 1 day or 2 weeks of treatment.</td>
<td>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.</td>
<td>Moderate&lt;br&gt;Discrepancy in timing of assessments across groups makes conclusions around sustainability of effects challenging.</td>
<td>rTMS may improve spatial awareness as tested by ota's task</td>
</tr>
</tbody>
</table>

1. discrepancy in timing of follow-up assessments across groups
2. Primary study[336]. 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, no power calculations. **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.**
Clinical Question/ PICO

Population: Adults with stroke with neglect
Intervention: transcranial direct current stimulation (tDCS)
Comparator: Control

Summary

Fan et al. (2018) [351] evaluated the effect of noninvasive brain stimulation techniques in the recovery of unilateral neglect in poststroke patients. Twelve studies (11 RCTs) were included. Patients who received active transcranial magnetic stimulation (tDCS) improved unilateral neglect compared to the control group (effect size [ES] -0.51; 95% CI -1.02 to -0.01). However, subgroup analysis found conflicting results.

A meta-analysis by Kwon (2018) [352] broadly evaluated interventions of qualitatively, well-designed studies from the past 10 years for treating visuo-spatial neglect, in patients who had suffered a stroke. Eight RCTs with 237 participants were included. The outcomes were categorised broadly into two as mental function and activity and participation. The effect size of mental function was 0.850, [large effect size] and for activity and participation was 0.536, [medium effect size]. It is difficult to draw conclusions based on the multiple interventions included in this review and it doesn't really draw conclusions about specific interventions (the review also states this as a limitation).

Similarly, Salazar et al. (2018) [354] evaluated the effectiveness of non-invasive brain stimulation on hemispatial neglect and performance in activities of daily living (ADL) after stroke. The review included 10 trials with 226 patients and found that brain stimulation combined with other therapies significantly improved hemispatial neglect (SMD -1.91; 95% CI -2.57 to -1.25). Subgroup analysis of tDCS versus sham tDCS control reported significant difference (SMD -1.07; 95% CI -1.76 to -0.37).

<table>
<thead>
<tr>
<th>Outcome Timeframe</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Neglect (Motor-Free Visual Perception Test) 3 weeks 7 Critical</td>
<td>Measured by: Motor-Free Visual Perception Test (MVPT) High better Based on data from: 12 patients in 1 studies. (Randomized controlled)</td>
<td>Control transcranial direct current stimulation (tDCS) 25.3 (Mean) 30.83 (Mean) Difference: MD 5.8 higher n/a</td>
<td>Very Low Due to very serious risk of bias, Due to serious imprecision, Due to serious indirectness 1</td>
<td>We are uncertain whether transcranial direct current stimulation (tDCS) improves or worsen neglect (motor-free visual perception test).</td>
</tr>
<tr>
<td>Neglect (Line Bisection Test) 3 weeks 7 Critical</td>
<td>Measured by: Line Bisection Test Based on data from: 12 patients in 1 studies. (Randomized controlled)</td>
<td>5.9 (Mean) 5.37 (Mean) Difference: MD 0.53 lower n/a</td>
<td>Very Low Due to very serious risk of bias, Due to serious indirectness, Due to serious imprecision 2</td>
<td>We are uncertain whether transcranial direct current stimulation (tDCS) increases or decreases neglect (line bisection test).</td>
</tr>
<tr>
<td>Functional independence 3 weeks</td>
<td>Measured by: Modified Barthel Index Based on data from: 12 patients in 1 studies.</td>
<td>69.2 (Mean) 78.3 (Mean) Difference: MD 9.1 higher</td>
<td>Very Low Due to very serious risk of bias, Due to serious</td>
<td>We are uncertain whether transcranial direct current stimulation (tDCS) increases or decreases functional independence.</td>
</tr>
</tbody>
</table>
1. **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 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.

2. **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.

3. **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.

### Clinical Question/ PICO
- **Population:** Adults with stroke with neglect
- **Intervention:** Continuous theta-burst stimulation (cTBS)
- **Comparator:** Sham

### Summary
A systematic review by Cotoi et al (2019) [350] evaluated the effectiveness of theta-burst stimulation compared against placebo or active controls for the treatment of stroke-induced unilateral spatial neglect. Nine studies with 148 patients met the inclusion criteria (7 RCTs and 2 CCTs). Eight studies evaluated a continuous stimulation protocol and one evaluated an intermittent stimulation protocol. Overall, both protocols significantly improved neglect severity (p < 0.05). There were inconsistencies in application of the intervention and its duration varied. Due to heterogeneity, it is difficult to make any conclusive statements about the intervention effectiveness.

Fan et al. (2018) [351] evaluated the effect of noninvasive brain stimulation techniques in the recovery of unilateral...
neglect in poststroke patients. Twelve studies (11 RCTs) were included. Patients who received active transcranial direct current stimulation or repetitive transcranial magnetic stimulation, improved unilateral neglect compared to the control group (-0.51; 95% CI -1.02 to -0.01 and ES -1.76; 95% CI -2.40 to -1.12 respectively). The effect from continuous theta burst stimulation was non-significant (-0.77; 95% CI -1.90 to 0.37; p = 0.18).

