National Institute for Health and Care Excellence

Draft for consultation

Rehabilitation for chronic neurological disorders including acquired brain injury

[F] Evidence review for speech, language and communication

NICE guideline <number>

Evidence reviews underpinning recommendations 1.12.1 to 1.20.7 in the NICE guideline

April 2025

Draft for consultation

This evidence review was developed by NICE

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Speech, language, and communication

Review question

What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Introduction

Many people with chronic neurological disorders including acquired brain injury, spinal cord injury, peripheral nerve disorders, progressive neurological diseases and functional neurological disorders, are known to have communication needs. These may include problems with speech, fluency, understanding, language or voice, or any combination of these factors. They cause problems that may impact at any point in a person's life, from childhood to adulthood, and can negatively impact their relationships, independence, everyday tasks, mood and quality of life.

There is little treatment guidance available for the health professionals, including the speech and language therapists, who intervene to assist people with communication needs. Little is known about which interventions may best help to improve, maintain, or support these fundamental skills. Therefore, the aim of this review was to determine the most effective speech, language, and communication rehabilitation interventions that could be used to help people experiencing these challenges as a result of their chronic neurological condition.

Summary of the protocol

See Table 1 for a summary of the Population, Intervention, Comparison and Outcome (PICO) characteristics of this review.

Table 1: Summary of the protocol

Population	Adults and children with rehabilitation needs due to the following chronic neurological disorders: ○ Acquired brain injury ○ Acquired spinal cord injury ○ Acquired peripheral nerve disorders ○ Progressive neurological diseases ○ Functional neurological disorders
Intervention	• **Intervention group 1: Interventions to improve speech and language skills (including fluency).** Examples include, but are not limited to, strategy training, RESTART-Demands and Capabilities Model method (children and young people only), and Lidcombe stuttering programme (children and young people only). • **Intervention group 2: Interventions to support communication (augmentative and alternative communication).** Examples include, but are not limited to, Talking Mats, visual aids, and technological communication aids. • **Intervention group 3: Interventions to improve communication (for example, to improve the underlying condition)**. Examples include, but are not limited to, integrated comprehensive aphasia therapy, script training, and attention and listening therapy (children and young people only). • **Intervention group 4: Interventions to improve language**. Examples include, but are not limited to, semantic feature analysis, word and sentence

	therapies, and discourse therapy. • **Intervention group 5: Interventions to support and improve voice**. Examples include, but are not limited to, vocal hygiene interventions, twang, Lee Silverman Voice Treatment, and compensatory methods (amplification, reducing compensatory muscle strain).
Comparison	• Interventions compared with others in the same group or: • Placebo (placebo or sham) • Control (no intervention, waitlist, standard rehabilitation care alone, or 'usual care') • The same intervention (as listed under 'intervention') but varied in terms of: ○ Frequency ○ Intensity ○ Timing ○ Setting
Outcomes	**Critical:** • Speech [measured using a validated tool, such as the Frenchay Dysarthria Assessment, Assessment of Intelligibility of Dysarthric Speech (AIDS), Apraxia Battery for Adults (oral domain only), Speech Phonological Screening Assessment, and South Tyneside Assessment of Phonology] • Language [measured using a validated tool, such as Western Aphasia Battery – Revised (WAB-R), Boston Naming Test (BNT), Comprehensive Aphasia Test (CAT), Psycholinguistic Assessments of Language Processing in Aphasia (PALPA), Pyramids and Palm Trees, Object Naming Test (ONT), Right Hemisphere Language Battery, Clinical Evaluation of Language Fundamentals (CELF), Preschool Language Scales, Renfrew Action Picture Test, and Test of Word Finding] • Communication [measured using a validated tool, such as The Scenario Test, La Trobe Communication Questionnaire (LCQ), Functional Assessment of Verbal Reasoning and Executive Strategies (FAVRES), Communication Activities of Daily Living (CADL), and Communication Outcome After Stroke Scale (COAST)] • Voice [measured using a validated tool, such as Voice Impact Scale, Grade, Roughness, Breathiness, Asthenia, Strain (GRBAS scale), Voice Symptoms Scale (VoiSS), Voice-Related Quality of Life Measure (V-RQOL), Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)] • Fluency [measured using a validated tool, such as Riley's Stuttering Severity Instrument, Wright and Ayre Stuttering Self-rating Profile (WASSP), Overall Assessment of the Speaker's Experience of Stuttering (OASES)]. **Important:** • Physical and mental health related quality of life and social care related quality of life [measured using a validated tool, such as EQ-5D, SF-12, Short Musculoskeletal Function Assessment (SFMA), Adult Social Care Outcomes Toolkit (ASCOT) and ICECAP-A, Stroke Aphasia QOL Scale (SAQOL), Warwick Edinburgh Mental Well-Being Scale, Satisfaction with Life Scale (SWLS), Quality of Life in Brain Injury Scale (QOLIBRI), and Therapy Outcome Measures (TOMs)] • Mood [assessed using standardised, validated measures of anxiety and depression such as HADS, PHQ-9, Beck's Depression/Anxiety Inventory (BD/AI), DAS, CES-D, State-Trait Anxiety Inventory (STAI), Children's Depression Inventory (CDI), Children's Depression Rating Scale (CDRS and the Geriatric Depression Scale (GDS)]

ICECAP-A: ICEpop CAPability measure for adults; CES-D: Center for Epidemiologic Studies depression scale; DAS: depression, anxiety and stress scale; EQ 5D: EuroQoL five dimensions; HADS: hospital anxiety and depression scale; PHQ-9: patient health questionnaire-9; QOL: quality of life; SF-36: 36-Item short form survey

For further details see the review protocol in appendix A.

Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocol in appendix A and the methods document (Supplement 1: methods).

Declarations of interest were recorded according to NICE's conflicts of interest policy.

Effectiveness evidence

Included studies

Seven papers were included in this review; 5 randomised controlled trials (RCT; Brabenec 2021; Crispiatico 2022; Raglio 2016; Sackley 2018; Theodoros 2016), 1 secondary paper reporting additional information for Brabenec 2021 (Brabenec 2022) and 1 follow-up economic evaluation reporting long-term data for Sackley 2018 (Scobie 2021).

The included studies are summarised in Table 2.

One study was conducted in the UK (Sackley 2018), 2 studies were conducted in Italy (Crispiatico 2022; Raglio 2016), 1 study was conducted in the Czech Republic (Brabenec 2021) and 1 study was conducted in Australia (Theodoros 2016).

All studies were conducted in adults with progressive neurological diseases. Three RCTs reported on adults with Parkinson's disease (Brabenec 2021; Sackley 2018; Theodoros 2016); 1 RCT reported on adults with multiple sclerosis (Crispiatico 2022); and 1 RCT reported on adults with amyotrophic lateral sclerosis (Raglio 2016).

Three RCTs (Crispiatico 2022; Sackley 2018; Theodoros 2016) investigated interventions to improve voice. Two RCTs (Crispiatico 2022; Sackley 2018) compared Lee Silverman Voice Treatment (LSVT) LOUD® versus standard care (with speech and language therapy [SLT]), 1 RCT (Sackley 2018l) compared LSVT LOUD® versus standard care (without SLT), and 1 RCT (Theodoros 2016) compared LSVT LOUD® online versus LSVT LOUD® face to face. One RCT (Brabenec 2021) compared rTMS (repetitive transcranial magnetic stimulation) versus sham rTMS to improve speech and language. One RCT (Raglio 2016) compared active music therapy (AMT) versus standard care to improve communication.

There were no trials reporting data for children and young people. Additionally, none of the included studies reported data from adults with an acquired brain injury, acquired spinal cord injury, acquired peripheral nerve disorders, or a functional neurological disorder.

Data for the following outcomes were identified through analysis of the included studies:

- Speech
- Communication
- Voice
- Physical and mental health related quality of life and social care related quality of life
- Mood

See the literature search strategy in appendix B and study selection flow chart in appendix C.

Excluded studies

Studies not included in this review are listed, and reasons for their exclusion are provided in appendix J.

Summary of included studies

Summaries of the studies that were included in this review are presented in Table 2.

Table 2: Summary of included studies

Study	Population	Intervention	Comparison	Outcomes
Brabenec 2021 (Brabenec 2022) RCT Czech Republic	N=39 adults with Parkinson's disease • Real rTMS: n=20 • Sham rTMS: n=19 Age in years [Mean (SD)]: • Real rTMS: 68.9 (7.6) • Sham rTMS: 70.7 (7.8) Sex (M/F): • Real rTMS: n=14/n=6 • Sham rTMS: n=9/n=4 Chronic neurological disorder category: Progressive neurological disease.	Real rTMS 10x 40-minute sessions over 2 weeks in a university setting by a trained technician. Participants underwent 1 Herz repetitive transcranial magnetic stimulation over the right posterior superior temporal gyrus (STG) with 100% intensity of the resting motor threshold and 1800 pulses per session. An air-cooled figure-eight-shaped coil was placed over the STG region to achieve this. Protocol intervention group: Interventions to improve speech and language (including fluency).	Sham rTMS 10x 40-minute sessions over 2 weeks in a university setting by a trained technician Conditions for the sham rTMS were replicated such that there was a sham coil placed over the STG which emitted similar clicking sounds. There was no induction of magnetic field or electrical scalp stimulation.	• Speech
Crispiatico 2022 RCT Italy	N=44 adults with multiple sclerosis: • LSVT LOUD®: n=23 • Standard care: n=21 Age in years [Mean (SD)]: • LSVT LOUD®: 55.1 (9.3) • Standard care: 57.6 (10.4) Sex (M/F): • LSVT LOUD®: n=14/n=9 • Standard care: n=11/n=10 Chronic neurological disorder cate-	LSVT LOUD® 16 sessions (1 session x 4 times a week) Daily tasks consist of 30 minutes of sustained /a/ phonation, /a/ at high volume, pitch glides, and the reading of 10 functional sentences. Hierarchical exercises consist of 30 minutes reading and conversation exercises progressing in difficulty by increasing duration and complexity of tasks. Protocol intervention	Standard care Included a wide range of speech therapy techniques, such as exercises targeting respiration, phonation, and behavioural strategies. The intensity and types of exercises were personalised and adapted to the individuals needs and abilities.	• Voice

Study	Population	Intervention	Comparison	Outcomes
	gory: Progressive neurological disease.	group: Interventions to support and improve voice.		
Raglio 2016 RCT Italy	N=30 adults with amyotrophic lateral sclerosis (ALS) or primary lateral sclerosis. • Active music therapy: n=15 • Standard care: n=15 Age in years [mean (SD)]: • Active music therapy: 62.9 (9.83). • Standard care: 65.1 (12.10). Sex (M/F): • Active music therapy: n=7/n=8 • Standard care: n=6/n=9 Chronic neurological disease category: Progressive neurological disease.	Active music therapy. 12 sessions (One 30minute session x 3 times a week) Music therapist stimulates the patient to interact/communicate using rhythmic and melodic instruments and facilitates the patient's emotional expression and regulation Protocol intervention group: Interventions to improve communication (for example, to improve the underlying condition).	Standard care Treatment based on physical and speech rehabilitation sessions, occupational therapy, and psychological support).	• Physical and mental health related quality of life and social care related quality of life • Mood
Sackley 2018 RCT UK	N=89 adults with Parkinson's disease. • LSVT LOUD®: n=30 • Standard care with speech and language therapy (SLT): n=30 • Standard care without SLT: n=29 Age in years [Mean (SD)]: • LSVT LOUD®: 67 (8.4). • Standard care with SLT: 68 (10.3) • Standard care without SLT: 65	LSVT LOUD® 16 sessions (Four 50–60-minute sessions per week over 4 weeks) Maximum effort non-speech and speech drills. Exercises are for improving vocal effort and loudness for translation into functional speech. Protocol intervention group: Interventions to support and improve voice.	Comparison 1: Standard care without SLT. No intervention in the first 6 months, unless deemed medically necessary Comparison 2: Standard care with NHS SLT	• Communication • Voice • Physical and mental health related quality of life and social care related quality of life

Study	Population	Intervention	Comparison	Outcomes
	(7.5). Sex (M/F): • LSVT LOUD®: n=23/n=7 • Standard care with SLT: n=23/n=7 • Standard care without SLT: n=23/n=6 Chronic neurological disorder category: Progressive neurological disease.			
Scobie 2021 RCT UK	See Sackley 2018	See Sackley 2018	See Sackley 2018	• Voice • Physical and mental health related quality of life and social care related quality of life
Theodoros 2016 RCT Australia	N=52 adults with Parkinson's disease (n=31 randomised and included in evidence review). • LSVT LOUD® online n=16 • LSVT LOUD® face to face n=15 Age in years [Mean (SD)]: Whole population (per group data not reported): 71.02 (8.80) Sex (M/F): Whole population (per group data not reported): n=36/n=16 Chronic neurological disease category: Progressive neurological disease.	LSVT LOUD® online 16 online sessions (Four 1-hour sessions per week over 1 month) Maximum effort non-speech and speech drills for improving vocal effort and loudness for translation into functional speech. Protocol intervention group: Interventions to support and improve voice.	LSVT LOUD® face to face 16 face-to-face sessions (Four 1-hour sessions per week over 1 month) Maximum effort non-speech and speech drills. These exercises are for improving vocal effort and loudness for translation into functional speech.	• Voice • Physical and mental health related quality of life and social care related quality of life • Mood

LSVT: Lee Silverman voice treatment; RCT: randomised controlled trial; rTMS: repetitive transcranial magnetic stimulation; SD: Standard deviation

See the full evidence tables in appendix D.

Summary of the evidence

Evidence was identified on interventions to improve speech and language, interventions to improve communication (underlying condition) and interventions to support and improve voice in progressive neurological diseases.

Interventions to improve speech and language

For one outcome, rTMS in adults with Parkinson's disease showed a statistically significant improvement in speech as measured by the 3FT phonetics subset score at 10-weeks from baseline compared to sham rTMS. The term statistically significant benefit rather than important benefit is used because although there is a statistically significant benefit, we cannot ascertain clinical importance as only the estimated marginal mean differences were reported.

The quality of evidence was very low. The single outcome was downgraded due to concerns over risk of bias from the study and imprecision in the effect estimate.

Interventions to improve communication

Overall, active music therapy (AMT) in adults with amyotrophic lateral sclerosis (ALS) or primary lateral sclerosis showed no evidence of important difference in terms of anxiety, depression, or physical and mental health related quality of life at 3 months post-intervention compared to standard care.

The quality of evidence was low to very low. Effect estimates where no difference was found between interventions were all marked down for imprecision, and only came from 1 study. As such, these findings should not be taken as definitive evidence of no difference between the interventions.

Interventions to support and improve voice

LSVT LOUD® (Lee Silverman Voice Treatment) in adults with progressive neurological diseases showed improvement in voice quality (monologue intensity, sustained /a/ intensity, functional sentences, GIRBAS (grade, instability, roughness, breathiness, asthenia, and strain) GRADE, GIRBAS_instability, GIRBAS_asthenia] post-intervention compared to standard care with speech and language therapy (SLT). However, when the outcomes were measured after 12 months no evidence of important difference was seen. The impact of voice related quality of life measured using the Voice Handicap Index-summary (VHI) improved with LVST LOUD® compared to SLT post-intervention and meta-analysis evidence across 2 studies showed that this improvement was sustained after 12 months. All other outcomes showed no evidence of important difference. The quality of evidence ranged from moderate to very low.

LSVT LOUD® in adults with Parkinson's disease (PD) showed an improvement in voice related quality of life measured using VHI-summary compared to standard care without SLT at 6 months post-intervention. However, when the outcome was measured after 12 months no evidence of important difference was seen. No evidence of important differences was seen across all other outcomes. The quality of evidence ranged from very low to low.

LVST LOUD® online versus LVST LOUD® face to face in adults with PD showed no evidence of important difference across all outcomes.

The quality of evidence was very low. Outcomes were typically downgraded due to concerns over risk of bias from the contributing studies and imprecision in the effect estimate.

There was no evidence for the following outcomes:

- Language

- Fluency

See appendix F for full GRADE tables.

Economic evidence

Included studies

One economic study was identified which was relevant to this review (Scobie 2021).

See supplementary material 2 for details on the economic search undertaken for this guideline.

Excluded studies

Economic studies not included in this review are listed, and reasons for their exclusion are provided in appendix J.

Summary of included economic evidence

The systematic search of the economic literature undertaken for the guideline identified the following study:

- One UK study which examined the cost-utility of *LSVT LOUD*® for people with idiopathic Parkinson's disease (Scobie 2021).

See the economic evidence table in appendix H. See

1 Table 3 for the economic evidence profile of the included study.

Table 3: Economic evidence profile for *LSVT LOUD*® in people with idiopathic Parkinson's disease:

Study	Limitations	Applicability	Other comments	Incremental			Uncertainty
				Costs	QALYs	Cost effectiveness (Cost/QALY)	
Scobie 2021 UK Cost-utility analysis	Potentially serious[1]	Directly[2]	Economic evaluation alongside an RCT (Sackley 2018) Comparators: NHS speech and language therapy (NHS SLT) and no intervention in the first 6 months unless deemed medically necessary (Control) Time horizon: 12 months Outcome: QALYs	£1,255 (LSVT LOUD vs NHS SLT) £295 (NHS SLT vs control) £1,550 (LSVT LOUD vs control)	-0.07 (LSVT LOUD vs NHS SLT) 0.00 (NHS SLT vs control) -0.07 (LSVT LOUD vs control)	Control dominant when compared with LSVT LOUD and cost minimising when compared with NHS SLT	-Cost differences between LSVT LOUD vs NHS SLT and LSVT LOUD vs control were significant and between NHS SLT vs control was not significant. -All QALY differences were not significant. - Various adjustments for costs and outcomes were undertaken, including adjusting for the duration of illness and baseline Voice Handicap Index, EuroQoL 5 Dimensions-3 levels (EQ-5D-3L) and Parkinson's Disease Questionnaire-39 (PDQ-39) communication scores. However, the conclusions remained unchanged.

CI: confidence interval; EQ-5D-3L: EuroQoL 5 dimensions-3 levels; LVST LOUD®: Lee Silverman voice treatment; NHS SLT: National Health Service speech and language therapy; PDQ-39: Parkinson's disease questionnaire-39; QALY: quality-adjusted life year; RCT: randomised controlled trial; VHI: voice handicap index

1 Effectiveness and baseline data from a single small RCT(N=99), short time horizon (12 months), the high proportion of people in the control arm receiving intervention

2 UK study, QALYs (EQ-5D-3L)

Economic model

No economic modelling was undertaken for this review because the committee agreed that other topics were higher priorities for economic evaluation.

The committee's discussion and interpretation of the evidence

The outcomes that matter most

Speech, language, communication, voice, and fluency were prioritised as critical outcomes by the committee. This is because the aim of the question was to determine the effectiveness of speech, language, and communication rehabilitation interventions for people with chronic neurological disorders.

Health and social care related quality of life and mood were selected as important outcomes to assess the effect of the rehabilitation interventions on the lives of people with chronic neurological disorders. It is important to know how these interventions impact the day-to-day lives of people with chronic neurological disorders, including psychological and emotional factors.

The quality of the evidence

The evidence was assessed using GRADE methodology and the overall confidence in the findings ranged from very low to moderate. Findings were downgraded due to risk of bias stemming from lack of blinding because rehabilitation interventions and controls are difficult to conceal, poor reporting of randomisation procedures, or allocation concealment. Studies were also downgraded for imprecision when 95% confidence intervals crossed 1 or more decision-making thresholds. Evidence was not downgraded for inconsistency, however there was only 1 meta-analysis conducted and all other outcomes were limited to single study evidence. Evidence was not downgraded for indirectness.

There was no evidence for the following interventions:

- Interventions to support communication (augmentative and alternative communication)
- Interventions to improve language

There was no evidence for the following outcomes:

- Language
- Fluency

See appendix F for full GRADE tables with quality ratings of all outcomes.

Benefits and harms

The committee discussed the meta-analysis of 2 RCTs in this evidence review that showed an important benefit in voice-related quality of life measured using the VHI-summary at 12-months in people with progressive neurological diseases receiving LSVT LOUD® when compared to a speech and language therapist (SLT). However, they also noted that this evidence was low quality and that it was only the outcome at 12 months follow up where there was any important difference. The committee observed that the 2 RCTs on LSVT LOUD® compared to usual care or SLT failed to show any important difference on any other outcome in the long-term, important differences were limited to the post-intervention period. The remaining RCT on interventions for voice, comparing LSVT LOUD® online to LSVT LOUD® face-to-face failed to show any important differences in voice, physical and mental health related quality of life, social care related quality of life, and mood. For these reasons, the com-

mittee decided not to use the evidence on interventions to improve voice to make any recommendations and instead used their collective experience and expertise.

The committee also discussed the limited evidence on interventions to improve speech and language and interventions to improve communication. The committee highlighted that the only evidence on interventions to improve speech and language was an RCT comparing repetitive transcranial magnetic stimulation (rTMS) to sham rTMS. The evidence on interventions to improve speech and language showed a statistically significant improvement in speech, however the evidence was very low quality, limited to a phonetic sub-score and presented as an estimated marginal mean difference. With regards to evidence on interventions to improve communication, an RCT comparing active music therapy to control was included. The evidence on interventions to communication showed an important benefit on mood at 1-month post intervention, however these benefits were not seen at 3-months post-intervention and no important differences were seen at all timepoints for physical and mental health related quality of life. Similarly to the recommendations on interventions to improve voice, the committee decided not to use the evidence on interventions to improve speech and language and interventions to improve communication to make any recommendations and instead used their collective experience and expertise.