<table>
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<tr>
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<tbody>
<tr>
<td>Neglect (Line Bisection Test)</td>
<td>4 weeks</td>
<td>Measured by: Line bisection test Lower better Based on data from: 20 patients in 1 studies. (Randomized controlled) Follow up: 4 weeks.</td>
<td>35.79 (Mean)</td>
<td>Low Due to very serious imprecision 1</td>
<td>Continuous theta-burst stimulation (cTBS) may improve neglect (line bisection test).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11.17 (Mean)</td>
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<td></td>
<td></td>
<td></td>
<td>Difference: MD 24.62 lower n/a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neglect (Star cancellation test)</td>
<td>4 weeks</td>
<td>Measured by: Star cancellation test Lower better Based on data from: 20 patients in 1 studies. (Randomized controlled) Follow up: 4 weeks.</td>
<td>45.29 (Mean)</td>
<td>Low Due to very serious imprecision 2</td>
<td>Continuous theta-burst stimulation (cTBS) may improve neglect (star cancellation test).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6.25 (Mean)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Difference: MD 39.95 lower n/a</td>
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</tbody>
</table>

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.
Telehealth in rehabilitation

Evidence is currently being reviewed for this topic.
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.

Penumbral-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

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACE</td>
<td>Angiotensin-converting enzyme</td>
</tr>
<tr>
<td>ADL</td>
<td>Activities of daily living</td>
</tr>
<tr>
<td>AF</td>
<td>Atrial fibrillation</td>
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<tr>
<td>AFO</td>
<td>Ankle foot orthosis</td>
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<tr>
<td>BAO</td>
<td>Basilar artery occlusion</td>
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<tr>
<td>BI</td>
<td>Barthel Index</td>
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<tr>
<td>BMI</td>
<td>Body mass index</td>
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<tr>
<td>BP</td>
<td>Blood pressure</td>
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<tr>
<td>CEA</td>
<td>Carotid endarterectomy</td>
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<tr>
<td>CEMRA</td>
<td>Contrast-enhanced magnetic resonance angiography</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
</tr>
<tr>
<td>CIMT</td>
<td>Constraint induced movement therapy</td>
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<tr>
<td>CT</td>
<td>Computed tomography</td>
</tr>
<tr>
<td>CTA</td>
<td>Computed tomography angiography</td>
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<tr>
<td>CVD</td>
<td>Cardiovascular disease</td>
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<tr>
<td>DALY</td>
<td>Disability-adjusted life years</td>
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<tr>
<td>DBP</td>
<td>Diastolic blood pressure</td>
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<tr>
<td>DOAC</td>
<td>Direct oral anticoagulant</td>
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<tr>
<td>DSA</td>
<td>Digital subtraction angiography</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>DUS</td>
<td>Doppler ultrasonography</td>
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<tr>
<td>DVT</td>
<td>Deep vein thrombosis</td>
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<td>DWI</td>
<td>Diffusion-weighted imaging</td>
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<tr>
<td>ECG</td>
<td>Electrocardiography</td>
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<tr>
<td>ED</td>
<td>Emergency department</td>
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<td>EMG</td>
<td>Electromyographic feedback</td>
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<td>EMS</td>
<td>Emergency medical services</td>
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<tr>
<td>ESD</td>
<td>Early supported discharge</td>
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<tr>
<td>ESS</td>
<td>European Stroke Scale</td>
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<tr>
<td>FAST</td>
<td>Face, Arm, Speech, Time</td>
</tr>
<tr>
<td>FEES</td>
<td>Fibre-optic endoscopic examination of swallowing</td>
</tr>
<tr>
<td>FeSS</td>
<td>Fever, Sugar, Swallowing</td>
</tr>
<tr>
<td>FFP</td>
<td>Fresh frozen plasma</td>
</tr>
<tr>
<td>FIM</td>
<td>Functional independence measure</td>
</tr>
<tr>
<td>GP</td>
<td>General practitioner</td>
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<tr>
<td>HR</td>
<td>Hazard ratio</td>
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<tr>
<td>HRQOL</td>
<td>Health related quality of life</td>
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<tr>
<td>HRT</td>
<td>Hormone replacement therapy</td>
</tr>
<tr>
<td>IA</td>
<td>Intra-arterial</td>
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<tr>
<td>ICH</td>
<td>Intracerebral haemorrhage</td>
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<tr>
<td>ICU</td>
<td>Intensive care unit</td>
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<tr>
<td>INR</td>
<td>International normalised ratio</td>
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<tr>
<td>IPC</td>
<td>Intermittent pneumatic compression</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenous</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>LMWH</td>
<td>Low molecular weight heparin</td>
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<tr>
<td>LOS</td>
<td>Length of stay</td>
</tr>
<tr>
<td>MCA</td>
<td>Middle cerebral artery</td>
</tr>
<tr>
<td>MD</td>
<td>Mean difference</td>
</tr>
<tr>
<td>MI</td>
<td>Myocardial infarction</td>
</tr>
<tr>
<td>MNA</td>
<td>Mini Nutritional Assessment</td>
</tr>
<tr>
<td>MR</td>
<td>Magnetic resonance</td>
</tr>
<tr>
<td>MRA</td>
<td>Magnetic resonance angiography</td>
</tr>
<tr>
<td>MRI</td>
<td>Magnetic resonance imaging</td>
</tr>
<tr>
<td>mRS</td>
<td>Modified rankin scale</td>
</tr>
<tr>
<td>MST</td>
<td>Malnutrition screening tool</td>
</tr>
<tr>
<td>MUST</td>
<td>Malnutrition universal screening tool</td>
</tr>
<tr>
<td>N</td>
<td>Number of participants in a trial</td>
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<tr>
<td>NASCET</td>
<td>North American Symptomatic Carotid Endarterectomy Trial</td>
</tr>
<tr>
<td>NG</td>
<td>Nasogastric</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
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<tr>
<td>NIHSS</td>
<td>National Institutes of Health Stroke Scale</td>
</tr>
<tr>
<td>NMES</td>
<td>Neuromuscular electrical stimulation</td>
</tr>
<tr>
<td>NNH</td>
<td>Numbers needed to harm</td>
</tr>
<tr>
<td>NNT</td>
<td>Numbers needed to treat</td>
</tr>
<tr>
<td>OR</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>OT</td>
<td>Occupational therapist</td>
</tr>
<tr>
<td>PBS</td>
<td>Pharmaceutical Benefits Scheme</td>
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<tr>
<td>PE</td>
<td>Pulmonary embolism</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>PEG</td>
<td>Percutaneous endoscopic gastrostomy</td>
</tr>
<tr>
<td>PFO</td>
<td>Patent foramen ovale</td>
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<tr>
<td>PPV</td>
<td>Positive predictive value</td>
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<tr>
<td>QALYs</td>
<td>Quality-adjusted life years</td>
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<tr>
<td>QOL</td>
<td>Quality of life</td>
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<tr>
<td>RCT</td>
<td>Randomised controlled trial</td>
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<tr>
<td>rFVIIa</td>
<td>Recombinant activated factor VII</td>
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<td>RHS</td>
<td>Right hemisphere syndrome</td>
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<tr>
<td>ROC</td>
<td>Receiver operator curve</td>
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<tr>
<td>ROM</td>
<td>Range of motion</td>
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<tr>
<td>ROSIER</td>
<td>Recognition of stroke in the emergency room</td>
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<tr>
<td>RR</td>
<td>Relative risk</td>
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<tr>
<td>RRR</td>
<td>Relative risk reduction</td>
</tr>
<tr>
<td>rTMS</td>
<td>Repetitive transcranial magnetic stimulation</td>
</tr>
<tr>
<td>rt-PA</td>
<td>Recombinant tissue plasminogen activator</td>
</tr>
<tr>
<td>SBP</td>
<td>Systolic blood pressure</td>
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<tr>
<td>SC</td>
<td>Subcutaneous</td>
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<tr>
<td>SD</td>
<td>Standard deviation</td>
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<tr>
<td>SE</td>
<td>Standard error</td>
</tr>
<tr>
<td>SES</td>
<td>Standardised effect size</td>
</tr>
<tr>
<td>SGA</td>
<td>Subjective global assessment</td>
</tr>
<tr>
<td>sICH</td>
<td>Symptomatic intracerebral haemorrhage</td>
</tr>
<tr>
<td>SMD</td>
<td>Standardised mean difference</td>
</tr>
<tr>
<td>SSS</td>
<td>Scandinavian stroke scale</td>
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<td>Abbreviation</td>
<td>Description</td>
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</tr>
<tr>
<td>TEE</td>
<td>Transoesophageal echocardiography</td>
</tr>
<tr>
<td>TIA</td>
<td>Transient ischaemic attack</td>
</tr>
<tr>
<td>TOE</td>
<td>Transoesophageal echocardiography</td>
</tr>
<tr>
<td>TOR-BSST</td>
<td>Toronto Bedside Swallowing Screening test</td>
</tr>
<tr>
<td>tPA</td>
<td>Tissue plasmogen activator</td>
</tr>
<tr>
<td>TTE</td>
<td>Transthoracic echocardiography</td>
</tr>
<tr>
<td>UFH</td>
<td>Unfractionated heparin</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UL</td>
<td>Upper limb</td>
</tr>
<tr>
<td>VF or VFS</td>
<td>Videofluoroscopy</td>
</tr>
<tr>
<td>VR</td>
<td>Virtual reality</td>
</tr>
<tr>
<td>VTE</td>
<td>Venous thromboembolism</td>
</tr>
<tr>
<td>WMD</td>
<td>Weighted mean difference</td>
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