The committee discussed the importance of identifying difficulties with speech, language, and communication in people with CND, which enables appropriate referral for further assessment and management. The committee emphasised that it is paramount to ask about difficulties with speech, language, and communication because it isn't always recognised by the healthcare professional or person with CND that there are problems and that referral is warranted. For example some speech or language impairment may be hidden or not immediately apparent whereas some may be more overt. In the committee's experience, this question is often overlooked by healthcare professionals and speech, language and communication difficulties go undiagnosed and untreated, which can significantly impact the individual's overall health and wellbeing and ability to function in day to day activities. Therefore, the committee recommended that healthcare professionals discuss this with people at risk of difficulties at initial assessment and subsequent reviews.

The committee discussed the significance of offering an initial screening for speech, language, or communication impairment in people with CND with a SLT if deficits were suspected. The committee emphasised that it is the healthcare professional's duty of care to make a referral to an SLT if an impairment is identified or suspected. In the committee's experience, not all people with CND identified with a speech, language, or communication difficulty are referred, therefore they agreed that it was paramount to make this recommendation to ensure that individuals are not overlooked and to optimise their ability to communicate which is part of active functioning in day to day activities. The effectiveness review didn't provide evidence to make a more detailed recommendation on suitable assessments for people with CND and speech, language, or communication difficulties, therefore a general recommendation to offer an initial screening for impairment by a speech and language therapist was made by the committee.

The committee discussed that following an initial screening for speech, language, or communication deficits, further assessment may be required if impairments were identified. The committee highlighted that this was of upmost importance if speech, language, or communication impairments were deemed severe and this should be done by a SLT to ensure that their communication deficits are fully addressed, and an appropriate rehabilitation plan can be put in place to optimise their ability to communicate. In the committee's experience, speech and language therapists have the most appropriate skillset to assess the severest communication deficits in people with CND, their expertise is fundamental for a comprehensive assessment to initiate this part of a rehabilitation plan. The committee discussed the difficulty in defining severe speech, language or communication impairments as there are lots of different examples. However, the committee agreed on an overarching definition of severe as the impairment having a significant impact on the person's ability to carry out their usual

day to day activities. The evidence review didn't provide evidence on the assessment of speech, language, and communication difficulties, therefore a recommendation limiting the urgent speech and language therapist assessment to the severest form of communication difficulties was made by the committee.

The committee discussed that the effectiveness review didn't provide sufficient evidence on which speech, language and communication techniques to adopt with a person with CND and speech, language and communication deficits. The committee agreed that not offering therapy to those with speech, language and communication deficits was unacceptable and could lead to health inequalities. In view of this, the committee emphasised that if speech, language and communication impairments are identified, it is imperative that therapy be offered to optimise the individual's ability to communicate. The committee highlighted that therapy for speech, language and communication impairments will most likely differ between individual's dependent on their needs. Despite this, the committee agreed that for all people with CND and speech, language and communication impairments, therapy should aim to support the person's rehabilitation goals, for example getting back to work.

The committee discussed that it is paramount to provide the opportunity for people with severe communication difficulties and CND to access alternative and augmentative communication equipment to optimise the individual's ability to communicate and consequently aid empowerment, self-identity, and participation. The committee discussed the provision of alternative and augmentative communication equipment by different services within the NHS, with low technology equipment provided by locally commissioned services and high technology equipment provided by NHS England Specialised Alternative and Augmentative Communication Services. The committee agreed that once the individual with severe communication difficulties is referred to the specialist service, the healthcare professionals within that service would decide the most appropriate alternative and augmentative communication equipment for the individual based on their assessment and needs. The effectiveness review didn't provide evidence on alternative and augmentative communication equipment, therefore the committee agreed that a recommendation on specific equipment should be avoided and rather focus the recommendation on referral to the highly specialist services.

The committee discussed the importance of contextualised therapy, learning, rehearsal, and practice of functional skills in real life contexts and emphasised that it is a crucial part of rehabilitation and should be applied to speech, language, and communication skills. The committee discussed that it was paramount to conduct 'learning cycles' and highlighted that what might work in a quiet silent space may not work in a busy noisy space, therefore testing out functional skills in different environments helps develop the toolset required for dealing with real-life situations. The evidence review didn't provide evidence on contextualised therapy, however the committee agreed to make a recommendation on the importance of adapting the skills learnt to real-life situations.

Finally, the committee discussed the importance of teaching and training communication skills for family members, carers or others close to the person with CND and communication difficulties. The committee emphasised that it is fundamental to the entirety of rehabilitation, for example changing the environment around the individual by teaching sign language to both the individual and significant others means the individual can communicate meaningfully to the people most important to them. The effectiveness review didn't provide evidence on partner education and training, nevertheless the committee are aware of supporting evidence that didn't meet our protocol criteria, for example RCTs published pre-2013 and non-RCTs in adults, and thus agreed based on their expertise to recommend teaching and training communication skills for family members, carers or others close to the person with CND and communication difficulties.

Given the paucity of evidence on speech, language and communication, the committee discussed the possibility of making a research recommendation. However, the committee agreed not to make research recommendations in this area as they were able to make rec-

ommendations based on their expertise which was also supported by qualitative data. The committee agreed to prioritise other areas for research recommendations, including some review questions for which no data were located at all.

Cost effectiveness and resource use

The committee discussed evidence from one UK cost-utility study (Scobie 2021). This study was conducted alongside an RCT which suggested that the LSVT LOUD® may not be cost effective when compared to NHS speech and language therapy (NHS SLT) and a control group. People in the control group did not receive the intervention during the first 6 months, except when medically necessary. The study population was people with idiopathic Parkinson's disease who have self-reported voice or speech issues. Despite this study being directly applicable, it had potentially serious limitations. The committee noted the high proportion of people in the control arm receiving SLT and the very small number of participants in each arm. The need for specialised training to deliver LSVT LOUD® was also discussed. Given the lack of evidence supporting its effectiveness and cost effectiveness, and that fact that it is an intervention used very specifically for people with Parkinson's disease, the committee did not recommend it in the context of this guideline.

The committee discussed that addressing speech, language and communication challenges should be integral to a holistic assessment, which should be reviewed throughout a patient's care journey. Furthermore, they noted that any healthcare professional could be undertaking this as part of a holistic assessment and the recommendation on this is not expected to require additional resources. The committee also discussed that more people may be identified and referred to specialist services due to these recommendations. Nevertheless, the committee believed that the additional costs could be offset by the benefits of improved communication, health, and wellbeing for individuals and in supporting people to live more autonomous, independent lives.

The committee recognised the limited capacity of SLTs to handle the increased demand for their services. To ease this strain, they decided to limit SLT assessments to individuals with identified or suspected speech, language, or communication impairments (after initial screening), or those with severe communication difficulties (based on the impact on their usual day to day activities). This should help alleviate some of the pressure on SLT services.

Providing alternative and augmentative communication devices is standard practice. There is also a legal obligation to provide such devices based on equality considerations. Most individuals will only need basic, low-cost devices.

The committee discussed that whilst some clinicians already offer teaching and training in communication skills for family members, carers or others close to the person with CND and communication difficulties, there is variation in practice. The committee explained that such training would require approximately 20-35 hours of training per group and would have resource implications where this is not implemented.

Overall, the committee agreed that the benefits of improved communication, health and wellbeing for individuals, such as, reduced anxiety, depression, and social isolation, could offset the additional resources associated with better identification and management. The committee discussed that this may also lead to better engagement with other rehabilitation care, fewer admissions and unplanned care visits, greater independence, less intensive support from carers and other costly services, such as mental health services, and increased participation in education and employment.

There may also be an increase in referrals for voice banking for individuals who are, or are likely to, experience voice loss. This process typically takes a few hours and is usually provided outside of the NHS at a personal cost or could be covered by Personal Independence Payment (PIP).

Recommendations supported by this evidence review

This evidence review supports recommendations 1.20.1 to 1.20.7. No research recommendations were made from this evidence review.

References – included studies

Effectiveness

Brabenec 2021

Brabenec, Lubos, Klobusiakova, Patricia, Simko, Patrik et al. (2021) Non-invasive brain stimulation for speech in Parkinson's disease: A randomized controlled trial. Brain stimulation 14(3): 571-578

Brabenec 2022

Brabenec, L, Simko, P, Sejnoha Minsterova, A et al. (2022) rTMS treatment for hypokinetic dysarthria in Parkinson's disease enhances white matter integrity of the auditory-motor loop. European journal of neurology

Crispiatico 2022

Crispiatico, Baldanzi, Napoletano, et al. (2022) Effects of voice rehabilitation in people with MS: A double-blinded long-term randomized controlled trial. Multiple sclerosis (Houndmills, Basingstoke, England) 28(7): 1081-1090

Raglio 2016

Raglio, Giovanazzi, Pain, et al. (2016) Active music therapy approach in amyotrophic lateral sclerosis: a randomized-controlled trial. International journal of rehabilitation research. Internationale Zeitschrift fur Rehabilitationsforschung. Revue internationale de recherches de readaptation 39(4): 365-367

Sackley 2018

Sackley, Smith, Rick, Caroline, et al. (2018) Lee Silverman Voice Treatment versus standard speech and language therapy versus control in Parkinson's disease: a pilot randomised controlled trial (PD COMM pilot). Pilot and feasibility studies 4: 30

Scobie 2021

Scobie, Jowett, Lambe, et al. (2021) Lee Silverman Voice Treatment versus standard speech and language therapy versus control in Parkinson's disease: preliminary cost-consequence analysis of the PD COMM pilot randomised controlled trial. Pilot and feasibility studies 7(1): 154

Theodoros 2016

Theodoros, Deborah G; Hill, Anne J; Russell, Trevor G (2016) Clinical and Quality of Life Outcomes of Speech Treatment for Parkinson's Disease Delivered to the Home Via Telerehabilitation: A Noninferiority Randomized Controlled Trial. American journal of speech-language pathology 25(2): 214-32

Economic

Scobie 2021

Scobie, Jowett, Lambe, et al. (2021) Lee Silverman Voice Treatment versus standard speech and language therapy versus control in Parkinson's disease: preliminary cost-consequence

analysis of the PD COMM pilot randomised controlled trial. Pilot and feasibility studies 7(1): 154

Appendices

Appendix A Review protocols

Review protocol for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Table 4: Review protocol

ID	Field	Content
0.	PROSPERO registration number	CRD42023469168
1.	Review title	Speech, language and communication
2.	Review question	What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?
3.	Objective	To determine the effectiveness of speech, language, and communication rehabilitation interventions for people with chronic neurological disorders.
4.	Searches	The following databases will be searched: • Medline All • Embase • Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • International Health Technology Assessment (INAHTA) Searches will be restricted by: • Date: 2013 onwards • English language • Human studies • Systematic Reviews

ID	Field	Content
		• RCTs • Non-randomised studies Other searches: • Inclusion lists of systematic reviews With the agreement of the guideline committee the searches will be re-run 6 weeks before final submission of the review and further studies retrieved for inclusion. The full search strategies will be published in the final review.
5.	Condition or domain being studied	Speech, language and communication rehabilitation for people with chronic neurological disorders
6.	Population	**Inclusion:** Adults and children with rehabilitation needs due to the following chronic neurological disorders: • Acquired brain injury • Acquired spinal cord injury • Acquired peripheral nerve disorders • Progressive neurological diseases • Functional neurological disorders **Exclusion:** • Conditions which do not fit one of the 5 categories of chronic neurological disorder as defined in the guideline scope. These exclusions will be by exception and examined on a case-by-case basis rather than whole disorder groups. For example, this guideline will not cover autonomic neuropathy or the acute stabilisation of conditions such as encephalitis or hydrocephalus and will not cover degenerative disc disorder as spinal discs do not form part of the spinal cord. • Disorders for which interventions are primarily focused on altering body structure and functions, for example isolated peripheral nerve injuries such as single nerve or plexus injuries. • Surgical management of conditions (for example brain tumours, orthopaedic complications). • Conditions for which NICE rehabilitation and rehabilitation related recommendations already exist, including

ID	Field	Content
		stroke in people aged 16 years and over, dementia including Alzheimer's disease, cerebral palsy, myalgic encephalomyelitis (or encephalopathy)/chronic fatigue syndrome and post-COVID-19 syndrome. • Early rehabilitation after spinal cord injury as this will be covered in the NICE guideline on rehabilitation after traumatic injury
7.	Intervention	• **Intervention group 1: Interventions to improve speech and language skills (including fluency)** Examples include, but are not limited to, strategy training, RESTART-Demands and Capabilities Model method, children and young people only), and Lidcombe stuttering programme (children and young people only), • **Intervention group 2: Interventions to support communication (augmentative and alternative communication)** Examples include, but are not limited to, Talking Mats, visual aids, and technological communication aids. • **Intervention group 3: Interventions to improve communication (for example, to improve the underlying condition)** Examples include, but are not limited to, integrated comprehensive aphasia therapy, script training, and attention and listening therapy (children and young people only). • **Intervention group 4: Interventions to improve language** Examples include, but are not limited to, semantic feature analysis, word and sentence therapies, and discourse therapy. • **Intervention group 5: Interventions to support and improve voice** Examples include, but are not limited to, vocal hygiene interventions, twang, Lee Silverman Voice Therapy, and compensatory methods [amplification, reducing compensatory muscle strain])
8.	Comparator	Interventions compared with others in the same group or: • Placebo (placebo or sham) • Control (no intervention, waitlist, standard rehabilitation care alone, or 'usual care')

ID	Field	Content

		• The same intervention (as listed under 'intervention') but varied in terms of:
		○ Frequency
		○ Intensity
		  ○ Timing
		  ○ Setting

9.	Types of study to be included	Include published full-text papers**: • Systematic reviews of RCTs • Experimental studies with random assignment to intervention and control groups. If insufficient* RCT evidence is located to support decision making about children and young people, then experimental studies with non-random assignment to intervention and control groups (quasi-randomised controlled trials, non-randomised controlled trials and prospective and retrospective cohort studies) will also be considered, if a method of controlling for confounding variables is used. Systematic reviews of these studies will also be considered. *Sufficiency will be judged on issues such as the number and quality of the included studies; sample sizes, reported outcomes, and availability of data on subgroups of interest. **Studies must match or adjust for age and chronic neurological disorder. Other confounding factors are: • Sex • delivery setting, for instance whether community or inpatient.
10.	Other exclusion criteria	**Inclusion**: • Full text papers • Studies conducted in the UK, Australia, New Zealand and Canada and high-income European countries (according to the World Bank). **Exclusion**: • Conference abstracts/proceedings

ID	Field	Content
		• Non-English language articles • Articles published before 2013 • Books, book chapters and theses • Papers that do not include methodological details will not be included as they do not provide sufficient information to evaluate risk of bias/study quality.
11.	Context	Recommendations will apply to all inpatient (excluding critical care units), outpatient and community settings, including tertiary settings and care homes in which either fully or partially NHS-funded rehabilitation interventions for chronic neurological disorders are provided.
12.	Primary outcomes (critical outcomes)	• **Speech** [measured using a validated tool, such as the Frenchay Dysarthria Assessment, Assessment of Intelligibility of Dysarthric Speech (AIDS), Apraxia Battery for Adults (oral domain only), Speech Phonological Screening Assessment, and South Tyneside Assessment of Phonology] • **Language** [measured using a validated tool, such as Western Aphasia Battery – Revised (WAB-R), Boston Naming Test (BNT), Comprehensive Aphasia Test (CAT), Psycholinguistic Assessments of Language Processing in Aphasia (PALPA), Pyramids and Palm Trees, Object Naming Test (ONT), Right Hemisphere Language Battery, Clinical Evaluation of Language Fundamentals (CELF), Preschool Language Scales, Renfrew Action Picture Test, and Test of Word Finding] • **Communication** [measured using a validated tool, such as The Scenario Test, La Trobe Communication Questionnaire (LCQ), Functional Assessment of Verbal Reasoning and Executive Strategies (FAVRES), Communication Activities of Daily Living (CADL), and Communication Outcome After Stroke Scale (COAST)] • **Voice** [measured using a validated tool, such as Voice Impact Scale, Grade, Roughness, Breathiness, Asthenia, Strain (GRBAS scale), Voice Symptoms Scale (VoiSS), Voice-Related Quality of Life Measure (V-RQOL), Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)] • **Fluency** [measured using a validated tool, such as Riley's Stuttering Severity Instrument, Wright and Ayre Stuttering Self-rating Profile (WASSP), Overall Assessment of the Speaker's Experience of Stuttering (OASES)]
13.	Secondary outcomes (important outcomes)	• **Physical and mental health related quality of life and social care related quality of life** [measured using a validated tool, such as EQ-5D, SF-12, Short Musculoskeletal Function Assessment (SFMA), Adult Social Care Outcomes Toolkit (ASCOT) and ICECAP-A, Stroke Aphasia QOL Scale (SAQOL), Warwick Edinburgh Mental Well-Being Scale, Satisfaction with Life Scale (SWLS), Quality of Life in Brain Injury Scale (QOLIBRI), and Therapy Outcome Measures (TOMs)] • **Mood** [assessed using standardised, validated measures of anxiety and depression such as HADS, PHQ-9,

ID	Field	Content
		Beck's Depression/Anxiety Inventory (BD/AI), DAS, CES-D, State-Trait Anxiety Inventory (STAI), Children's Depression Inventory (CDI), Children's Depression Rating Scale (CDRS and the Geriatric Depression Scale (GDS)]
14.	Data extraction (selection and coding)	All references identified by the searches and from other sources will be uploaded into EPPI reviewer and de-duplicated. Titles and abstracts of the retrieved citations will be screened to identify studies that potentially meet the inclusion criteria outlined in the review protocol. Dual sifting will be performed on at least 10% of records (or 300 records, whichever is smaller); 90% agreement is required and disagreements will be resolved via discussion with the senior systematic reviewer. The full set of records will not be dual screened because the population, interventions and relevant study designs are relatively clear and should be readily identified from titles and abstracts. Full versions of the selected studies will be obtained for assessment. Studies that fail to meet the inclusion criteria once the full version has been checked will be excluded at this stage. Each study excluded after checking the full version will be listed, along with the reason for its exclusion. The included and excluded studies lists will be circulated to the Topic Group for their comments. Resolution of disputes will be by discussion between the senior reviewer, Topic Advisor and Chair. A standardised form will be used to extract the following data from included studies: study details (reference, country where study was carried out, type and dates), participant characteristics, inclusion and exclusion criteria, details of the interventions if relevant, setting and follow-up, relevant outcome data and source of funding. This will be quality assessed by the senior reviewer.
15.	Risk of bias (quality) assessment	Quality assessment of individual studies will be performed using the following checklists: • ROBIS tool for systematic reviews • Cochrane RoB tool v.2 for RCTs • Cochrane ROBINS-I tool for non-randomised controlled trials. The quality assessment will be performed by one reviewer and this will be quality assessed by the senior reviewer.
16.	Strategy for data synthesis	Depending on the availability of the evidence, the findings will be summarised narratively or quantitatively.

ID	Field	Content

		Where possible, meta-analyses will be conducted using Cochrane Review Manager software. A fixed effect meta-analysis will be conducted and data will be presented as risk ratios or odds ratios for dichotomous outcomes, and mean differences or standardised mean differences for continuous outcomes.
		
		Heterogeneity in the effect estimates of the individual studies will be assessed using the I^2 statistic. Alongside visual inspection of the point estimates and confidence intervals, I^2 values of greater than 50% and 80% will be considered as significant and very significant heterogeneity, respectively.
		
		Heterogeneity will be explored as appropriate using sensitivity analyses and pre-specified subgroup analyses. If heterogeneity cannot be explained through subgroup analysis then a random effects model will be used for meta-analysis, or the data will not be pooled.
		
		The confidence in the findings across all available evidence will be evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group: http://www.gradeworkinggroup.org/
		
		Importance and imprecision of findings will be assessed against minimally important differences (MIDs). Default MIDs will be used for risk ratios and continuous outcomes only, unless the committee pre-specifies published or other MIDs for specific outcomes
		• For risk ratios: 0.8 and 1.25.
		• For continuous outcomes:
		  ○ MID is calculated by ranking the studies in order of SD in the control arms. The MID is calculated as +/- 0.5 times median SD.
		  ○ For studies that have been pooled using SMD (meta-analysed): +0.5 and -0.5 in the SMD scale are used as MID boundaries.

17.	Analysis of sub-groups	Evidence will be stratified by: • Age at time of intervention (children vs. adults). Children are classified as being aged 17 years or younger. • Functional neurological disorders as distinct from the 4 other categories of neurological disorder.

ID	Field	Content			
		Evidence will be sub-grouped by the following only in the event that there is significant heterogeneity in outcomes: • The 4 disorder categories not separated out through a priori stratification (acquired brain injury, acquired spinal cord injury, acquired peripheral nerve disorders and progressive neurological diseases) • Study design (RCT v. NRS) • Age (for the ≤17 years of age stratification only). Categories are <4 years, 4-11 years and >11 years. Where evidence is stratified or sub-grouped the committee will consider on a case-by-case basis if separate recommendations should be made for distinct groups. Separate recommendations may be made where there is evidence of a differential effect of interventions in distinct groups. If there is a lack of evidence in one group, the committee will consider, based on their experience, whether it is reasonable to extrapolate and assume the interventions will have similar effects in that group compared with others.			
18.	Type and method of review	☒	Intervention		
		☐	Diagnostic		
		☐	Prognostic		
		☐	Qualitative		
		☐	Epidemiologic		
		☐	Service Delivery		
		☐	Other (please specify)		
19.	Language	English			
20.	Country	England			
21.	Anticipated or actual start date	May 2022			
22.	Anticipated completion date	December 2023			
23.	Stage of review at time of this submission	**Review stage**	**Started**	**Completed**	
		Preliminary searches	☑	☑	
		Piloting of the study selection process	☑	☑	

ID	Field	Content		
		Formal screening of search results against eligibility criteria	☑	☑
		Data extraction	☑	☑
		Risk of bias (quality) assessment	☑	☑
		Data analysis	☑	☑
24.	Named contact	**5a Named contact** National Institute for Health and Care Excellence (NICE) **5b Named contact e-mail** rehabforcnd@nice.org.uk **5c Organisational affiliation of the review** National Institute for Health and Care Excellence (NICE)		
25.	Review team members	NICE Technical Team		
26.	Funding sources/sponsor	This systematic review is being completed by NICE, which receives funding from the Department of Health and Social Care.		
27.	Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.		
28.	Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: https://www.nice.org.uk/guidance/indevelopment/gid-ng10181.		

ID	Field	Content	
29.	Other registration details	Not applicable.	
30.	Reference/URL for published protocol	crd.york.ac.uk/prospero/display_record.php?ID=CRD42023469168	
31.	Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: • notifying registered stakeholders of publication • publicising the guideline through NICE's newsletter and alerts • issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE.	
32.	Keywords	Quantitative; effectiveness; speech; language; communication; swallowing; music therapy	
33.	Details of existing review of same topic by same authors	Not applicable.	
34.	Current review status	☐	Ongoing
		☐	Completed but not published
		☒	Completed and published
		☐	Completed, published and being updated
		☐	Discontinued
35.	Additional information	Not applicable	
36.	Details of final publication	www.nice.org.uk	

CDSR: Cochrane database of systematic reviews; CECAP-A: ICEpop CAPability measure for adults; CENTRAL: Cochrane central register of controlled trials; CERQual: confidence in the evidence from reviews of qualitative research; CES-D: center for epidemiologic studies depression scale; DAS: depression, anxiety and stress scale; EQ 5D: EuroQoL five dimensions; GRADE: grading of recommendations assessment, development and evaluation; HADS: hospital anxiety and depression scale; HRQoL: health related quality of life; INAHTA: international network of agencies for health technology assessment; MEDLINE: medical literature analysis and retrieval system online; MID: minimally important difference; NRS: non-randomised trials; PHQ-9: patient health questionnaire-9; PRESS: peer review of electronic search strategies; QOL: quality of life; RCT: randomised controlled trial; RoB: risk of bias; ROBINS-I: risk of bias In non-randomised studies - of Interventions; ROBIS: risk of bias in systematic reviews; SF-36: 36-item short form survey; SMD: standard mean deviation; SD: standard deviation

Appendix B Literature search strategies

Literature search strategies for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Database: Ovid MEDLINE(R) ALL

Database: Embase

Date of last search: 21/3/23

1	(head injury/ or exp brain injury/ or chronic brain disease/ or brain hemorrhage/ or brain hypoxia/ or exp brain tumor/ or brain disease/ or brain abscess/ or metabolic encephalopathy/ or cerebellum disease/ or exp cerebrovascular disease/ or encephalitis/ or hydrocephalus/) not (exp cerebrovascular accident/ or dementia/)
2	((brain* or cereb* or craniocereb* or cranial or intracrani* or neurocognit*) adj2 (injur* or trauma* or damage* or disease*1 or disorder* or infect* or h?emorrhag* or neoplasm* or cancer* or tumo?r* or insult* or impair* or ischemi* or infarcti* or hypoxi* or drown*)).ti,ab.
3	(chronic* adj1 trauma* adj2 encephalopath*).ti,ab.
4	((infratentorial* or supratentorial* or hypothalam* or pituitar* or choroid plexus) adj2 (neoplasm* or cancer* or tumo?r* or carcinom* or adenocarcinom*)).ti,ab.
5	(brain* adj2 abscess*).ti,ab.
6	(carotid arter* adj2 (disease* or injur*)).ti,ab.
7	("basal ganglia disease*" or encephalitis or meningoencephalitis or hydrocephal* or "paraneoplastic cereb* degenerat*" or "shak* baby syndrome*").ti,ab.
8	exp cerebrovascular accident/ and (adolescent/ or "minor (person)"/ or exp child/ or exp infant/ or pediatrics/ or exp pediatrics/ or exp puberty/)
9	(stroke? adj3 (p?ediatric* or child* or adolescen* or kid or kids or youth* or youngster* or minor or minors or underage* or under-age* or "under age*" or teen or teens or teenager* or juvenile* or boy or boys or boyhood or girl or girls or girlhood or schoolchild* or "school age*" or schoolage* or "under 16" or "under sixteen*")).ti,ab.
10	exp spinal cord injury/ or exp spinal cord tumor/ or epidural abscess/ or spinal cord disease/ or exp spinal cord vascular disease/ or spinal cord compression/ or transverse myelitis/
11	((spinal* or spine?) adj2 (injur* or trauma* or tumo?r* or neoplasm* or cancer* or infect* or insult* or disease? or disorder* or degenrat* or compress* or vascular* or ischemi* or ischaemi* or infarct* or h?emorrhag*)).ti,ab.
12	(Central cord syndrome* or transverse myelitis).ti,ab.
13	(epidural* adj2 (neoplasm* or cancer* or tumo?r* or abscess*)).ti,ab.
14	((spinal* or spine?) adj2 (viral* or virus* or polio* or acquired immunodeficiency syndrome or AIDS or HIV or bacterial* or neurosyphili* or neuro-syphili* or tubercul*)).ti,ab.
15	peripheral nerve injury/ or exp cranial nerve injury/ or peripheral nerve tumor/ or exp cranial nerve tumor/ or exp peripheral neuropathy/ or exp cranial neuropathy/
16	((periph* or cranial*) adj1 (nerve? or nervous system) adj2 (injur* or trauma* or disorder* or disease* or damage* or neoplasm* or cancer* or tumo?r* or inflamm* or autoimmun* or paraneoplastic* or neuropath* or syndrome?)).ti,ab.
17	(Guillain* adj1 Barr*).ti,ab.
18	((abducen* or accessory or facial or glossopharyngeal or hypoglossal or oculomotor or ocular motility or olfactory or optic* or trigeminal or trochlear or vestibulocochlear) adj1 nerve* adj1 injur*).ti,ab.
19	(optic* adj1 nerve* adj2 (neoplasm* or cancer* or tumo?r*)).ti,ab.
20	(brachial plexus adj1 (neuropath* or neuritis)).ti,ab.
21	(complex regional pain syndrome* or causalgia or mononeuropath* or nerve compression syndrome*).ti,ab.
22	((femoral or median or peroneal or radial or sciatic or tibial or ulnar) adj1 neuropath*).ti,ab.
23	((carpal-tunnel or piriformis-muscle or tarsal-tunnel or thoracic-outlet) adj1 syndrome*).ti,ab.
24	(pudendal neuralgia or polyneuropath* or polyradiculoneuropath* or polyradiculopath* or radiculopath*).ti,ab.
25	((abducen* or accessory or facial or glossopharyngeal or hypoglossal or oculomotor or ocular motility or olfactory or optic* or trigeminal or trochlear or vestibulocochlear) adj1 nerve* adj1 disease*).ti,ab.
26	(periph* adj2 neuropath*).ti,ab.

27	(((periph* or cranial*) adj2 (nerve? or nervous system)) and lupus).ti,ab.
28	((multi-focal* or multifocal*) adj2 motor adj1 neuropath*).ti,ab.
29	(((periph* or cranial*) adj2 (nerve? or nervous system)) and alcohol*).ti,ab.
30	exp motor neuron disease/ or postpoliomyelitis syndrome/ or exp parkinsonism/ or Duchenne muscular dystrophy/ or exp multiple sclerosis/ or neuromuscular disease/ or hereditary motor sensory neuropathy/ or Friedreich ataxia/ or exp Shy Drager syndrome/ or progressive supranuclear palsy/ or corticobasal degeneration/ or metachromatic leukodystrophy/ or exp mitochondrial myopathy/ or exp mucopolysaccharidosis/ or Williams Beuren syndrome/ or genetic disorder/ or Rett syndrome/ or fetal alcohol syndrome/ or dystonic disorder/ or hereditary motor sensory neuropathy/ or spinal dysraphism/
31	(neurolog* adj1 (disease* or damage* or disorder* or impair*)).ti,ab.
32	((motor-neuron* or gehrig* or charcott* or kennedy*) adj1 disease*).ti,ab.
33	((amyotroph* or primary) adj1 lateral* adj1 sclero*).ti,ab.
34	(bulbar adj1 pals*).ti,ab.
35	((muscular or muscle* or bulbo) adj1 atroph* adj1 spin*).ti,ab.
36	(progressiv* adj1 (muscular or muscle*) adj1 atroph*).ti,ab.
37	((postpolio* or post-polio*) adj1 syndrome?).ti,ab.
38	(Parkinson* or duchenne* or multiple scleros?s* or aphasia or creutzfeldt-jakob or huntington* or kluver-bucy).ti,ab.
39	(muscular adj1 dystroph*).ti,ab.
40	(neuromusc* adj1 (disease* or disorder?)).ti,ab.
41	(heredit* adj1 spastic* adj1 parapleg*).ti,ab.
42	"friedreich* ataxia*".ti,ab.
43	((multiple system or olivopontocerebellar) adj1 atroph*).ti,ab.
44	(shy-drager syndrome* or striatonigral degenerat* or batten* disease?).ti,ab.
45	(progressive adj1 supranuclear adj1 pals*).ti,ab.
46	(richardson* adj1 (disease? or syndrome?)).ti,ab.
47	((corticobasal or cortico basal) adj1 degenerat*).ti,ab.
48	(white adj1 matter adj1 disorder?).ti,ab.
49	(metachromatic leukodystroph* or mitochondrial myopath* or mucopolysaccharidos*).ti,ab.
50	(lysosomal adj1 storage adj1 disorder?).ti,ab.
51	((genetic or William* or catch-22 or rett* or congenital or f?etal alcohol) adj1 (syndrome or disorder*)).ti,ab.
52	(perinatal illness* or perinatal hypoxia*).ti,ab.
53	(primary adj1 dystonia?).ti,ab.
54	(heredit* adj1 motor* adj1 sens* adj1 neuropath*).ti,ab.
55	(spina bifida? or spinal dysraphism?).ti,ab.
56	motor dysfunction/ or motor dysfunction/ or conversion disorder/
57	((functional* or psychogenic* or dissociative*) adj1 neurologic* adj1 (disorder* or dysfunction* or difficult*)).ti,ab.
58	((movement* or motor* or convers*) adj1 (disorder* or dysfunct*)).ti,ab.
59	((psychogenic or dissociative or non-epilep* or nonepilep*) adj1 (seizure* or convulsion* or fit or fits or spasm* or attack*)).ti,ab.
60	(pseudo-seizure* or pseudoseizure*).ti,ab.
61	(medical* adj1 (unexplain* or un-explain*) adj1 symptom?).ti,ab.
62	or/1-61
63	(exp speech disorder/ or exp communication disorder/ or language therapy/ or muscle training/ or alaryngeal speech/ or esophageal speech/ or exp speech rehabilitation/ or exp "speech and language rehabilitation"/) and (rehabilitation/ or neurorehabilitation/ or telerehabilitation/)
64	(exp speech disorder/ or exp communication disorder/ or language therapy/ or muscle training/ or alaryngeal speech/ or esophageal speech/ or exp speech rehabilitation/ or exp "speech and language rehabilitation"/) and (rehab* or telerehab* or neurorehab*).ti.
65	or/63-64
66	65 not (exp cerebrovascular accident/ or dementia/)
67	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) adj3 (speech* or languag* or linguistic* or articulat* or intonat* or pronunciat*)).ti,ab.
68	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) adj1 communicat*).ti,ab.

69	exp "speech and language rehabilitation"/ or exp communication disorder/rh or exp speech disorder/rh
70	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or strengthen* or rehab* or decreas* or reduc*) adj3 (aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic*)).ti,ab.
71	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) adj3 (fluenc* or voice* or accent*1)).ti,ab.
72	("lee silverman" or "LVST LOUD" or camperdown or RESTART-DCM).ti,ab.
73	(Lidcombe adj2 (program* or therap* or stutter* or behavio?r*)).ti,ab.
74	(palin adj3 interact*).ti,ab.
75	((((augment* or alternat*) adj1 communicat*) or AAC) adj3 (aid* or device* or technolog* or apps* or comput* or tool*1)).ti,ab.
76	((communicat* or vocal* or voice* or speech* or languag* or linguistic* or articulat* or intonat* or pronunciat*) adj3 (signalong* or sign-a-long or "finger spell*" or "manual alphabet*" or gestur* or sign* or output* or aid)).ti,ab.
77	("talking mat*" or VOCAs or makaton* or paget-gorman or amer-ind).ti,ab.
78	(("social skill*" or script* or attention* or listen* or "social comm*") adj3 (train* or technique* or therap* or rehab* or treat* or remediat* or pathol*)).ti,ab.
79	((speech* or languag* or linguistic* or articulat* or aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic* or fluenc* or voice* or accent*1) adj3 (train* or technique* or strateg* or shaping* or shape* or "block modif*" or prolong* or approach* or "social story*" or "social stories*" or multimod* or amplificat*)).ti,ab.
80	((speech* or languag* or linguistic* or articulat* or aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic* or fluenc* or voice* or accent*1 or intonat* or pronunciat*) adj3 (therap* or rehab* or treat* or remediat* or pathol*)).ti,ab.
81	((word*1 or sentence*1 or discours* or reading* or writing* or "semantic feature*" or "verb network strength*" or "melodic intonat*" or "constraint induc*") adj3 (analys* or treatment* or therap* or train* or technique* or rehab* or remediat* or pathol*)).ti,ab.
82	((voice* or vocal or laryngeal* or circumlaryngeal*) adj2 (hygien* or function* or resonan* or manual* or confiden*) adj2 (therap* or treatment* or exercis* or method* or train* or technique* or rehab* or remediat* or pathol*)).ti,ab.
83	((voice* or vocal*) adj3 (hyperfunct* or dysphoni*)).ti,ab.
84	((voice* or vocal*) adj3 muscle* adj1 (strain* or tense* or tension*)).ti,ab.
85	or/67-84
86	85 and (62 or 66)
87	limit 86 to english language
88	limit 87 to yr="2013 -Current"
89	letter.pt. or LETTER/
90	note.pt.
91	editorial.pt.
92	CASE REPORT/ or CASE STUDY/
93	(letter or comment*).ti.
94	or/89-93
95	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
96	94 not 95
97	ANIMAL/ not HUMAN/
98	NONHUMAN/
99	exp ANIMAL EXPERIMENT/
100	exp EXPERIMENTAL ANIMAL/
101	ANIMAL MODEL/
102	exp RODENT/
103	(rat or rats or mouse or mice or rodent*).ti.
104	or/96-103
105	88 not 104
106	SYSTEMATIC REVIEW/
107	META-ANALYSIS/
108	(meta analy* or metanaly* or metaanaly*).ti,ab.
109	((systematic or evidence) adj2 (review* or overview*)).ti,ab.
110	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.

111	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
112	(search* adj4 literature).ab.
113	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
114	((pool* or combined) adj2 (data or trials or studies or results)).ab.
115	cochrane.jw.
116	or/106-115
117	random*.ti,ab.
118	factorial*.ti,ab.
119	(crossover* or cross over*).ti,ab.
120	((doubl* or singl*) adj blind*).ti,ab.
121	(assign* or allocat* or volunteer* or placebo*).ti,ab.
122	CROSSOVER PROCEDURE/
123	SINGLE BLIND PROCEDURE/
124	RANDOMIZED CONTROLLED TRIAL/
125	DOUBLE BLIND PROCEDURE/
126	or/117-125
127	cohort analysis/ or longitudinal study/ or prospective study/ or retrospective study/ or follow up/
128	((follow up* or followup* or concurrent* or incidence* or population*) adj3 (study* or studies* or analy* or observation* or design* or method* or research*)).ti,ab.
129	(longitudinal* or prospective* or retrospective* or cohort*).ti,ab.
130	cross-sectional study/
131	((prevalence* or disease frequenc*) adj3 (study* or studies* or analy* or observation* or design* or method* or research*)).ti,ab.
132	cross sectional*.ti,ab.
133	pilot study/
134	(pilot adj3 (project* or study* or studies* or analy* or observation* or design* or method* or research*)).ti,ab.
135	or/127-134
136	105 and 116
137	105 and 126
138	105 and 135
139	or/136-138

Database: Cochrane Database of Systematic Reviews

Date of last search: 21/03/2023

#1	MeSH descriptor: [Craniocerebral Trauma] this term only
#2	MeSH descriptor: [Brain Injuries] this term only
#3	MeSH descriptor: [Brain Hemorrhage, Traumatic] explode all trees
#4	MeSH descriptor: [Brain Injuries, Diffuse] explode all trees
#5	MeSH descriptor: [Brain Injuries, Traumatic] explode all trees
#6	MeSH descriptor: [Brain Injury, Chronic] explode all trees
#7	MeSH descriptor: [Shaken Baby Syndrome] this term only
#8	MeSH descriptor: [Brain Damage, Chronic] explode all trees
#9	MeSH descriptor: [Hypoxia, Brain] this term only
#10	MeSH descriptor: [Intracranial Hemorrhage, Traumatic] explode all trees
#11	MeSH descriptor: [Brain Neoplasms] explode all trees
#12	MeSH descriptor: [Brain Diseases] this term only
#13	MeSH descriptor: [Brain Abscess] this term only
#14	MeSH descriptor: [Brain Diseases, Metabolic] this term only
#15	MeSH descriptor: [Cerebellar Diseases] this term only
#16	MeSH descriptor: [Cerebrovascular Disorders] this term only

#17	MeSH descriptor: [Basal Ganglia Cerebrovascular Disease] this term only
#18	MeSH descriptor: [Cerebrovascular Trauma] this term only
#19	MeSH descriptor: [Intracranial Arteriovenous Malformations] this term only
#20	MeSH descriptor: [Intracranial Embolism and Thrombosis] this term only
#21	MeSH descriptor: [Intracranial Hemorrhages] this term only
#22	MeSH descriptor: [Vascular Headaches] this term only
#23	MeSH descriptor: [Encephalitis] this term only
#24	MeSH descriptor: [Hydrocephalus] this term only
#25	{or #1-#24}
#26	MeSH descriptor: [Stroke] explode all trees
#27	MeSH descriptor: [Dementia] this term only
#28	#26 or #27
#29	#25 NOT #28
#30	((brain* or cereb* or craniocereb* or cranial or intracrani* or neurocognit*) NEAR/2 (injur* or trauma* or damage* or disease* or dieases* or disorder* or infect* or hemorrhag* or haemorrhag* or neoplasm* or cancer* or tumour* or tumor* or insult* or impair* or ischemi* or ischaemi* or infarcti* or hypoxi* or drown*)):ti,ab
#31	(chronic* NEAR/1 trauma* NEAR/2 encephalopath*):ti,ab
#32	((infratentorial* or supratentorial* or hypothalam* or pituitar* or choroid plexus) NEAR/2 (neoplasm* or cancer* or tumour* or tumor* or carcinom* or adenocarcinom*)):ti,ab
#33	(brain* NEAR/2 abscess*):ti,ab
#34	(carotid arter* NEAR/2 (disease* or injur*)):ti,ab
#35	("basal ganglia disease" or "basal ganglia diseases" or encephalitis or meningoencephalitis or hydrocephal* or "paraneoplastic cerebellar degenerate" or "paraneoplastic cerebellar degenerated" or "paraneoplastic cerebellar degenerative" or "paraneoplastic cerebellar degeneration" or "shaken baby syndrome" or "shaken baby syndromes" or "shaking baby syndrome" or "shaking baby syndromes"):ti,ab
#36	MeSH descriptor: [Stroke] explode all trees
#37	MeSH descriptor: [Adolescent] this term only
#38	MeSH descriptor: [Minors] this term only
#39	MeSH descriptor: [Child] explode all trees
#40	MeSH descriptor: [Infant] explode all trees
#41	MeSH descriptor: [Pediatrics] explode all trees
#42	MeSH descriptor: [Puberty] explode all trees
#43	{or #37-#42}
#44	#36 and #43
#45	((stroke or strokes) NEAR/3 (paediatric* or pediatric* or child* or adolescen* or kid or kids or youth* or youngster* or minor or minors or underage* or under-age* or "under age" or "under ages" or teen or teens or teenager* or juvenile* or boy or boys or boyhood or girl or girls or girlhood or schoolchild* or "school ages" or "school age" or schoolage* or "under 16" or "under sixteen" or "under sixteens")):ti,ab
#46	MeSH descriptor: [Spinal Cord Injuries] explode all trees
#47	MeSH descriptor: [Spinal Cord Neoplasms] explode all trees
#48	MeSH descriptor: [Epidural Abscess] this term only
#49	MeSH descriptor: [Spinal Cord Diseases] this term only
#50	MeSH descriptor: [Spinal Cord Vascular Diseases] explode all trees
#51	MeSH descriptor: [Spinal Cord Compression] this term only
#52	MeSH descriptor: [Myelitis, Transverse] this term only
#53	((spinal* or spine or spines) NEAR/2 (injur* or trauma* or tumour* or tumor* or neoplasm* or cancer* or infect* or insult* or disease or diseases or disorder* or degenrat* or compress* or vascular* or ischemi* or ischaemi* or infarct* or hemorrhag* or haemorrhag*)):ti,ab
#54	("Central cord syndrome" or "Central cord syndromes" or transverse myelitis):ti,ab
#55	(epidural* NEAR/2 (neoplasm* or cancer* or tumour* or tumor* or abscess*)):ti,ab
#56	((spinal* or spine or spines) NEAR/2 (viral* or virus* or polio* or acquired immunodeficiency syndrome or AIDS or HIV or bacterial* or neurosyphili* or neuro next syphili* or tubercul*)):ti,ab
#57	MeSH descriptor: [Peripheral Nerve Injuries] this term only
#58	MeSH descriptor: [Cranial Nerve Injuries] explode all trees
#59	MeSH descriptor: [Peripheral Nervous System Neoplasms] this term only
#60	MeSH descriptor: [Cranial Nerve Neoplasms] explode all trees

#61	MeSH descriptor: [Peripheral Nervous System Diseases] explode all trees
#62	MeSH descriptor: [Cranial Nerve Diseases] explode all trees
#63	((periph* or cranial*) NEAR/1 (nerve or nerves or nervous system) NEAR/2 (injur* or trauma* or disorder* or disease* or damage* or neoplasm* or cancer* or tumour* or tumor* or inflamm* or autoimmun* or paraneoplastic* or neuropath* or syndrome or syndromes)):ti,ab
#64	(Guillain* NEAR/1 Barr*):ti,ab
#65	((abducen* or accessory or facial or glossopharyngeal or hypoglossal or oculomotor or "ocular motility" or olfactory or optic* or trigeminal or trochlear or vestibulocochlear) NEAR/1 nerve* NEAR/1 injur*):ti,ab
#66	(optic* NEAR/1 nerve* NEAR/2 (neoplasm* or cancer* or tumour* or tumor*)):ti,ab
#67	("brachial plexus" NEAR/1 (neuropath* or neuritis)):ti,ab
#68	("complex regional pain syndrome" or "complex regional pain syndromes" or causalgia or mononeuropath* or "nerve compression syndrome" or "nerve compression syndromes"):ti,ab
#69	((femoral or median or peroneal or radial or sciatic or tibial or ulnar) NEAR/1 neuropath*):ti,ab
#70	((carpal next tunnel or piriformis next muscle or tarsal next tunnel or thoracic next outlet) NEAR/1 syndrome*):ti,ab
#71	(pudendal next neuralgia or polyneuropath* or polyradiculoneuropath* or polyradiculopath* or radiculopath*):ti,ab
#72	((abducen* or accessory or facial or glossopharyngeal or hypoglossal or oculomotor or "ocular motility" or olfactory or optic* or trigeminal or trochlear or vestibulocochlear) NEAR/1 nerve* NEAR/1 disease*):ti,ab
#73	(periph* NEAR/2 neuropath*):ti,ab
#74	(((periph* or cranial*) NEAR/2 (nerve or nerves or nervous system)) and lupus):ti,ab
#75	((multi next focal* or multifocal*) NEAR/2 motor NEAR/1 neuropath*):ti,ab
#76	(((periph* or cranial*) NEAR/2 (nerve or nerves or nervous system)) and alcohol*):ti,ab
#77	{or #29-#35, #44-#76}
#78	MeSH descriptor: [Motor Neuron Disease] explode all trees
#79	MeSH descriptor: [Postpoliomyelitis Syndrome] this term only
#80	MeSH descriptor: [Parkinsonian Disorders] explode all trees
#81	MeSH descriptor: [Muscular Dystrophy, Duchenne] this term only
#82	MeSH descriptor: [Multiple Sclerosis] explode all trees
#83	MeSH descriptor: [Neuromuscular Diseases] this term only
#84	MeSH descriptor: [Spastic Paraplegia, Hereditary] this term only
#85	MeSH descriptor: [Friedreich Ataxia] this term only
#86	MeSH descriptor: [Multiple System Atrophy] explode all trees
#87	MeSH descriptor: [Supranuclear Palsy, Progressive] this term only
#88	MeSH descriptor: [Corticobasal Degeneration] explode all trees
#89	MeSH descriptor: [Leukodystrophy, Metachromatic] this term only
#90	MeSH descriptor: [Mitochondrial Myopathies] explode all trees
#91	MeSH descriptor: [Mucopolysaccharidoses] explode all trees
#92	MeSH descriptor: [Williams Syndrome] this term only
#93	MeSH descriptor: [Genetic Diseases, Inborn] this term only
#94	MeSH descriptor: [Rett Syndrome] this term only
#95	MeSH descriptor: [Fetal Alcohol Spectrum Disorders] this term only
#96	MeSH descriptor: [Dystonic Disorders] this term only
#97	MeSH descriptor: [Hereditary Sensory and Motor Neuropathy] this term only
#98	MeSH descriptor: [Spinal Dysraphism] this term only
#99	(neurolog* NEAR/1 (disease* or damage* or disorder* or impair*)):ti,ab
#100	((motor-neuron* or gehrig* or charcott* or kennedy*) NEAR/1 disease*):ti,ab
#101	((amyotroph* or primary) NEAR/1 lateral* NEAR/1 sclero*):ti,ab
#102	(bulbar NEAR/1 pals*):ti,ab
#103	((muscular or muscle* or bulbo) NEAR/1 atroph* NEAR/1 spin*):ti,ab
#104	(progressiv* NEAR/1 (muscular or muscle*) NEAR/1 atroph*):ti,ab
#105	((postpolio* or post next polio*) NEAR/1 (syndrome or syndromes)):ti,ab
#106	(Parkinson* or duchenne* or multiple next sclerosis* or sclerosos* or aphasia or creutzfeldt next jakob or huntington* or kluver next bucy):ti,ab
#107	(muscular NEAR/1 dystroph*):ti,ab
#108	(neuromusc* NEAR/1 (disease* or disorder or disorders)):ti,ab

#109	(heredit* NEAR/1 spastic* NEAR/1 parapleg*):ti,ab
#110	("friedreich ataxia" or "friedreich ataxias" or "friedreichs ataxia" or "friedreichs ataxias"):ti,ab
#111	((multiple-system or olivopontocerebellar) NEAR/1 atroph*):ti,ab
#112	(shy-drager syndrome* or striatonigral degenerat* or batten-disease or batten-diseases):ti,ab
#113	(progressive NEAR/1 supranuclear NEAR/1 pals*):ti,ab
#114	(richardson* NEAR/1 (disease or diseases or syndrome or syndromes)):ti,ab
#115	((corticobasal or cortico basal) NEAR/1 degenerat*):ti,ab
#116	(white-matter NEAR/1 (disorder or disorders)):ti,ab
#117	(metachromatic-leukodystroph* or mitochondrial-myopath* or mucopolysaccharidos*):ti,ab
#118	(lysosomal NEAR/1 storage NEAR/1 (disorder or disorders)):ti,ab
#119	((genetic or William* or catch-22 or rett* or congenital or fetal or foetal-alcohol) NEAR/1 (syndrome or disorder*)):ti,ab
#120	(perinatal NEAR/1 (illness* or hypoxia*)):ti,ab
#121	(primary NEAR/1 (dystonia or dystonias)):ti,ab
#122	(heredit* NEAR/1 motor* NEAR/1 sens* NEAR/1 neuropath*):ti,ab
#123	(spina-bifida or bifidas or spinal-dysraphism or dysraphisms):ti,ab
#124	MeSH descriptor: [Movement Disorders] this term only
#125	MeSH descriptor: [Motor Disorders] this term only
#126	MeSH descriptor: [Conversion Disorder] this term only
#127	((functional* or psychogenic* or dissociative*) NEAR/1 neurologic* NEAR/1 (disorder* or dysfunction* or difficult*)):ti,ab
#128	((movement* or motor* or convers*) NEAR/1 (disorder* or dysfunct*)):ti,ab
#129	((psychogenic or dissociative or non-epilep* or nonepilep*) NEAR/1 (seizure* or convulsion* or fit or fits or spasm* or attack*)):ti,ab
#130	(pseudo-seizure or pseudoseizure):ti,ab
#131	(medical* NEAR/1 (unexplain* or un-explain*) NEAR/1 (symptom or symptoms)):ti,ab
#132	{or #77-#131}
#133	MeSH descriptor: [Speech Disorders] explode all trees
#134	MeSH descriptor: [Communication Disorders] explode all trees
#135	MeSH descriptor: [Language Therapy] this term only
#136	MeSH descriptor: [Myofunctional Therapy] this term only
#137	MeSH descriptor: [Speech, Alaryngeal] this term only
#138	MeSH descriptor: [Speech, Esophageal] this term only
#139	MeSH descriptor: [Speech Therapy] this term only
#140	MeSH descriptor: [Voice Training] this term only
#141	{or #133-#140}
#142	MeSH descriptor: [Rehabilitation] this term only
#143	MeSH descriptor: [Neurological Rehabilitation] this term only
#144	MeSH descriptor: [Telerehabilitation] this term only
#145	(rehab* or telerehab* or neurorehab*):ti
#146	{or #142-#145}
#147	#141 and #146
#148	MeSH descriptor: [Stroke] explode all trees
#149	MeSH descriptor: [Dementia] this term only
#150	{or #148-#149}
#151	#147 NOT #150
#152	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) NEAR/3 (speech* or languag* or linguistic* or articulat* or intonat* or pronunciat*)):ti,ab
#153	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) NEAR/1 communicat*):ti,ab
#154	MeSH descriptor: [Rehabilitation of Speech and Language Disorders] explode all trees
#155	MeSH descriptor: [Communication Disorders] explode all trees and with qualifier(s): [rehabilitation - RH]
#156	MeSH descriptor: [Speech Disorders] explode all trees and with qualifier(s): [rehabilitation - RH]
#157	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or strengthen* or rehab* or decreas* or reduc*) NEAR/3 (aphasi* or apraxi* or

	dsyarthri* or dyspha* or stutter* or anomia* or anomic*)):ti,ab
#158	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) NEAR/3 (fluenc* or voice* or accent or accents)):ti,ab
#159	("lee silverman" or "LVST LOUD" or camperdown or RESTART-DCM):ti,ab
#160	(Lidcombe NEAR/2 (program* or therap* or stutter* or behavior* or behaviour*)):ti,ab
#161	(palin NEAR/3 interact*):ti,ab
#162	((((augment* or alternat*) NEAR/1 communicat*) or AAC) NEAR/3 (aid* or device* or technolog* or apps* or comput* or tool or tools)):ti,ab
#163	((communicat* or vocal* or voice* or speech* or languag* or linguistic* or articulat* or intonat* or pronunciat*) NEAR/3 (signalong* or sign-a-long or "finger spell" or "finger spells" or "finger spelling" or "finger spellings" or "manual alphabet" or "manual alphabets" or gestur* or sign* or output* or aid)):ti,ab
#164	("talking mat" or "talking mats" or VOCAs or makaton* or paget-gorman or amer-ind):ti,ab
#165	(("social skill" or "social skills" or script* or attention* or listen* or "social communication" or "social communications") NEAR/3 (train* or technique* or therap* or rehab* or treat* or remediat* or pathol*)):ti,ab
#166	((speech* or languag* or linguistic* or articulat* or aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic* or fluenc* or voice* or accent or accents) NEAR/3 (train* or technique* or strateg* or shaping* or shape* or "block modify" or "block modifys" or "block modified" or "block modification" or "block modifications" or prolong* or approach* or "social story" or "social stories" or multimod* or amplificat*)):ti,ab
#167	((speech* or languag* or linguistic* or articulat* or aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic* or fluenc* or voice* or accent or accents or intonat* or pronunciat*) NEAR/3 (therap* or rehab* or treat* or remediat* or pathol*)):ti,ab
#168	((word or words or sentence or sentences or discours* or reading* or writing* or "semantic feature" or "semantic features" or "verb network strength" or "verb network strengths" or "verb network strengthen" or "verb network strengthens" or "verb network strengthened" or "verb network strengthening" or "melodic intonation" or "melodic intonations" or "constraint induce" or "constraint induces" or "constraint induced" or "constraint inductive") NEAR/3 (analys* or treatment* or therap* or train* or technique* or rehab* or remediat* or pathol*)):ti,ab
#169	((voice* or vocal or laryngeal* or circumlaryngeal*) NEAR/2 (hygien* or function* or resonan* or manual* or confiden*) NEAR/2 (therap* or treatment* or exercis* or method* or train* or technique* or rehab* or remediat* or pathol*)):ti,ab
#170	((voice* or vocal*) NEAR/3 (hyperfunct* or dysphoni*)):ti,ab
#171	((voice* or vocal*) NEAR/3 muscle* NEAR/1 (strain* or tense* or tension*)):ti,ab
#172	{or #152-#171}
#173	#132 or #151
#174	#172 and #173
#175	conference:pt or (clinicaltrials or trialsearch or "www.who.int"):so
#176	#174 NOT #175
#177	#174 NOT #175 with Cochrane Library publication date Between Jan 2013 and Mar 2023, in Cochrane Reviews

Database: Cochrane Central Register of Controlled Trials

Date of last search: 21/03/2023

#1	MeSH descriptor: [Craniocerebral Trauma] this term only
#2	MeSH descriptor: [Brain Injuries] this term only
#3	MeSH descriptor: [Brain Hemorrhage, Traumatic] explode all trees
#4	MeSH descriptor: [Brain Injuries, Diffuse] explode all trees
#5	MeSH descriptor: [Brain Injuries, Traumatic] explode all trees
#6	MeSH descriptor: [Brain Injury, Chronic] explode all trees
#7	MeSH descriptor: [Shaken Baby Syndrome] this term only
#8	MeSH descriptor: [Brain Damage, Chronic] explode all trees
#9	MeSH descriptor: [Hypoxia, Brain] this term only
#10	MeSH descriptor: [Intracranial Hemorrhage, Traumatic] explode all trees
#11	MeSH descriptor: [Brain Neoplasms] explode all trees
#12	MeSH descriptor: [Brain Diseases] this term only
#13	MeSH descriptor: [Brain Abscess] this term only

#14	MeSH descriptor: [Brain Diseases, Metabolic] this term only
#15	MeSH descriptor: [Cerebellar Diseases] this term only
#16	MeSH descriptor: [Cerebrovascular Disorders] this term only
#17	MeSH descriptor: [Basal Ganglia Cerebrovascular Disease] this term only
#18	MeSH descriptor: [Cerebrovascular Trauma] this term only
#19	MeSH descriptor: [Intracranial Arteriovenous Malformations] this term only
#20	MeSH descriptor: [Intracranial Embolism and Thrombosis] this term only
#21	MeSH descriptor: [Intracranial Hemorrhages] this term only
#22	MeSH descriptor: [Vascular Headaches] this term only
#23	MeSH descriptor: [Encephalitis] this term only
#24	MeSH descriptor: [Hydrocephalus] this term only
#25	{or #1-#24}
#26	MeSH descriptor: [Stroke] explode all trees
#27	MeSH descriptor: [Dementia] this term only
#28	#26 or #27
#29	#25 NOT #28
#30	((brain* or cereb* or craniocereb* or cranial or intracrani* or neurocognit*) NEAR/2 (injur* or trauma* or damage* or disease* or dieases* or disorder* or infect* or hemorrhag* or haemorrhag* or neoplasm* or cancer* or tumour* or tumor* or insult* or impair* or ischemi* or ischaemi* or infarcti* or hypoxi* or drown*)):ti,ab
#31	(chronic* NEAR/1 trauma* NEAR/2 encephalopath*):ti,ab
#32	((infratentorial* or supratentorial* or hypothalam* or pituitar* or choroid plexus) NEAR/2 (neoplasm* or cancer* or tumour* or tumor* or carcinom* or adenocarcinom*)):ti,ab
#33	(brain* NEAR/2 abscess*):ti,ab
#34	(carotid arter* NEAR/2 (disease* or injur*)):ti,ab
#35	("basal ganglia disease" or "basal ganglia diseases" or encephalitis or meningoencephalitis or hydrocephal* or "paraneoplastic cerebellar degenerate" or "paraneoplastic cerebellar degenerated" or "paraneoplastic cerebellar degenerative" or "paraneoplastic cerebellar degeneration" or "shaken baby syndrome" or "shaken baby syndromes" or "shaking baby syndrome" or "shaking baby syndromes"):ti,ab
#36	MeSH descriptor: [Stroke] explode all trees
#37	MeSH descriptor: [Adolescent] this term only
#38	MeSH descriptor: [Minors] this term only
#39	MeSH descriptor: [Child] explode all trees
#40	MeSH descriptor: [Infant] explode all trees
#41	MeSH descriptor: [Pediatrics] explode all trees
#42	MeSH descriptor: [Puberty] explode all trees
#43	{or #37-#42}
#44	#36 and #43
#45	((stroke or strokes) NEAR/3 (paediatric* or pediatric* or child* or adolescen* or kid or kids or youth* or youngster* or minor or minors or underage* or under-age* or "under age" or "under ages" or teen or teens or teenager* or juvenile* or boy or boys or boyhood or girl or girls or girlhood or schoolchild* or "school ages" or "school age" or schoolage* or "under 16" or "under sixteen" or "under sixteens")):ti,ab
#46	MeSH descriptor: [Spinal Cord Injuries] explode all trees
#47	MeSH descriptor: [Spinal Cord Neoplasms] explode all trees
#48	MeSH descriptor: [Epidural Abscess] this term only
#49	MeSH descriptor: [Spinal Cord Diseases] this term only
#50	MeSH descriptor: [Spinal Cord Vascular Diseases] explode all trees
#51	MeSH descriptor: [Spinal Cord Compression] this term only
#52	MeSH descriptor: [Myelitis, Transverse] this term only
#53	((spinal* or spine or spines) NEAR/2 (injur* or trauma* or tumour* or tumor* or neoplasm* or cancer* or infect* or insult* or disease or diseases or disorder* or degenrat* or compress* or vascular* or ischemi* or ischaemi* or infarct* or hemorrhag* or haemorrhag*)):ti,ab
#54	("Central cord syndrome" or "Central cord syndromes" or transverse myelitis):ti,ab
#55	(epidural* NEAR/2 (neoplasm* or cancer* or tumour* or tumor* or abscess*)):ti,ab
#56	((spinal* or spine or spines) NEAR/2 (viral* or virus* or polio* or acquired immunodeficiency syndrome or AIDS or HIV or bacterial* or neurosyphili* or neuro next syphili* or tubercul*)):ti,ab
#57	MeSH descriptor: [Peripheral Nerve Injuries] this term only

#58	MeSH descriptor: [Cranial Nerve Injuries] explode all trees
#59	MeSH descriptor: [Peripheral Nervous System Neoplasms] this term only
#60	MeSH descriptor: [Cranial Nerve Neoplasms] explode all trees
#61	MeSH descriptor: [Peripheral Nervous System Diseases] explode all trees
#62	MeSH descriptor: [Cranial Nerve Diseases] explode all trees
#63	((periph* or cranial*) NEAR/1 (nerve or nerves or nervous system) NEAR/2 (injur* or trauma* or disorder* or disease* or damage* or neoplasm* or cancer* or tumour* or tumor* or inflamm* or autoimmun* or paraneoplastic* or neuropath* or syndrome or syndromes)):ti,ab
#64	(Guillain* NEAR/1 Barr*):ti,ab
#65	((abducen* or accessory or facial or glossopharyngeal or hypoglossal or oculomotor or "ocular motility" or olfactory or optic* or trigeminal or trochlear or vestibulocochlear) NEAR/1 nerve* NEAR/1 injur*):ti,ab
#66	(optic* NEAR/1 nerve* NEAR/2 (neoplasm* or cancer* or tumour* or tumor*)):ti,ab
#67	("brachial plexus" NEAR/1 (neuropath* or neuritis)):ti,ab
#68	("complex regional pain syndrome" or "complex regional pain syndromes" or causalgia or mononeuropath* or "nerve compression syndrome" or "nerve compression syndromes"):ti,ab
#69	((femoral or median or peroneal or radial or sciatic or tibial or ulnar) NEAR/1 neuropath*):ti,ab
#70	((carpal next tunnel or piriformis next muscle or tarsal next tunnel or thoracic next outlet) NEAR/1 syndrome*):ti,ab
#71	(pudendal next neuralgia or polyneuropath* or polyradiculoneuropath* or polyradiculopath* or radiculopath*):ti,ab
#72	((abducen* or accessory or facial or glossopharyngeal or hypoglossal or oculomotor or "ocular motility" or olfactory or optic* or trigeminal or trochlear or vestibulocochlear) NEAR/1 nerve* NEAR/1 disease*):ti,ab
#73	(periph* NEAR/2 neuropath*):ti,ab
#74	(((periph* or cranial*) NEAR/2 (nerve or nerves or nervous system)) and lupus):ti,ab
#75	((multi next focal* or multifocal*) NEAR/2 motor NEAR/1 neuropath*):ti,ab
#76	(((periph* or cranial*) NEAR/2 (nerve or nerves or nervous system)) and alcohol*):ti,ab
#77	{or #29-#35, #44-#76}
#78	MeSH descriptor: [Motor Neuron Disease] explode all trees
#79	MeSH descriptor: [Postpoliomyelitis Syndrome] this term only
#80	MeSH descriptor: [Parkinsonian Disorders] explode all trees
#81	MeSH descriptor: [Muscular Dystrophy, Duchenne] this term only
#82	MeSH descriptor: [Multiple Sclerosis] explode all trees
#83	MeSH descriptor: [Neuromuscular Diseases] this term only
#84	MeSH descriptor: [Spastic Paraplegia, Hereditary] this term only
#85	MeSH descriptor: [Friedreich Ataxia] this term only
#86	MeSH descriptor: [Multiple System Atrophy] explode all trees
#87	MeSH descriptor: [Supranuclear Palsy, Progressive] this term only
#88	MeSH descriptor: [Corticobasal Degeneration] explode all trees
#89	MeSH descriptor: [Leukodystrophy, Metachromatic] this term only
#90	MeSH descriptor: [Mitochondrial Myopathies] explode all trees
#91	MeSH descriptor: [Mucopolysaccharidoses] explode all trees
#92	MeSH descriptor: [Williams Syndrome] this term only
#93	MeSH descriptor: [Genetic Diseases, Inborn] this term only
#94	MeSH descriptor: [Rett Syndrome] this term only
#95	MeSH descriptor: [Fetal Alcohol Spectrum Disorders] this term only
#96	MeSH descriptor: [Dystonic Disorders] this term only
#97	MeSH descriptor: [Hereditary Sensory and Motor Neuropathy] this term only
#98	MeSH descriptor: [Spinal Dysraphism] this term only
#99	(neurolog* NEAR/1 (disease* or damage* or disorder* or impair*)):ti,ab
#100	((motor-neuron* or gehrig* or charcott* or kennedy*) NEAR/1 disease*):ti,ab
#101	((amyotroph* or primary) NEAR/1 lateral* NEAR/1 sclero*):ti,ab
#102	(bulbar NEAR/1 pals*):ti,ab
#103	((muscular or muscle* or bulbo) NEAR/1 atroph* NEAR/1 spin*):ti,ab
#104	(progressiv* NEAR/1 (muscular or muscle*) NEAR/1 atroph*):ti,ab
#105	((postpolio* or post next polio*) NEAR/1 (syndrome or syndromes)):ti,ab
#106	(Parkinson* or duchenne* or multiple next sclerosis* or sclerosos* or aphasia or creutzfeldt next jakob or

	huntington* or kluver next bucy):ti,ab
#107	(muscular NEAR/1 dystroph*):ti,ab
#108	(neuromusc* NEAR/1 (disease* or disorder or disorders)):ti,ab
#109	(heredit* NEAR/1 spastic* NEAR/1 parapleg*):ti,ab
#110	("friedreich ataxia" or "friedreich ataxias" or "friedreichs ataxia" or "friedreichs ataxias"):ti,ab
#111	((multiple-system or olivopontocerebellar) NEAR/1 atroph*):ti,ab
#112	(shy-drager syndrome* or striatonigral degenerat* or batten-disease or batten-diseases):ti,ab
#113	(progressive NEAR/1 supranuclear NEAR/1 pals*):ti,ab
#114	(richardson* NEAR/1 (disease or diseases or syndrome or syndromes)):ti,ab
#115	((corticobasal or cortico basal) NEAR/1 degenerat*):ti,ab
#116	(white-matter NEAR/1 (disorder or disorders)):ti,ab
#117	(metachromatic-leukodystroph* or mitochondrial-myopath* or mucopolysaccharidos*):ti,ab
#118	(lysosomal NEAR/1 storage NEAR/1 (disorder or disorders)):ti,ab
#119	((genetic or William* or catch-22 or rett* or congenital or fetal or foetal-alcohol) NEAR/1 (syndrome or disorder*)):ti,ab
#120	(perinatal NEAR/1 (illness* or hypoxia*)):ti,ab
#121	(primary NEAR/1 (dystonia or dystonias)):ti,ab
#122	(heredit* NEAR/1 motor* NEAR/1 sens* NEAR/1 neuropath*):ti,ab
#123	(spina-bifida or bifidas or spinal-dysraphism or dysraphisms):ti,ab
#124	MeSH descriptor: [Movement Disorders] this term only
#125	MeSH descriptor: [Motor Disorders] this term only
#126	MeSH descriptor: [Conversion Disorder] this term only
#127	((functional* or psychogenic* or dissociative*) NEAR/1 neurologic* NEAR/1 (disorder* or dysfunction* or difficult*)):ti,ab
#128	((movement* or motor* or convers*) NEAR/1 (disorder* or dysfunct*)):ti,ab
#129	((psychogenic or dissociative or non-epilep* or nonepilep*) NEAR/1 (seizure* or convulsion* or fit or fits or spasm* or attack*)):ti,ab
#130	(pseudo-seizure or pseudoseizure):ti,ab
#131	(medical* NEAR/1 (unexplain* or un-explain*) NEAR/1 (symptom or symptoms)):ti,ab
#132	{or #77-#131}
#133	MeSH descriptor: [Speech Disorders] explode all trees
#134	MeSH descriptor: [Communication Disorders] explode all trees
#135	MeSH descriptor: [Language Therapy] this term only
#136	MeSH descriptor: [Myofunctional Therapy] this term only
#137	MeSH descriptor: [Speech, Alaryngeal] this term only
#138	MeSH descriptor: [Speech, Esophageal] this term only
#139	MeSH descriptor: [Speech Therapy] this term only
#140	MeSH descriptor: [Voice Training] this term only
#141	{or #133-#140}
#142	MeSH descriptor: [Rehabilitation] this term only
#143	MeSH descriptor: [Neurological Rehabilitation] this term only
#144	MeSH descriptor: [Telerehabilitation] this term only
#145	(rehab* or telerehab* or neurorehab*):ti
#146	{or #142-#145}
#147	#141 and #146
#148	MeSH descriptor: [Stroke] explode all trees
#149	MeSH descriptor: [Dementia] this term only
#150	{or #148-#149}
#151	#147 NOT #150
#152	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) NEAR/3 (speech* or languag* or linguistic* or articulat* or intonat* or pronunciat*)):ti,ab
#153	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) NEAR/1 communicat*):ti,ab
#154	MeSH descriptor: [Rehabilitation of Speech and Language Disorders] explode all trees

#155	MeSH descriptor: [Communication Disorders] explode all trees and with qualifier(s): [rehabilitation - RH]
#156	MeSH descriptor: [Speech Disorders] explode all trees and with qualifier(s): [rehabilitation - RH]
#157	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or strengthen* or rehab* or decreas* or reduc*) NEAR/3 (aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic*)):ti,ab
#158	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) NEAR/3 (fluenc* or voice* or accent or accents)):ti,ab
#159	("lee silverman" or "LVST LOUD" or camperdown or RESTART-DCM):ti,ab
#160	(Lidcombe NEAR/2 (program* or therap* or stutter* or behavior* or behaviour*)):ti,ab
#161	(palin NEAR/3 interact*):ti,ab
#162	((((augment* or alternat*) NEAR/1 communicat*) or AAC) NEAR/3 (aid* or device* or technolog* or apps* or comput* or tool or tools)):ti,ab
#163	((communicat* or vocal* or voice* or speech* or languag* or linguistic* or articulat* or intonat* or pronunciat*) NEAR/3 (signalong* or sign-a-long or "finger spell" or "finger spells" or "finger spelling" or "finger spellings" or "manual alphabet" or "manual alphabets" or gestur* or sign* or output* or aid)):ti,ab
#164	("talking mat" or "talking mats" or VOCAs or makaton* or paget-gorman or amer-ind):ti,ab
#165	(("social skill" or "social skills" or script* or attention* or listen* or "social communication" or "social communications") NEAR/3 (train* or technique* or therap* or rehab* or treat* or remediat* or pathol*)):ti,ab
#166	((speech* or languag* or linguistic* or articulat* or aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic* or fluenc* or voice* or accent or accents) NEAR/3 (train* or technique* or strateg* or shaping* or shape* or "block modify" or "block modifys" or "block modified" or "block modification" or "block modifications" or prolong* or approach* or "social story" or "social stories" or multimod* or amplificat*)):ti,ab
#167	((speech* or languag* or linguistic* or articulat* or aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic* or fluenc* or voice* or accent or accents or intonat* or pronunciat*) NEAR/3 (therap* or rehab* or treat* or remediat* or pathol*)):ti,ab
#168	((word or words or sentence or sentences or discours* or reading* or writing* or "semantic feature" or "semantic features" or "verb network strength" or "verb network strengths" or "verb network strengthen" or "verb network strengthens" or "verb network strengthened" or "verb network strengthening" or "melodic intonation" or "melodic intonations" or "constraint induce" or "constraint induces" or "constraint induced" or "constraint inductive") NEAR/3 (analys* or treatment* or therap* or train* or technique* or rehab* or remediat* or pathol*)):ti,ab
#169	((voice* or vocal or laryngeal* or circumlaryngeal*) NEAR/2 (hygien* or function* or resonan* or manual* or confiden*) NEAR/2 (therap* or treatment* or exercis* or method* or train* or technique* or rehab* or remediat* or pathol*)):ti,ab
#170	((voice* or vocal*) NEAR/3 (hyperfunct* or dysphoni*)):ti,ab
#171	((voice* or vocal*) NEAR/3 muscle* NEAR/1 (strain* or tense* or tension*)):ti,ab
#172	{or #152-#171}
#173	#132 or #151
#174	#172 and #173
#175	conference:pt or (clinicaltrials or trialsearch or "www.who.int"):so
#176	#174 NOT #175
#177	#174 NOT #175 with Publication Year from 2013 to 2023, in Trials

Database: INAHTA

Date of last search: 21/03/2023

#1	(brain* or cereb* or craniocereb* or cranial or intracrani* or neurocognit*) AND (injur* or trauma* or damage* or disease*1 or disorder* or infect* or hemorrhag* or haemorrhag* or neoplasm* or cancer* or tumour* or tumor* or insult* or impair* or ischemi* or infarcti* or hypoxi* or drown*)
#2	(chronic* AND trauma* AND encephalopath*)
#3	(infratentorial* or supratentorial* or hypothalam* or pituitar* or choroid plexus) AND (neoplasm* or cancer* or tumour* or tumor* or carcinom* or adenocarcinom*)
#4	(brain* AND abscess*)
#5	(carotid arter* AND (disease* or injur*))
#6	("basal ganglia disease" or "basal ganglia diseases" or encephalitis or meningoencephalitis or hydrocephal* or "paraneoplastic cerebellar degenerate" or "paraneoplastic cerebellar degenerated" or "paraneoplastic cerebellar degenerative" or "paraneoplastic cerebellar degeneration" or "shaken baby syndrome" or "shaken baby syndromes" or "shaking baby syndrome" or "shaking baby syndromes")

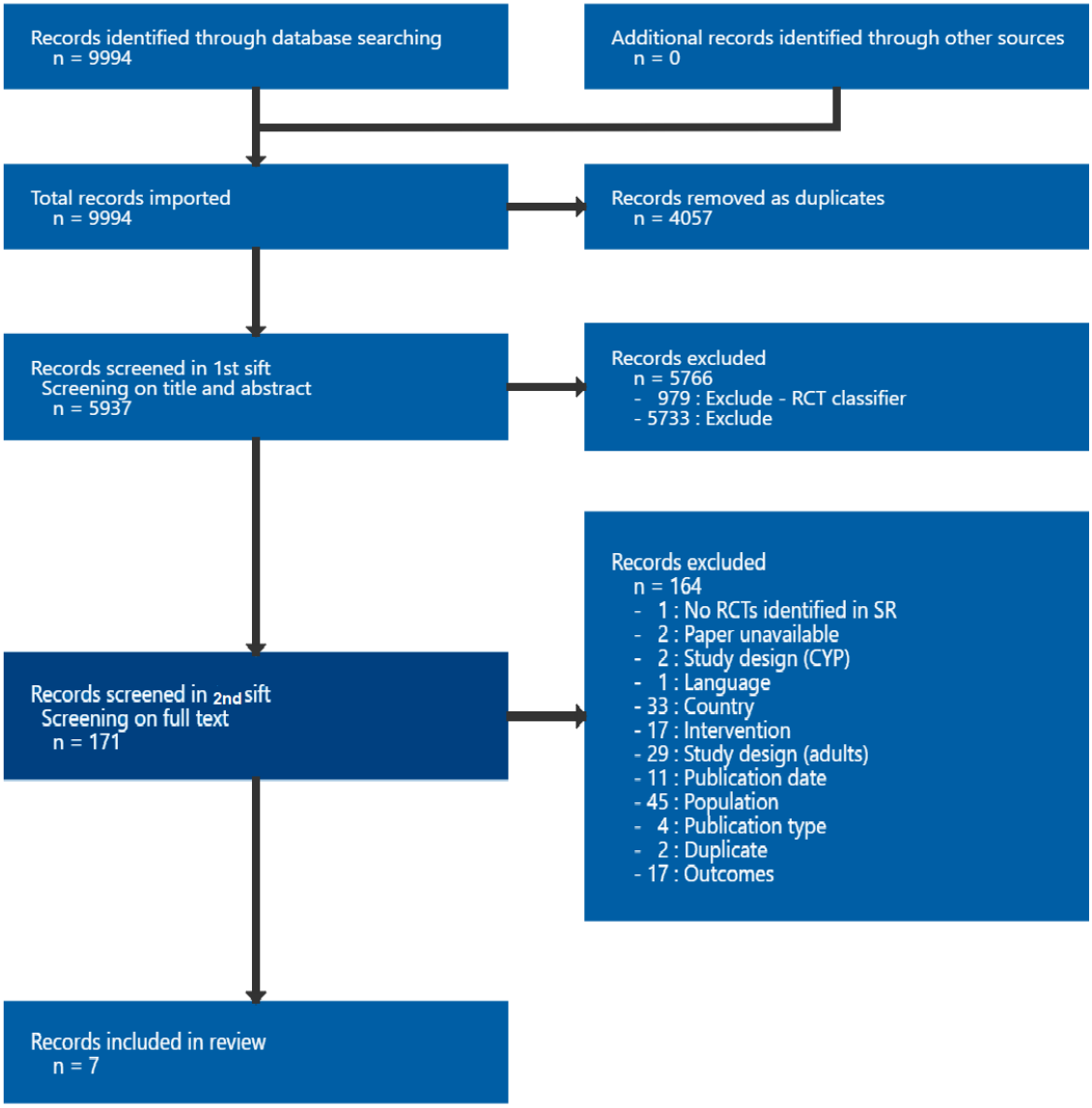
#7	(stroke or strokes AND (paediatric* or pediatric* or child* or adolescen* or kid or kids or youth* or youngster* or minor or minors or underage* or under-age* or "under age" or "under ages" or teen or teens or teenager* or juvenile* or boy or boys or boyhood or girl or girls or girlhood or schoolchild* or "school ages" or "school age" or schoolage* or "under 16" or "under sixteen" or "under sixteens"))
#8	((spinal* or spine or spines) AND (injur* or trauma* or tumour* or tumor* or neoplasm* or cancer* or infect* or insult* or disease or diseases or disorder* or degenrat* or compress* or vascular* or ischemi* or infarct* or hemorrhag* or haemorrhag*))
#9	(Central cord syndrome* or transverse myelitis)
#10	(epidural* AND (neoplasm* or cancer* or tumour* or tumor* or abscess*))
#11	((spinal* or spine or spines) AND (viral* or virus* or polio* or acquired immunodeficiency syndrome or AIDS or HIV or bacterial* or neurosyphili* or neuro-syphili* or tubercul*))
#12	((periph* or cranial*) AND (nerve or nerves or nervous system) AND (injur* or trauma* or disorder* or disease* or damage* or neoplasm* or cancer* or tumour* or tumor* or inflamm* or autoimmun* or paraneoplastic* or neuropath* or syndrome or syndromes))
#13	(Guillain* AND Barr*)
#14	((abducen* or accessory or facial or glossopharyngeal or hypoglossal or oculomotor or ocular motility or olfactory or optic* or trigeminal or trochlear or vestibulocochlear) AND nerve* AND injur*)
#15	(optic* AND nerve* AND (neoplasm* or cancer* or tumour* or tumor*))
#16	(brachial plexus AND (neuropath* or neuritis))
#17	(complex regional pain syndrome* or causalgia or mononeuropath* or nerve compression syndrome*)
#18	((femoral or median or peroneal or radial or sciatic or tibial or ulnar) AND neuropath*)
#19	((carpal-tunnel or piriformis-muscle or tarsal-tunnel or thoracic-outlet) AND syndrome*)
#20	(pudendal neuralgia or polyneuropath* or polyradiculoneuropath* or polyradiculopath* or radiculopath*)
#21	((abducen* or accessory or facial or glossopharyngeal or hypoglossal or oculomotor or ocular motility or olfactory or optic* or trigeminal or trochlear or vestibulocochlear) AND nerve* AND disease*)
#22	(periph* AND neuropath*)
#23	(((periph* or cranial*) AND (nerve or nerves or nervous system)) and lupus)
#24	(((periph* or cranial*) AND (nerve or nerves or nervous system)) and alcohol*)
#25	(neurolog* AND (disease* or damage* or disorder* or impair*))
#26	((motor-neuron* or gehrig* or charcott* or kennedy*) AND disease*)
#27	((amyotroph* or primary) AND lateral* AND sclero*)
#28	(bulbar AND pals*)
#29	((muscular or muscle* or bulbo) AND atroph* AND spin*)
#30	(progressiv* AND (muscular or muscle*) AND atroph*)
#31	((postpolio* or post-polio*) AND (syndrome or syndromes))
#32	(Parkinson* or duchenne* or multiple sclerosis* or sclerosos* or aphasia or creutzfeldt-jakob or huntington* or kluver-bucy)
#33	(muscular AND dystroph*)
#34	(neuromusc* AND (disease* or disorder or disorders))
#35	(heredit* AND spastic* AND parapleg*)
#36	("friedreich* ataxia" or "friedreich* ataxias")
#37	((multiple system or olivopontocerebellar) AND atroph*)
#38	(shy-drager syndrome* or striatonigral degenerat* or batten* disease or diseases)
#39	(progressive AND supranuclear AND pals*)
#40	(richardson* AND (disease or diseases or syndrome or syndromes))
#41	((corticobasal or cortico basal) AND degenerat*)
#42	(white AND matter AND (disorder or disorders))
#43	(metachromatic leukodystroph* or mitochondrial myopath* or mucopolysaccharidos*)
#44	(lysosomal AND storage AND (disorder or disorders))
#45	((genetic or William* or catch-22 or rett* or congenital or fetal or faetal alcohol) AND (syndrome or disorder*))
#46	(perinatal illness* or perinatal hypoxia*)
#47	(primary AND (dystonia or dystonias))
#48	(heredit* AND motor* AND sens* AND neuropath*)
#49	(spina bifida or bifidas or spinal dysraphism or dysraphisms)
#50	((functional* or psychogenic* or dissociative*) AND neurologic* AND (disorder* or dysfunction* or difficult*))

#51	((movement* or motor* or convers*) AND (disorder* or dysfunct*))
#52	((psychogenic or dissociative or non-epilep* or nonepilep*) AND (seizure* or convulsion* or fit or fits or spasm* or attack*))
#53	(pseudo-seizure or pseudoseizure)
#54	(medical* AND (unexplain* or un-explain*) AND (symptom or symptoms))
#55	((multi-focal* or multifocal*) AND motor AND neuropath*)
#56	(rehab* or telerehab* or neurorehab*)
#57	#28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 OR #8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1
#58	#56 OR #55 OR #54 OR #53 OR #52 OR #51 OR #50 OR #49 OR #48 OR #47 OR #46 OR #45 OR #44 OR #43 OR #42 OR #41 OR #40 OR #39 OR #38 OR #37 OR #36 OR #35 OR #34 OR #33 OR #32 OR #31 OR #30 OR #29
#59	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) AND (speech* or languag* or linguistic* or articulat* or intonat* or pronunciat*))
#60	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) AND communicat*)
#61	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or strengthen* or rehab* or decreas* or reduc*) AND (aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic*))
#62	((improv* or benefit* or increas* or enhanc* or support* or encourag* or promot* or optimiz* or optimis* or motivat* or incentiv* or maintain* or strengthen* or rehab* or restor*) AND (fluenc* or voice* or accent or accents))
#63	("lee silverman" or "LVST LOUD" or camperdown or RESTART-DCM)
#64	(Lidcombe AND (program* or therap* or stutter* or behavior* or behaviour*))
#65	(palin AND interact*)
#66	((((augment* or alternat*) AND communicat*) or AAC) AND (aid* or device* or technolog* or apps* or comput* or tool or tools))
#67	((communicat* or vocal* or voice* or speech* or languag* or linguistic* or articulat* or intonat* or pronunciat*) AND (signalong* or sign-a-long or "finger spell" or "finger spells" or "finger spelling" or "finger spellings" or "manual alphabet" or "manual alphabets" or gestur* or sign* or output* or aid))
#68	("talking mat" or "talking mats" or VOCAs or makaton* or paget-gorman or amer-ind)
#69	(("social skill" or "social skills" or script* or attention* or listen* or "social communication" or "social communications") AND (train* or technique* or therap* or rehab* or treat* or remediat* or pathol*))
#70	((speech* or languag* or linguistic* or articulat* or aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic* or fluenc* or voice* or accent or accents) AND (train* or technique* or strateg* or shaping* or shape* or "block modify" or "block modifys" or "block modified" or "block modification" or "block modifications" or prolong* or approach* or "social story" or "social stories" or multimod* or amplificat*))
#71	((speech* or languag* or linguistic* or articulat* or aphasi* or apraxi* or dsyarthri* or dyspha* or stutter* or anomia* or anomic* or fluenc* or voice* or accent or accents or intonat* or pronunciat*) AND (therap* or rehab* or treat* or remediat* or pathol*))
#72	((word or words or sentence or sentences or discours* or reading* or writing* or "semantic feature" or "semantic features" or "verb network strength" or "verb network strengths" or "verb network strengthen" or "verb network strengthens" or "verb network strengthened" or "verb network strengthening" or "melodic intonation" or "melodic intonations" or "constraint induce" or "constraint induces" or "constraint induced" or "constraint inductive") AND (analys* or treatment* or therap* or train* or technique* or rehab* or remediat* or pathol*))
#73	((voice* or vocal or laryngeal* or circumlaryngeal*) AND (hygien* or function* or resonan* or manual* or confiden*) AND (therap* or treatment* or exercis* or method* or train* or technique* or rehab* or remediat* or pathol*))
#74	((voice* or vocal*) AND (hyperfunct* or dysphoni*))
#75	((voice* or vocal*) AND muscle* AND (strain* or tense* or tension*))
#76	#75 OR #74 OR #73 OR #72 OR #71 OR #70 OR #69 OR #68 OR #67 OR #66 OR #65 OR #64 OR #63 OR #62 OR #61 OR #60 OR #59
#77	#76 AND #57
#78	#76 AND #58

Appendix C Effectiveness evidence study selection

Study selection for: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Figure 1: Study selection flow chart



Appendix D Evidence tables

Evidence tables for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Table 5: Evidence tables

Brabenec, 2021

Bibliographic Reference

Brabenec, Lubos; Klobusiakova, Patricia; Simko, Patrik; Kostalova, Milena; Mekyska, Jiri; Rektorova, Irena; Non-invasive brain stimulation for speech in Parkinson's disease: A randomized controlled trial.; Brain stimulation; 2021; vol. 14 (no. 3); 571-578

Brabenec, L, Simko, P, Sejnoha Minsterova, A et al. (2022) rTMS treatment for hypokinetic dysarthria in Parkinson's disease enhances white matter integrity of the auditory-motor loop. European journal of neurology

Study details

Country/ies where study was carried out	Czech Republic
Study type	Randomised controlled trial (RCT)
Study dates	Not reported
Inclusion criteria	- Diagnosis of Parkinson's disease with mild to moderate hypokinetic dysarthia as determined by speech therapist, - Aged 50 to 90 years.

Exclusion criteria	- Psychiatric disorders including major depression and hallucinations, - Unable to undertake MRI due to metal in the body, - Epilepsy, - Not willing to cooperate, - Dementia.

Patient characteristics	N=39 adults with Parkinson's disease. Real rTMS: n=20 Sham rTMS: n=19 Age in years [Mean (SD)]: - Real rTMS: 68.9 (7.6) - Sham rTMS: 70.7 (7.8) Sex (M/F): - Real rTMS: n=14/n=6 - Sham rTMS: n=9/n=4 Time since PD diagnosis in years [Mean (SD) not reported] [Median (IQR)]: - Real rTMS: 4.0 (2.0-10.5) - Sham rTMS: 3.0 (1.0-8.2) Chronic neurological disorder category: Progressive neurological disease. Note: Study baseline characteristics available for n=20 in real rTMS and n=13 in sham rTMS groups. In the sham rTMS group, 19 were randomised and 6 participants did not complete all of the sessions. Longest follow-up data was extracted (10 weeks).

Intervention(s)/control	**Intervention** Name: Real rTMS Protocol intervention group: Interventions to improve speech and language (including fluency) Delivery setting: Central European Institute (CEITEC) within Masaryk University Number/frequency of sessions: 10x 40-minute sessions Duration: 2 weeks Practitioner: Trained technician Participants underwent 1 Herz repetitive transcranial magnetic stimulation over the right posterior superior temporal gyrus (STG) with 100% intensity of the resting motor threshold and 1800 pulses per session. An air-cooled figure-eight-shaped coil was placed over the STG region to achieve this. **Control** Name: Sham rTMS Protocol description: Placebo (sham) Delivery setting: Central European Institute (CEITEC) within Masaryk University Number and frequency of sessions: 10x40-minute sessions Duration: 2 weeks Practitioner: Trained technician Conditions for the sham rTMS were replicated such that there was a sham coil placed over the STG which emitted similar clicking sounds. There was no induction of magnetic field or electrical scalp stimulation.

Duration of follow-up	10 weeks
Sources of funding	Not industry funded
Sample size	N=39 adults with Parkinson's disease - Real rTMS: n=20 - Sham rTMS: n=19
Other information	Participants were on stable dopaminergic medication for a minimum of 4 weeks prior to baseline and throughout the study. Participants were assessed on the ON medication state without dyskinesias and there were no speech therapy sessions undertaken by participants during the study period. Data was not presented in an extractable form for total 3FT scores at post-intervention and 2 months (10-weeks follow-up from baseline). Secondary study Brabenec 2022 provided additional baseline information to calculate baseline age.

N/n: number of participants; rTMS: repetitive transcranial magnetic stimulation; 3FT: the 3F test dysarthric profile

Outcomes

Study timepoints

- 2 months follow-up (10 weeks from baseline)

Real rTMS versus sham rTMS: Speech

Speech as measured by 3FT Phonetics subtest scores - polarity - Higher values are better

Outcome	Estimated marginal mean difference (p-value)
3FT Phonetics subtest scores at 2 months (10 weeks from baseline) Real rTMS n=20; sham rTMS n=13 Custom value	12.5 (0.031)

N/n: number of participants; rTMS: repetitive transcranial magnetic stimulation; 3FT: the 3F test dysarthric profile

Critical appraisal – Cochrane RoB 2

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Randomisation and allocation sequence was performed through computerised simple randomisation by an independent investigator and all researchers except of the investigator performing rTMS were blinded to allocation. Characteristics are only presented for participants analysed rather than randomised, however, unlikely imbalances between randomised participants at baseline as authors perform the Kruskal-Wallis test to compare intervention and comparator arms with and without drop-outs and found no significant differences in baseline values.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Participants and personnel who were performing rTMS were aware of assigned intervention and there was no information about deviations due to the experimental context. Authors excluded 6/19 (32%) in the control arm who did not complete all 10 sessions and one of the common reasons cited for exclusion was withdrawal of consent (number not specified). Reasons for withdrawal were not reported and these participants were excluded from analysis.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(There were missing outcome data for 6/19 (31.6%) in the control arm who were not included in the analysis with primary reasons for withdrawal due to withdrawal of consent and health related reasons (no further information reported). Authors used a mixed linear model for analyses which tend to be robust when there are unbalanced arms and also performed the Kruskal-Wallis test to compare intervention to comparator arms with and without drop-outs and found no significant differences in outcomes.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Speech pathologists that assessed outcomes were blinded to allocation. Same time points and measurement tool used.)*

Section	Question	Answer
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Study provides clinicaltrials.gov protocol which names the outcome measure as changes in score of the 3FT test but does not detail measuring subtest scores and therefore is unclear whether reporting of these subtest measurements were planned. Timepoints of outcome assessment in the clinicaltrials.gov record differ to that in the study and pre-specified statistical analysis plan is not reported.)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	Not applicable

rTMS: repetitive transcranial magnetic stimulation; 3FT: the 3F test dysarthric profile

Crispiatico, 2022

Bibliographic Reference	Crispiatico, Valeria; Baldanzi, Cinzia; Napoletano, Arianna; Tomasoni, Laura; Tedeschi, Francesca; Groppo, Elisabetta; Rovaris, Marco; Vitali, Chiara; Cattaneo, Davide; Effects of voice rehabilitation in people with MS: A double-blinded long-term randomized controlled trial.; Multiple sclerosis (Houndmills, Basingstoke, England); 2022; vol. 28 (no. 7); 1081-1090

Study details

Country/ies where study was carried out	Italy
Study type	Randomised controlled trial (RCT)
Study dates	January 2018 - September 2019

Inclusion criteria	- Multiple sclerosis (MS) diagnosed according to revisited McDonald's criteria, - Age ≥18 years, - Mini Mental State Examination (MMSE) score >21, - Hypophonia (voice intensity during conversation <60 dB Sound Pressure Level [SPL]), - Ability to understand Italian language; and aims of the study.
Exclusion criteria	- Presence of other neurological disorders, - Clinical history of laryngeal cancer, chemotherapy, radiotherapy, head, and neck trauma or endotracheal intubation, - Visual/hearing impairments hindering rehabilitation, - Relapse or sudden changes in multiple sclerosis symptoms within previous 3 months.

Patient characteristics	N=44 adults with multiple sclerosis. LSVT LOUD n=23 Standard care n=21 Age in years [Mean (SD)]: - LSVT LOUD®: 55.1 (9.3) - Standard Care: 57.6 (10.4) Sex (M/F): - LSVT LOUD®: n=14/n=9 - Standard Care: n=11/n=10 Time since diagnosis in years [Mean (SD)]: - LSVT LOUD®: 26.7 (12.6) - Standard Care: 25.2 (10.3) Chronic neurological disorder category: Progressive neurological disease.

Intervention(s)/control	Intervention
	Name: LSVT LOUD®
	Protocol intervention group: Interventions to sup
	Delivery setting: Inpatient, individual, face to fac
	Number/ frequency of sessions: 16 sessions (4
	Duration: 1 month
	Practitioner(s): State-registered speech therapis
	Based on recognised principles of motor learnin beneficial.
	Each session comprised of 'daily tasks' that are minutes of sustained /a/ phonation, /a/ at high v erarchical exercises consist of 30 minutes readi tion and complexity of tasks.
	Participants were also asked to practice for 5–1 days.
	Control
	Name: Standard care
	Protocol description: Control (standard care)
	Delivery setting: Inpatient, individual, face to fac
	Number/ frequency of sessions: 16 sessions (4
	Duration: 1 month
	Practitioner(s): Speech therapists with experien
	Included a wide range of speech therapy techni strategies. The intensity and types of exercises
	Both groups were asked to perform tailored car support generalisation to daily life.

Duration of follow-up	15 months (extended from 12 months due to C
Sources of funding	Not industry funded
Sample size	N=44 randomised - LSVT LOUD®: n=23 - Standard care: n=21

COVID-19: coronavirus; db: decibel; LVST: Lee Silverman voice treatment; N/n: number of participants; SD: standard deviation

Outcomes

Study timepoints

- Baseline
- Post-intervention (1 month from baseline)
- 15 months follow-up

LSVT LOUD® versus standard care: Voice and voice related quality of life

Voice as measured by monologue intensity - polarity - higher values are better

Voice as measured by sustained/a/intensity - polarity - higher values are better

Voice as measured by intensity of functional sentences - polarity - higher values are better

Voice as measured by Maximum Phonation Time (MPT) - polarity - higher values are better

Voice as measured by Grade, Instability, Roughness, Breathiness, Asthenia, and Strain (GIRBAS) – polarity - lower values are better

Voice related quality of life as measured by VHI - polarity - lower values are better

Outcome	LSVT LOUD® vs Treatment as usual, post-intervention, N=23 vs 21	LSVT LOUD® vs Treatment as usual, 15-months, N=23 vs 21

Outcome	LSVT LOUD® vs Treatment as usual, post-intervention, N=23 vs 21	LSVT LOUD® vs Treatment as usual, 15-months, N=23 vs 21
Monologue intensity (dB SPL [decibel sound pressure level]) - Adjusted for baseline values Mean difference between groups (95% CI)	6.3 (2.5 to 10.01)	1.7 (-2.5 to 5.8)
Sustained /a/ intensity (dB SPL [decibel sound pressure level]) Adjusted for baseline values Mean difference between groups (95% CI)	7.4 (2.3 to 12.5)	5.2 (-3.1 to 13.5)
Intensity of functional sentences (dB SPL [decibel sound pressure level]) Adjusted for baseline values Mean difference between groups (95% CI)	9.5 (4.7 to 14.3)	4.4 (-0.7 to 9.5)
MPT (Maximum Phonation Time) in seconds Adjusted for baseline values Mean difference between groups (95% CI)	-0.3 (-3.1 to 2.6)	1.8 (-2.3 to 5.8)
GIRBAS_grade (Grade, Instability, Roughness, Breathiness, Asthenia, and Strain) Adjusted for baseline values Mean difference between groups (95% CI)	-0.5 (-0.9 to -0.1)	-0.6 (-1 to 0)
GIRBAS_instability (Grade, Instability, Roughness, Breathiness, Asthenia, and Strain) Adjusted for baseline values Mean difference between groups (95% CI)	-0.7 (-1.1 to -0.2)	-0.2 (-0.8 to 0.3)

Outcome	LSVT LOUD® vs Treatment as usual, post-intervention, N=23 vs 21	LSVT LOUD® vs Treatment as usual, 15-months, N=23 vs 21
GIRBAS_roughness (Grade, Instability, Roughness, Breathiness, Asthenia, and Strain) Adjusted for baseline values Mean difference between groups (95% CI)	-0.1 (-0.1 to 0.1)	-0.5 (-0.6 to 0.5)
GIRBAS_breathiness (Grade, Instability, Roughness, Breathiness, Asthenia, and Strain) Adjusted for baseline values Mean difference between groups (95% CI)	-0.4 (-0.8 to 0)	-0.4 (-0.9 to 0)
GIRBAS_asthenia (Grade, Instability, Roughness, Breathiness, Asthenia, and Strain) Adjusted for baseline values Mean difference between groups (95% CI)	-0.7 (-1.2 to -0.2)	-0.3 (-0.9 to 0.3)
GIRBAS_strain (Grade, Instability, Roughness, Breathiness, Asthenia, and Strain) Adjusted for baseline values Mean difference between groups (95% CI)	-0.2 (-0.5 to 0.1)	0 (-0.3 to 0.4)
VHI (Voice Handicap Index) Adjusted for baseline values Mean difference between groups (95% CI)	-10.8 (-21.2 to -0.4)	-11.3 (-24.3 to -1.7)

CI: confidence interval; db: decibels; GIRBAS: grade, instability, roughness, breathiness, asthenia, and strain; LSVT®: Lee Silverman voice treatment; MD: mean difference; MPT: maximum phonation time; N/n: number of participants; SPL: sound pressure level; VHI: voice handicap index

Critical appraisal – Cochrane RoB 2

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(The randomisation sequence [kept off-site and drawn up by a computerized random number generator] and group allocation were kept concealed from all assessors throughout the entire study. Baseline characteristics balanced at baseline.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(Participants blinded to interventions, however no details on how participants were unaware of group assignment. Therapists delivering the interventions aware of intervention assigned. ITT analyses were used.*)
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(All participants randomised were analysed.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(The questionnaires used were all validated and widely used tools: GIRBAS, VHI. Standardised and validated measurement tools implemented by researchers blinded to allocation, however outcomes subjective and unclear if participants aware of allocation – no details on how participants were unaware of group assignment.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low (*Published protocol available.)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	Not applicable

ITT: intention-to-treat

Raglio, 2016

Bibliographic Reference	Raglio, Alfredo; Giovanazzi, Elena; Pain, Debora; Baiardi, Paola; Imbriani, Chiara; Imbriani, Marcello; Mora, Gabriele; Active music therapy approach in amyotrophic lateral sclerosis: a randomized-controlled trial.; International journal of rehabilitation research. Internationale Zeitschrift fur Rehabilitationsforschung. Revue internationale de recherches de readaptation; 2016; vol. 39 (no. 4); 365-367

Study details

Country/ies where study was carried out	Italy
Study type	Randomised controlled trial (RCT)
Study dates	Not reported
Inclusion criteria	- Diagnosis of amyotrophic lateral sclerosis (ALS) or primary lateral sclerosis (PLS), - Mild–moderate disability (ALS Functional Rating Scale Revised ≤40), - Acceptable respiratory functions (forced vital capacity ≥50%), - Motor ability in the use of musical instruments, - Cognitive integrity.
Exclusion criteria	- Patients with other severe neurological diseases and severe psychiatric, cardiovascular, kidney, or hepatic diseases were excluded from the study.

Patient characteristics	N=30 people with ALS or PLS (n=26 people with ALS; n=4 people with PLS) Active music therapy n=15 Standard care n=15 Age in years [mean (SD)]: - Active music therapy: 62.9 (9.83) - Standard care: 65.1 (12.10) Sex (M/F): - Active music therapy: n=7/n=8 - Standard care: n=6/n=9 Time since diagnosis of ALS in months [mean (SD)]: - Active music therapy: 36.8 (11.6) - Standard care: 36.0 (12.9) Time since diagnosis of PLS in months [Mean (SD) not reported] [Median (minimum-maximum)]: - Active music therapy: 198 (188-208) - Standard care: 222.5 (77-368) Chronic neurological disease category: Progressive neurological disease.

Intervention(s)/control	Intervention
	Name: Active music therapy
	Protocol intervention group: Interventions to imp
	Delivery setting: Inpatient
	Number/frequency of sessions: 12 sessions (3x
	Duration: 1 month
	Practitioner: Trained music therapist
	Music therapist stimulates the patient to interact patient's emotional expression and regulation
	Control
	Name: Standard care
	Protocol description: Control (standard care)
	Delivery setting: Inpatient
	Number/frequency of sessions: Not reported
	Duration: 1 month
	Treatment was based on physical and speech r

Duration of follow-up	2 months
Sources of funding	Not industry funded
Sample size	N=30 adults with amyotrophic lateral sclerosis (- Active music therapy: n=15 - Standard care: n=15

ALS: amyotrophic lateral sclerosis; AMT: active music therapy; ALSFRS-R: PLS: primary lateral sclerosis; N/n: number of participants; RCT: randomised controlled trial; SC: standard care; SD: standard deviation

Outcomes

Study timepoints

- Baseline
- 1 month follow-up
- 3 months follow-up

AMT versus standard care: physical and mental health related quality of life and social care related quality of life, mood

Physical and mental health related quality of life as measured by MQoL-it - polarity - higher values are better

Mood as measured by HADS-A - polarity - lower values are better

Mood as measured by HADS-D - polarity - lower values are better

Outcome	Active music therapy, 1-month, N=15	Active music therapy, 3-months, N=15	Standard care, 1-month, N=15	Standard care, 3-months, N=15
MQoL-it Change in score from baseline Mean (SD)	0.17 (0.79)	0.15 (0.73)	0.75 (1.06)	-0.13 (1.01)
HADS-A Change in score from baseline Mean (SD)	0.72 (2.22)	-0.5 (2.28)	-1.94 (2.9)	-0.67 (4.68)
HADS-D Change in score from baseline Mean (SD)	-1.28 (2.4)	-0.43 (2.29)	-1 (2.15)	0.54 (2.07)

AMT: active music therapy; CI: confidence interval HADS-A: Hospital Anxiety and Depression Scale-Anxiety; HADS-D: Hospital Anxiety and Depression Scale-Depression; MD: mean difference; MQoL-it: McGill Quality of Life Questionnaire-Italian; N/n: number of participants; SC: standard care; SD: standard deviation

Critical appraisal – Cochrane RoB 2

Section	Question	Answer

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information about randomisation process or how allocation concealment was provided, however baseline characteristics were balanced.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(Participants blinded to interventions, however no details on how participants were unaware of group assignment. Therapists delivering the interventions aware of intervention assigned. ITT analyses were used.*)
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(All participants randomised were analysed.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(The questionnaires used were all validated and widely used tools: MQOL-it, HADS-A, HADS-D. Standardised and validated measurement tools implemented by researchers blinded to allocation, however outcomes subjective and participants aware of allocation.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(No published protocol and unable to assess ascertain if all outcomes reported/deviation from planned analysis.)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	Not applicable

HADS-A: hospital anxiety and depression scale-anxiety; HADS-D: hospital anxiety and depression scale-depression; MD: mean difference; ITT: intention-to-treat; MQoL-it: McGill quality of life questionnaire-Italian

Sackley, 2018

Bibliographic Reference	Sackley, Catherine M; Smith, Christina H; Rick, Caroline E; Brady, Marian C; Ives, Natalie; Patel, Smitaa; Woolley, Rebecca; Dowling, Francis; Patel, Ramilla; Roberts, Helen; Jowett, Sue; Wheatley, Keith; Kelly, Debbie; Sands, Gina; Clarke, Carl E; Lee Silverman Voice Treatment versus standard speech and language therapy versus control in Parkinson's disease: a pilot randomised controlled trial (PD COMM pilot).; Pilot and feasibility studies; 2018; vol. 4; 30

Study details

Country/ies where study was carried out	UK
Study type	Randomised controlled trial (RCT)
Study dates	May 2012 - March 2014
Inclusion criteria	- Idiopathic Parkinson's disease (PD) defined by the UK Parkinson’s Disease Society Brain Bank Criteria - Presence of patient or carer-reported problems with speech.
Exclusion criteria	- Dementia as defined clinically by the physician - Evidence of laryngeal pathology including vocal nodules - History of vocal strain, or previous laryngeal surgery as LSVT LOUD® is not appropriate for all of this group - Received speech and language therapy (SLT) for PD speech-related problems in the past 2 years; and the investigator thought that the patient did not definitely require SLT in the short term.

Patient characteristics	N=89 adults with Parkinson's disease - LSVT LOUD®: n=30 - Standard care with speech and language therapy (SLT): n=30 - Standard care without SLT: n=29 Age in years [Mean (SD)]: - LSVT LOUD®: 67 (8.4) - Standard care with SLT: 68 (10.3) - Standard care without SLT: 65 (7.5) Sex (M/F): - LSVT LOUD®: n=23/n=7 - Standard care with SLT: n=23/n=7 - Standard care without SLT: n=23/n=6 Time since PD diagnosis in years [Mean (SD)]: - LSVT LOUD®: 6.1 (3.7) - Standard care with SLT: 5.6 (4.2) - Standard care without SLT: 4.9 (3.4). Chronic neurological disorder category: Progressive neurological disease.

Intervention(s)/control	Intervention
	Name: Lee Silverman Voice Treatment (LSVT)
	Protocol intervention group: Interventions to sup
	Delivery setting: Community-based healthcare l
	Number/frequency of sessions: Four sessions p to complete 5–10 min of home practise on treat
	Duration: 4 weeks (16 sessions in total).
	Practitioners: State registered speech and langu es working within the NHS.
	LSVT LOUD® comprises maximum effort non-s tained ‘ah’ phonation at a single pitch and pitch down on production of sustained ‘ah’). These ex functional speech.
	Control
	Name: • Standard PD care with SLT - Treatments coul ioural strategies to reduce prosodic abnormali strategies and therapeutic devices to improve • Standard PD care without SLT - No interventi
	Protocol description: Control (standard care)
	Delivery setting: Community-based healthcare l
	Number and frequency of sessions: As per loca pected to typically involve one session of 45 mi
	Duration: 6–8 weeks of varying content as dete
	Practitioners: State registered speech and langu
	No intervention in first 6 months, unless deeme

Duration of follow-up	3 months
Sources of funding	Not industry funded
Sample size	N=89 adults with Parkinson's disease. - LSVT LOUD®: n=30 - Standard care with SLT: n=30 - Standard care without SLT: n=29
Other information	VHI-total; PDQ-39 communication; PDQ-39 tota

CI: confidence interval; EQ-5D: EuroQoL 5 dimensions; LSVT®: Lee Silverman voice treatment; MD: mean difference; N/n: number of participants; PDQ-39: Parkinson's disease questionnaire-39; RCT: randomised controlled trial; SLT: speech and language therapy; SD: standard deviation; VHI: voice handicap index

Outcomes

Study timepoints

- Baseline
- 3 months follow-up

LSVT LOUD® versus standard care with SLT or standard care without SLT: communication and voice

Communication as measured by LwD - polarity - lower values are better

Voice related quality of life as measured by VRQoL- polarity - higher values are better

Outcome	**LSVT LOUD® vs standard care with SLT, 3-months, N=25 vs 25 (LwD); N=21 vs 38 (VRQoL)**	**LSVT LOUD® vs standard care without SLT, 3-months, N=24 vs 25 (LwD); N=25 vs 28 (VRQoL)**

Outcome	LSVT LOUD® vs standard care with SLT, 3-months, N=25 vs 25 (LwD); N=21 vs 38 (VRQoL)	LSVT LOUD® vs standard care without SLT, 3-months, N=24 vs 25 (LwD); N=25 vs 28 (VRQoL)
LwD Mean difference between groups (95% CI) Adjusted for baseline values	0 (-8.07 to 8.07)	-6 (-13.98 to 1.98)
VRQoL Mean difference between groups (95% CI) Adjusted for baseline values	-1 (-4.38 to 2.38)	-3 (-6.25 to 0.25)

CI: confidence interval; LSVT®: Lee Silverman voice treatment; LwD: living with dysarthia; MD: mean difference; N/n: number of participants; SLT: speech and language therapy; VRQoL: voice related quality of life

Critical appraisal – Cochrane RoB 2

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(A computer-generated randomisation list was used. Secure central randomisation service was available from 9 am to 5 pm weekdays and ensured the concealment of treatment allocation. No statistical methods used to assess the differences between groups (no p values reported). Groups look sufficiently similar comparing baseline characteristics, however mean levodopa dose seems significantly larger in the LSVT arm than the SLT and control arms.)*

Section	Question	Answer
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(Although participants and personnel were aware of interventions allocated, there were no deviations from intended interventions. ITT analyses were used.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Some concerns *(0% and 7% of participants in the intervention and control groups, respectively were lost to follow-up at the final assessment time-point; all results were biased by missing data; loss to follow-up balanced between groups so missingness unlikely depended on true value.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(The questionnaires used were all validated and widely used tools: V-RQoL, LwD. Standardised and validated measurement tools implemented by researchers who may not have been blinded to allocation.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low *(Published protocol available.)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	Not applicable

CI: confidence interval; ITT: intention-to-treat; LSVT®: Lee Silverman voice treatment; LwD: living with dysarthia; SLT: speech and language therapy; VRQoL: voice related quality of life

Scobie, 2021

Bibliographic Reference	Scobie, Sarah; Jowett, Sue; Lambe, Tosin; Patel, Smitaa; Woolley, Rebecca; Ives, Natalie; Rick, Caroline; Smith, Christina; Brady, Marion C; Clarke, Carl; Sackley, Cath; Lee Silverman Voice Treatment versus standard speech and language therapy versus control in Parkinson's disease: preliminary cost-consequence analysis of the PD COMM pilot randomised controlled trial.; Pilot and feasibility studies; 2021; vol. 7 (no. 1); 154

Study details

Country/ies where study was carried out	See Sackley 2018
Study type	Randomised controlled trial (RCT) Follow-up study of Sackley 2018
Study dates	See Sackley 2018
Inclusion criteria	See Sackley 2018
Exclusion criteria	See Sackley 2018
Patient characteristics	See Sackley 2018
Intervention(s)/control	See Sackley 2018
Duration of follow-up	See Sackley 2018
Sources of funding	See Sackley 2018
Sample size	See Sackley 2018

RCT: randomised controlled trial

Outcomes

Study timepoints

- Baseline
- 3 months follow-up
- 6 months follow-up
- 12 months follow-up

LSVT LOUD® versus standard care with SLT or standard care without SLT: Voice and physical and mental health related quality of life and social care related quality of life

Voice related quality of life as measured by VHI-total score - polarity - lower values are better

Physical and mental health related quality of life and social care related quality of life as measured by PDQ-39 - polarity - lower values are better

Physical and mental health related quality of life and social care related quality of life as measured by EQ-5D QoL - polarity - higher values are better

Physical and mental health related quality of life and social care related quality of life as measured by ICECAP-O - polarity - higher values are better

Outcome	LSVT LOUD® vs standard care with SLT, 3-months, N= 22 vs 22	LSVT LOUD® vs standard care with SLT, 6-months, N= 26 vs 21	LSVT LOUD® vs standard care with SLT, 12-months, N=23 vs 25	LSVT LOUD® vs standard care without SLT, 3-months, N=25 vs 28	LSVT LOUD® vs standard care without SLT, 6-months, N=26 vs 28	LSVT LOUD® vs standard care without SLT, 12-months, N=23 vs 28
VHI-total Mean difference between groups (95% CI)	-2.0 (-10.9 to 7)	-8.4 (-17.4 to 0.6)	-6.7 (-17.1 to 3.7)	-8.3 (-17.6 to 0.9)	-12.1 (-20.8 to -3.5)	6.3 (-15.6 to 3.1)

Outcome	LSVT LOUD® vs standard care with SLT, 3-months, N= 22 vs 22	LSVT LOUD® vs standard care with SLT, 6-months, N= 26 vs 21	LSVT LOUD® vs standard care with SLT, 12-months, N=23 vs 25	LSVT LOUD® vs standard care without SLT, 3-months, N=25 vs 28	LSVT LOUD® vs standard care without SLT, 6-months, N=26 vs 28	LSVT LOUD® vs standard care without SLT, 12-months, N=23 vs 28
Adjusted for baseline values						
PDQ-39 Mean difference between groups (95% CI) Adjusted for baseline values	-1.4 (-6.7 to 4)	-3.9 (-10.1 to 2.2)	-1.1 (-7.0 to 5.3)	-5.2 (-10.4 to 0.1)	-4.4 (-9.4 to 0.7)	2.3 (-4.2 to 8.8)
EQ-5D QoL Mean difference between groups (95% CI) Adjusted for baseline values	-0.07 (-0.16 to 0.03)	-0.05 (-0.17 to 0.08)	0.01 (-0.17 to 0.14)	0.09 (-0.04 to 0.21)	0.00 (-0.12 to 0.12)	0.002 (-0.14 to 0.17)
ICECAP-O Mean difference between groups (95% CI) Adjusted for	0.01 (-0.06 to 0.08)	0.05 (-0.05 to 0.16)	0.06 (-0.04 to 0.15)	-0.01 (-0.09 to 0.07)	0.02 (-0.07 to 0.11)	-0.01 (-0.09 to 0.07)

Outcome	LSVT LOUD® vs standard care with SLT, 3-months, N= 22 vs 22	LSVT LOUD® vs standard care with SLT, 6-months, N= 26 vs 21	LSVT LOUD® vs standard care with SLT, 12-months, N=23 vs 25	LSVT LOUD® vs standard care without SLT, 3-months, N=25 vs 28	LSVT LOUD® vs standard care without SLT, 6-months, N=26 vs 28	LSVT LOUD® vs standard care without SLT, 12-months, N=23 vs 28
baseline values						

CI: confidence interval; EQ-5D: EuroQoL 5 dimensions; ICECAP-O: ICEpop CAPability measure for older people; LSVT®: Lee Silverman voice treatment; N/n: number of participants; PDQ-39: Parkinson's disease questionnaire-39; SLT: speech and language therapy; VHI: voice handicap index

Critical Appraisal – Cochrane RoB 2

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(See Sackley 2018)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(See Sackley 2018)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Some concerns *(0% and 10% of participants in the intervention and control groups, respectively were lost to follow-up at the final assessment time-point; all results were biased by missing data; loss to follow-up balanced between groups so missingness unlikely depended on true value.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(The questionnaires used were all validated and widely used tools: VHI, PDQ39-summary, EQ-5D, ICECAP-O Standardised and validated measurement tools implemented by researchers who may not have been blinded to allocation.)*

Section	Question	Answer
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low *(See Sackley 2018)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	Not applicable.

EQ-5D: euroqoL-5 dimensions; ICECAP-O: ICEpop CAPability measure for older people; LSVT®: Lee Silverman voice treatment; PDQ-39: Parkinson's disease questionnaire-39; SLT: speech and language therapy; VHI: voice handicap index

Theodoros, 2016

Bibliographic Reference	Theodoros, Deborah G; Hill, Anne J; Russell, Trevor G; Clinical and Quality of Life Outcomes of Speech Treatment for Parkinson's Disease Delivered to the Home Via Telerehabilitation: A Noninferiority Randomized Controlled Trial.; American journal of speech-language pathology; 2016; vol. 25 (no. 2); 214-32

Study details

Country/ies where study was carried out	Australia
Study type	Randomised controlled trial (RCT)
Study dates	Not reported

Inclusion criteria	- Aged 18 to 89 years, - Diagnosis of Parkinson's Disease (PD) from a neurologist, - PD severity rating between Stage 1 and Stage 5 on the modified Hoehn and Yahr Scale, - Speak English, - Cognitive status that was adequate for participation in assessment and treatment tasks, - Each participant was required to demonstrate features of hypokinetic dysarthria associated with PD and to be stimulable for loud speech during sustained phonation and the repetition of words and short phrases.
Exclusion criteria	- Additional coexisting neurological disorder, - Speech and/or language disturbance unrelated to Parkinson’s disease (PD), - Abnormal vocal fold structure and function inconsistent with PD as determined by an otolaryngologist, - Respiratory dysfunction inconsistent with PD, - Positive history of alcohol abuse and/or dementia, - Inadequately aided vision or hearing for videoconferencing, - Previously participated in a Lee Silverman Voice Treatment (LSVT) LOUD® program.

Patient characteristics	N= 52 adults with Parkinson's disease (n=31 randomised and included in evidence review) n evidence review) LSVT LOUD® online: n=16 LSVT LOUD® face to face: n=15 Age in years [Mean (SD)]: Whole population (per group data not reported): 71.02 (8.80) Sex (M/F): Whole population (per group data not reported): n=36/n=16 Time since diagnosis of PD in years [Mean (SD)]: Whole population (per group data not reported): 4.8 (4.09) Chronic neurological disease category: Progressive neurological diseases.

Intervention(s)/control	**Intervention** Name: Lee Silverman Voice Treatment (LSVT) LOUD® Online Protocol intervention group: Interventions to support and improve voice Delivery setting: Online using eHAB telerehabilitation system with real-time videoconferencing Number/ frequency of sessions: Total of 16. 1 hour per day, 4 days per week Duration: 1 month Practitioner(s): Speech and language practitioner LSVT LOUD® comprises maximum effort non-speech and speech drills. The non-speech drills include production of sustained 'ah' phonation at a single pitch and pitch glides (moving from modal pitch to high pitch and modal pitch and going down on production of sustained 'ah'). These exercises are for improving vocal effort and loudness for translation into functional speech. **Control** Name: Lee Silverman Voice Treatment (LSVT) LOUD® face to face Protocol intervention group: Interventions to support and improve voice Delivery setting: Face to face at clinic room in research institution Number/ frequency of sessions: Total of 16. 1 hour per day, 4 days per week Duration: 1 month Practitioner(s): Speech and language practitioner LSVT LOUD® comprises maximum effort non-speech and speech drills. The non-speech drills include production of sustained 'ah' phonation at a single pitch and pitch glides (moving from modal pitch to high pitch and modal pitch and going down on production of sustained 'ah'). These exercises are for improving vocal effort and loudness for translation into functional speech.
Duration of follow-up	Short-term post-treatment assessment - timepoint not reported

Sources of funding	Not industry funded
Sample size	N=52 adults with Parkinson's disease (n=31 randomised and included in evidence review). - LSVT LOUD® online: n=16 - LSVT LOUD® face to face: n=15
Other information	N=52 people with PD were in the study, of these n=21 were from nonmetropolitan locations and were recruited to Group 3 (Nonmetro Online) and completed the assessment and treatment protocol. The remaining n=31 participants were randomized to either Group 1 (Metro FTF) or Group 2 (Metro Online). Only the randomised participants were included in the review.

FTF: face to face; LSVT: Lee Silverman voice treatment; N/n: number of participants; PD: Parkinson's disease; RCT: randomised controlled trial; SD: standard deviation

Outcomes

Study timepoints

- Baseline
- Post-intervention (timepoint not specified)

LSVT LOUD® online versus LSVT LOUD® face to face: Voice, Physical and mental health related quality of life and social care related quality of life and Mood

Voice as measured by acoustic measures – sustained phonation, reading, monologue, maximum F0 range - polarity - higher values are better

Voice as measured by direct magnitude estimation - speech intelligibility, pitch variability, loudness, articulation precision - polarity - higher values are better; vocal roughness – polarity - lower values are better

Physical and mental health related quality of life and social care related quality of life as measured by PDQ-39 - polarity - lower values are better

Mood as measured by DIP - polarity - higher values are better

Outcome	LSVT LOUD® online, post-intervention, N = 16	LSVT LOUD® face to face, post-intervention, N = 15

Outcome	LSVT LOUD® online, post-intervention, N = 16	LSVT LOUD® face to face, post-intervention, N = 15
Acoustic measure: sustained phonation (db) Change in score from baseline Mean (SD)	8.8 (2.83)	10.5 (3.58)
Acoustic measure: reading (db) Change in score from baseline Mean (SD)	7.5 (3)	9.6 (3.67)
Acoustic measure: monologue (db) Change in score from baseline Mean (SD)	6.2 (3.43)	7.5 (3.74)
Acoustic measure: Maximum F0 range (Hz) Change in score from baseline Mean (SD)	2.7 (41.6)	40.5 (55.3)
DME: Speech intelligibility Change in score from baseline Mean (SD)	5.4 (21.7)	19.8 (21.3)
DME: Pitch variability Change in score from baseline Mean (SD)	3.1 (21.7)	7.4 (18.74)

Outcome	LSVT LOUD® online, post-intervention, N = 16	LSVT LOUD® face to face, post-intervention, N = 15
DME: Loudness Change in score from baseline Mean (SD)	42.9 (21.99)	38.2 (24.35)
DME: vocal roughness Change in score from baseline Mean (SD)	-5.1 (26.17)	-2.7 (28.23)
DME: Articulation precision Change in score from baseline Mean (SD)	8.4 (22.46)	9.1 (12.21)
PDQ-39 Summary Change in score from baseline Mean (SD)	-1.3 (9)	-2 (9.78)
DIP: overall score Change in score from baseline Mean (SD)	9.4 (16.68)	12.9 (15.02)

dB: decibels; CI: confidence interval; DIP: dysarthia impact profile; DME: direct magnitude estimation; Hz: hertz; LSVT®: Lee Silverman voice treatment; MD: mean difference; N/n: number of participants; PDQ-39: Parkinson's disease questionnaire-39; SD: standard deviation

Critical appraisal – Cochrane RoB 2

Section	Question	Answer

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information about randomisation process or allocation concealment was provided, however baseline characteristics were balanced.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(Participants blinded to interventions, however no details on how participants were unaware of group assignment. Therapists delivering the interventions aware of intervention assigned. ITT analyses were used.*)
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Some concerns *(0% and 5% of participants in the intervention and control groups, respectively were lost to follow-up at the final assessment time-point; all results were biased by missing data; loss to follow-up balanced between groups so missingness unlikely depended on true value.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(The questionnaires used were all validated and widely used tools: acoustic measures, DME, DIP, PDQ-39. Standardised and validated measurement tools implemented by researchers who may not have been blinded to allocation.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(No details if a protocol was published prior to conducting study.)*
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	Not applicable

DIP: dysarthia impact profile; DME: direct magnitude estimation; ITT: intention-to-treat; PDQ-39: Parkinson's disease questionnaire-39

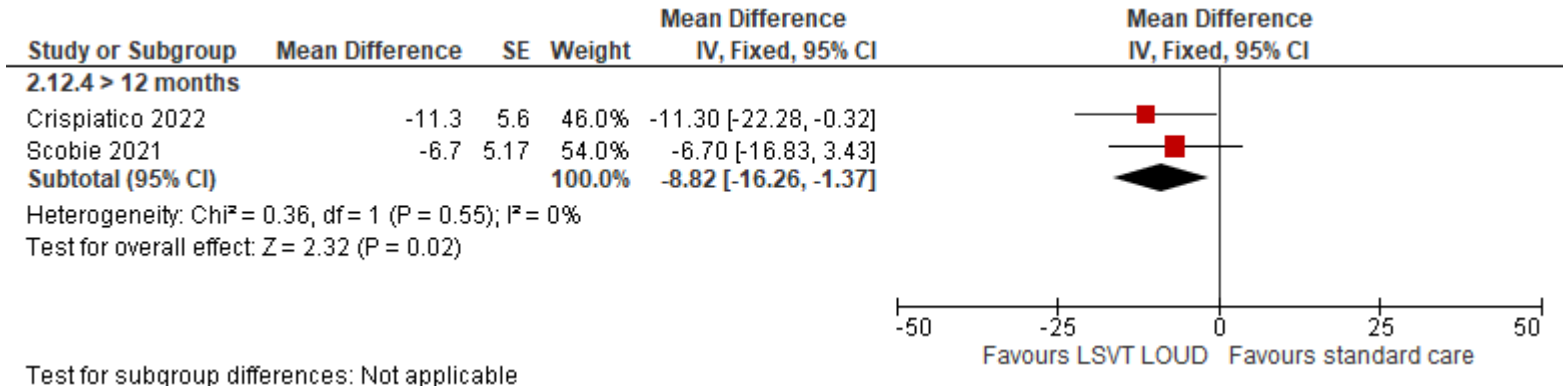
Appendix E Forest plots

Forest plots for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

This section includes forest plots only for outcomes that are meta-analysed. Outcomes from single studies are not presented here; the quality assessment for such outcomes is provided in the GRADE profiles in appendix F.

Lee Silverman Voice Treatment (LSVT) LOUD® versus standard care with speech and language therapy (SLT) in adults with progressive neurological disease

Figure 2: Voice related quality of life as measured by a validated scale at >12-months follow-up



Mean: mean difference between baseline and end-point
CI: confidence interval; IV: inverse variance; LSVT: Lee Silverman Voice treatment

Appendix F GRADE tables

GRADE tables for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Table 6: Evidence profile for comparison between repetitive transcranial magnetic stimulation (rTMS) and sham rTMS care in adults with Parkinson's disease

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Real rTMS	Sham rTMS	Relative (95% CI)	Absolute		
Speech as measured by 3FT Phonetics subtest scores at 10-weeks from baseline (Better indicated by higher values)												
1 (Brabenec 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	20	13	-	Estimated marginal MD 12.5 higher p-value 0.031[3]	VERY LOW	CRITICAL

3FT: 3F test–dysarthric profile; CI: confidence interval; MD: mean difference; rTMS: repetitive transcranial magnetic stimulation
1 Serious risk of bias in the evidence contributing to the outcomes as per Cochrane ROB2
2 Very serious imprecision due to sample size <200
3 Differences between groups judged to be statistically significant according to author analysis, favouring adjustment and engagement group. Clinical significance could not be determined.

Table 7: Evidence profile for comparison between active music therapy and standard care in adults with amyotrophic lateral sclerosis (ALS) or primary lateral sclerosis

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Active Music Therapy	Standard care	Relative (95% CI)	Absolute		
Physical and mental health related quality of life as measured by MQoL-it at 1 month (Better indicated by higher values)												
1 (Raglio 2016)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	15	15	-	MD 0.58 lower (1.25 lower to 0.09 higher)	LOW	IMPORTANT
Physical and mental health related quality of life as measured by MQoL-it at 3 months (Better indicated by higher values)												
1 (Raglio 2016)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	15	15	-	MD 0.28 higher (0.35 lower to 0.91 higher)	LOW	IMPORTANT
Mood as measured by HADS-Anxiety at 1 month (Better indicated by lower values)												
1 (Raglio 2016)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	15	15	-	MD 2.66 higher (0.81 to 4.51 higher)	LOW	IMPORTANT
Mood as measured by HADS-Anxiety at 3 months (Better indicated by lower values)												

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Active Music Therapy	Standard care	Relative (95% CI)	Absolute		
1 (Raglio 2016)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	15	15	-	MD 0.17 higher (2.46 lower to 2.8 higher)	VERY LOW	IMPORTANT
Mood as measured by HADS-Depression at 1 month (Better indicated by lower values)												
1 (Raglio 2016)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	15	15	-	MD 2.28 higher (0.91 to 3.65 higher)	LOW	IMPORTANT
Mood as measured by HADS-Depression at 3 months (Better indicated by lower values)												
1 (Raglio 2016)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	15	15	-	MD 0.97 lower (2.53 lower to 0.59 higher)	LOW	IMPORTANT

CI: confidence interval; HADS-A: hospital anxiety and depression scale-anxiety; HADS-D: hospital anxiety and depression scale-depression; MD: mean difference; MQoL-it: McGill quality of life questionnaire-Italian
1 Serious risk of bias in the evidence contributing to the outcomes as per Cochrane ROB2
2 95% CI crosses 1 MID (0.5x control group SD for: HADS-A 1 month = 1.5; HADS-D 1 month = 1.08; HADS-D 3 months = 1; MQoL-it 1 month and 3 months = 0.5)
3 95% CI crosses 2 MIDs (0.5x control group SD for: HADS-A 3 months = 2.34)

Table 8: Evidence profile for comparison between Lee Silverman Voice Treatment (LSVT) LOUD® versus standard care with speech and language therapy (SLT) in adults with progressive neurological disease

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	standard care with SLT	Relative (95% CI)	Absolute		
Communication - Self-perceived communication difficulties as measured by LwD-summary at 3 months (Better indicated by lower values)												
1 (Sackley 2018)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	25	24	-	MD 0 (8.07 lower to 8.07 higher)	MODERATE	CRITICAL
Voice - Monologue intensity as measured by decibel sound pressure level at post-intervention (Better indicated by higher values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23	21	-	MD 6.3 higher (2.5 to 10 higher)	VERY LOW	CRITICAL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	standard care with SLT	Relative (95% CI)	Absolute		
Voice - Monologue intensity as measured by decibel sound pressure level after 12 months (Better indicated by higher values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23	21	-	MD 1.7 higher (2.5 lower to 5.8 higher)	VERY LOW	CRITICAL
Voice - Sustained /a/ intensity as measured by decibel sound pressure level at post-intervention (Better indicated by higher values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 7.4 higher (2.3 to 12.5 higher)	LOW	CRITICAL
Voice - Sustained /a/ intensity as measured by decibel sound pressure level after 12 months (Better indicated by higher values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 5.2 higher (3.1 lower to 13.5 higher)	LOW	CRITICAL
Voice - Intensity of functional sentences at post-intervention (Better indicated by higher values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23	21	-	MD 9.5 higher (4.7 to 14.3 higher)	VERY LOW	CRITICAL
Voice - Intensity of functional sentences after 12 months (Better indicated by higher values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 4.4 higher (0.7 lower to 9.5 higher)	LOW	CRITICAL
Voice - Maximum phonation time as measured in seconds at post-intervention (Better indicated by higher values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23	21	-	MD 0.3 lower (3.1 lower to 2.6 higher)	VERY LOW	CRITICAL
Voice - Maximum phonation time as measured in seconds after 12 months (Better indicated by higher values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23	21	-	MD 1.8 higher (2.3 lower to 5.8 higher)	VERY LOW	CRITICAL
Voice - grade as measured by GIRBAS_GRADE at post-intervention (Better indicated by lower values)												

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	standard care with SLT	Relative (95% CI)	Absolute		
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.5 lower (0.9 to 0.1 lower)	LOW	CRITICAL
Voice - grade as measured by GIRBAS_GRADE after 12 months (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.6 lower (1 lower to 0 higher)	LOW	CRITICAL
Voice - instability as measured by GIRBAS_Instability at post-intervention (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.7 lower (1.1 to 0.2 lower)	LOW	CRITICAL
Voice - instability as measured by GIRBAS_Instability after 12 months (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.2 lower (0.8 lower to 0.3 higher)	LOW	CRITICAL
Voice - roughness as measured by GIRBAS_roughness at post-intervention (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	23	21	-	MD 0.1 lower (0.1 lower to 0.1 higher)	MODERATE	CRITICAL
Voice - roughness as measured by GIRBAS_roughness after 12 months (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	23	21	-	MD 0.5 lower (0.6 lower to 0.5 higher)	MODERATE	CRITICAL
Voice - breathiness as measured by GIRBAS_breathiness at post-intervention (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.4 lower (0.8 lower to 0 higher)	LOW	CRITICAL
Voice - breathiness as measured by GIRBAS_breathiness after 12 months (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.4 lower (0.9 lower to 0 higher)	LOW	CRITICAL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	standard care with SLT	Relative (95% CI)	Absolute		
Voice - asthenia as measured by GIRBAS_asthenia at post-intervention (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.7 higher (1.2 to 0.2 lower)	LOW	CRITICAL
Voice - asthenia as measured by GIRBAS_asthenia after 12 months (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.3 lower (0.9 lower to 0.3 higher)	LOW	CRITICAL
Voice - strain as measured by GIRBAS_strain at post-intervention (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 0.2 lower (0.5 lower to 0.1 higher)	LOW	CRITICAL
Voice - strain as measured by GIRBAS_strain after 12 months (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23	21	-	MD 0 higher (0.3 lower to 0.4 higher)	VERY LOW	CRITICAL
Voice related quality of life as measured by VRQoL-summary at 3 months (Better indicated by higher values)												
1 (Sackley 2018)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	21	24	-	MD 1 lower (4.38 lower to 2.38 higher)	LOW	CRITICAL
Voice related quality of life as measured by VHI-summary at post-intervention (Better indicated by lower values)												
1 (Crispiatico 2022)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	23	21	-	MD 10.8 lower (21.2 to 0.4 lower)	LOW	CRITICAL
Voice related quality of life as measured by VHI-summary at 3 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	22	22	-	MD 2 lower (10.9 lower to 7 higher)	LOW	CRITICAL
Voice related quality of life as measured by VHI-summary at 6 months (Better indicated by lower values)												

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	standard care with SLT	Relative (95% CI)	Absolute		
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	26	21	-	MD 8.4 lower (17.4 lower to 0.6 higher)	LOW	CRITICAL
Voice related quality of life as measured by VHI-summary after 12 months (Better indicated by lower values)												
2*	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	46	46	-	MD 8.82 lower (16.26 to 1.37 lower)	LOW	CRITICAL
Physical and mental health related quality of life for people affected by Parkinson's disease as measured by PDQ39-summary at 3 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	22	22	-	MD 1.4 lower (6.7 lower to 4 higher)	MODERATE	IMPORTANT
Physical and mental health related quality of life for people affected by Parkinson's disease as measured by PDQ39-summary at 6 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	26	21	-	MD 3.9 lower (10.1 lower to 2.2 higher)	LOW	IMPORTANT
Physical and mental health related quality of life for people affected by Parkinson's disease as measured by PDQ39-summary at 12 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	23	25	-	MD 1.1 lower (7 lower to 5.3 higher)	MODERATE	IMPORTANT
Physical and mental health related quality of life as measured by EQ-5D-summary at 3 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	22	22	-	MD 0.07 higher (0.03 lower to 0.16 higher)	LOW	IMPORTANT
Physical and mental health related quality of life as measured by EQ-5D-summary at 6 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	26	21	-	MD 0.05 lower (0.17 lower to 0.08 higher)	LOW	CRITICAL
Physical and mental health related quality of life as measured by EQ-5D-summary at 12 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23	25	-	MD 0.01 lower (0.17 lower to 0.14 higher)	VERY LOW	IMPORTANT

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	standard care with SLT	Relative (95% CI)	Absolute		
Social care related quality of life as measured by ICECAP-O at 3 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	22	22	-	MD 0.01 higher (0.06 lower to 0.8 higher)	MODERATE	IMPORTANT
Social care related quality of life as measured by ICECAP-O at 6 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	26	21	-	MD 0.05 higher (0.05 lower to 0.16 higher)	MODERATE	IMPORTANT
Social care related quality of life as measured by ICECAP-O at 12 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	23	25	-	MD 0.06 higher (0.04 lower to 0.15 higher)	MODERATE	IMPORTANT

CI: confidence interval; db: decibels; EQ-5D: euroQoL 5 dimensions; GIRBAS: grade, instability, roughness, breathiness, asthenia, and Sstrain; ICECAP-O: ICEpop CAPability measure for older people; LSVT®: Lee Silverman voice treatment; LwD: living with dysarthia; MD: mean difference; PDQ-39: Parkinson's disease questionnaire-39; SLT: speech and language therapy; SPL: sound pressure level; VHI: voice handicap index; VRQoL: voice related quality of life

[*] See corresponding forest plot

1 Serious risk of bias in the evidence contributing to the outcomes as per Cochrane RoB2

2 95% CI crosses 2 MIDs (0.5x control group SD for: monologue intensity = +/-2.45; intensity of functional sentences = +/-2.3; maximum phonation time = +/-1.95; GIRBAS_ strain = +/-0.25; EQ-5D - summary = +/-0.09)

[3] 95% CI crosses 1 MID (0.5x control group SD for: sustained / a / intensity = +/-3.9; intensity of functional sentences = +/-2.3; GIRBAS_GRADE =+/- 0.3; GIRBAS_instability = +/-0.45; GIRBAS_breathiness = +/-0.35 ; GIRBAS_asthenia = +/-0.35; GIRBAS_strain = +/-0.25; VRQoL- summary = +/-3.55; VHI – summary 3 months and 6 months = +/-10.5; VHI – summary post intervention = +/-10.15; VHI – summary > 12 months = +/-10.35; PDQ39 - summary = +/-7.5; EQ-5D - summary = +/-0.09)

Table 9: Evidence profile for comparison between Lee Silverman Voice Treatment (LVST) LOUD® versus standard care without speech and language therapy in adults with Parkinson's disease

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	Standard care without SLT	Relative (95% CI)	Absolute		
Communication - Self-perceived communication difficulties as measured by LwD-summary at 3 months (Better indicated by lower values)												

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	Standard care without SLT	Relative (95% CI)	Absolute		
1 (Sackley 2018)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	25	25	-	MD 6 lower (13.98 lower to 1.98 higher)	LOW	CRITICAL
Voice – voice related quality of life as measured by VRQoL-summary at 3 months (Better indicated by higher values)												
1 (Sackley 2018)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	21	28	-	MD 3 lower (6.25 lower to 0.25 higher)	LOW	CRITICAL
Voice – voice related quality of life as measured by VHI-summary at 3 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	22	28	-	MD 8.3 lower (17.6 lower to 0.9 higher)	LOW	CRITICAL
Voice - voice related quality of life as measured by VHI-summary at 6 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	26	28	-	MD 12.1 lower (20.8 to 3.5 lower)	LOW	CRITICAL
Voice – voice related quality of life as measured by VHI-summary at 12 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	23	28	-	MD 6.3 lower (15.6 lower to 3.1 higher)	LOW	CRITICAL
Physical and mental health related quality of life for people affected by Parkinson's disease as measured by PDQ39-summary at 3 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	22	28	-	MD 5.2 lower (10.4 lower to 0.1 higher)	LOW	IMPORTANT
Physical and mental health related quality of life for people affected by Parkinson's disease as measured by PDQ39-summary at 6 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	26	28	-	MD 4.4 lower (9.4 lower to 0.7 higher)	LOW	IMPORTANT
Physical and mental health related quality of life for people affected by Parkinson's disease as measured by PDQ39-summary at 12 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	23	28	-	MD 2.3 higher (4.2 lower to 8.8 higher)	LOW	IMPORTANT

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD®	Standard care without SLT	Relative (95% CI)	Absolute		
Physical and mental health related quality of life as measured by EQ-5D-summary at 3 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	22	28	-	MD 0.09 higher (0.04 lower to 0.21 higher)	LOW	IMPORTANT
Physical and mental health related quality of life as measured by EQ-5D-summary at 6 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	26	28	-	MD 0 (0.12 lower to 0.12 higher)	VERY LOW	IMPORTANT
Physical and mental health related quality of life as measured by EQ-5D-summary at 12 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	23	28	-	MD 0.002 higher (0.14 lower to 0.17 higher)	VERY LOW	IMPORTANT
Social care related quality of life as measured by ICECAP-O at 3 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	22	28	-	MD 0.01 lower (0.09 lower to 0.07 higher)	MODERATE	IMPORTANT
Social care related quality of life as measured by ICECAP-O at 6 months (Better indicated by higher values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	26	28	-	MD 0.02 lower (0.09 lower to 0.11 higher)	MODERATE	IMPORTANT
Social care related quality of life as measured by ICECAP-O at 12 months (Better indicated by lower values)												
1 (Scobie 2021)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	23	28	-	MD 0.01 lower (0.09 lower to 0.07 higher)	MODERATE	IMPORTANT

CI: confidence interval; EQ-5D: EuroQoL 5 Dimensions; ICECAP-O: ICEpop CAPability measure for older people; LSVT®: Lee Silverman voice treatment; LwD: living with dysarthia; MD: mean difference; PDQ-39: Parkinson's disease questionnaire-39; SLT: speech and language therapy; VHI: voice handicap index; VRQoL: voice related quality of life
1 Serious risk of bias in the evidence contributing to the outcomes as per ROB2
2 95% CI crosses 1 MID (0.5x control group SD for: VRQoL- summary = +/-3.55; LwD-summary = +/-10.35; VHI-summary = +/-10.5; PDQ39-summary = +/-7.5; EQ-5D-summary = +/-0.09)
3 95% CI crosses 2 MIDs (0.5x control group SD for: EQ-5D-summary = +/-0.09)

Table 10: Evidence profile for comparison between Lee Silverman Voice Treatment (LVST) LOUD® online versus LVST LOUD® face to face in adults with Parkinson's disease

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD® Online	LSVT LOUD® face to face	Relative (95% CI)	Absolute		
Voice - Acoustic measure: sustained phonation as measured by decibel sound pressure level (db) at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	15	-	MD 1.7 lower (3.98 lower to 0.58 higher)	VERY LOW	CRITICAL
Voice - Acoustic measure: reading (db) at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	15	-	MD 2.1 lower (4.47 lower to 0.27 higher)	VERY LOW	CRITICAL
Voice - Acoustic measure: monologue as measured by decibel sound pressure level at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	15	-	MD 1.3 lower (3.83 lower to 1.23 higher)	VERY LOW	CRITICAL
Voice - signal as measured by fundamental frequency (Hz) at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	15	-	MD 37.80 lower (72.42 to 3.18 lower)	VERY LOW	CRITICAL
Voice - speech intelligibility as measured by the DME at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	15	-	MD 14.40 lower (29.54 lower to 0.74 higher)	VERY LOW	CRITICAL
Voice - pitch variability as measured by the DME at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	15	-	MD 4.30 lower (18.55 lower to 9.95 higher)	VERY LOW	CRITICAL
Voice – loudness as measured by the DME at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	15	-	MD 4.70 lower (11.67 lower to 21.07 higher)	VERY LOW	CRITICAL
Voice - DME: vocal roughness at post-intervention (Better indicated by lower values)												

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	LSVT LOUD® Online	LSVT LOUD® face to face	Relative (95% CI)	Absolute		
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	15	-	MD 2.40 lower (21.6 lower to 16.8 higher)	VERY LOW	CRITICAL
Voice - DME: articulation precision at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	16	15	-	MD 0.7 lower (13.32 lower to 11.92 higher)	VERY LOW	CRITICAL
Physical and mental health related quality of life for people affected by Parkinson's disease as measured by PDQ-39 Summary at post-intervention (Better indicated by lower values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	16	15	-	MD 0.7 higher (5.93 lower to 7.33 higher)	VERY LOW	IMPORTANT
Mood - Self-perceived psychological impact for people affected by Parkinson's disease as measured by DIP: overall score at post-intervention (Better indicated by higher values)												
1 (Theodoros 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	16	15	-	MD 3.50 lower (14.66 lower to 7.66 higher)	VERY LOW	CRITICAL

dB: decibels; CI: confidence interval; DIP: dysarthia impact profile; DME: direct magnitude estimation; Hz: hertz; LSVT®: Lee Silverman voice treatment; MD: mean difference; PDQ-39: Parkinson's disease questionnaire-39

1 Very serious risk of bias in the evidence contributing to the outcomes as per ROB2

2 95% CI crosses 1 MID (0.5 x control group SD for: acoustic measure: sustained phonation = +/-1.79; acoustic measure: reading = +/-1.84; acoustic measure: monologue = +/-1.87; acoustic measure: maximum f0 range = +/-27.65; DME: speech intelligibility = +/-10.65; DME: pitch variability = +/-9.37; DME: loudness = +/-12.18; DME: vocal roughness = +/-14.17)

3 95% CI crosses 2 MIDs (0.5 x control group SD for: DME: articulation precision = +/-6.1: DIP: overall score = +/-7.5: PDQ39-summary = +/-4.89)

Appendix G Economic evidence study selection

Study selection for: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Please see Supplement 2 for details on search that was undertaken and study selection.

Appendix H Economic evidence tables

Economic evidence tables for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Table 11: Economic evidence table for Lee Silverman Voice Treatment (LSVT®) LOUD in people with idiopathic Parkinson's disease

Study country and type	Intervention and comparator	Study population, design and data sources	Costs and outcomes (descriptions and values)	Results	Comments

Study country and type	Intervention and comparator	Study population, design and data sources	Costs and outcomes (descriptions and values)	Results	Comments
			Scobie 2021 UK Cost-utility analysis Source of funding: The Dunhill Medical Trust. Grant: R192/0511.	Intervention Lee Silverman Voice Treatment (LSVT®) LOUD: - 4 sessions per week for 4 weeks (16 sessions in total) - delivered by registered speech and language therapists with certification in LSVT and appropriate refresher courses working within the NHS - each session lasted 50–60 min - 5–10 min of home practice on treatment days and up to 30 min of home practice on non-treatment days Comparators: NHS speech and language therapy (NHS SLT) - delivered by speech and language therapists - typically involves one session of 45 min per week for 6–8 weeks of varying content - treatments could include exercises targeting respiration, phonation, articulation, behavioural strategies to reduce prosodic abnormality, the use of augmentative and alternative communication strategies and therapeutic devices to improve functional communication	People with idiopathic Parkinson's disease (PD) and self-reported problems with voice or speech who had not received SLT for PD speech-related problems Economic evaluation alongside an RCT (Sackley 2018) Source of baseline data: RCT, LSVT LOUD (n=30), NHS SLT (n=30), control (n=29) Source of effectiveness data: RCT, LSVT LOUD (n=27), NHS SLT (n=27), control (n=29) Source of resource use data: RCT, LSVT LOUD (n=24), NHS SLT (n=24), control (n=28) Source of unit cost data: national (PSSRU) supplemented with published sources

CI: confidence interval; EQ-5D-3L: EuroQoL 5 dimensions-3 levels; GP: general practitioner; ICERs: incremental cost-effectiveness ratios; LSVT: Lee Silverman voice treatment; NHS SLT: National Health Service speech and language therapy; NS: not statistically significant; PD: Parkinson's disease; PDQ-39: Parkinson's disease questionnaire-39; PSS: personal social services; PSSRU: personal social services research Unit; QALYs: quality-adjusted life years; RCT: randomised controlled trial; VHI: voice handicap index

Appendix I Economic model

Economic model for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

No economic analysis was conducted for this review question.

Appendix J Excluded studies

Excluded studies for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

Excluded effectiveness studies

Table 12: Excluded studies and reasons for their exclusion

Study	Reason for exclusion
(2012) Lee Silverman voice treatment for speech and voice problems in Parkinson's disease.	- Publication type Report.
Abbas-Kayano, R.T. and Chadi, G. (2019) Augmentative and alternative communication in amyotrophic lateral sclerosis. A systematic review. Amyotrophic Lateral Sclerosis and Frontotemporal Degeneration 20(supplement1): 308	- Publication type Conference abstract.
Abisheva, Y., Rusetsky, Y., Daniyarova, A. et al. (2022) APPLICATION OF IT TECHNOLOGY IN THE MANAGEMENT OF VOICE-SPEECH DISORDERS AND PHONIATRIC REHABILITATION. Archives of the Balkan Medical Union 57(1): 71-83	- Country Systematic review with 4/37 studies conducted in Australia, 1/37 in Canada, 3/37 in UK, 2/37 in Italy, 2/37 in Spain, 1/37 in Switzerland, 18/37 in US, 1/37 in US/South Africa, 1/37 in Brazil, 1/37 in China, 1/37 in Pakistan, 1/37 in Turkey, 1/37 in South Korea, Australian, Canadian, UK, Italian, Spanish and Swiss studies were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Agrela, Nicole; Santos, Maria Emilia; Guerreiro, Sandra (2021) Communication skills training pilot programme after traumatic brain injury: short and medium-term benefits. Brain injury 35(3): 304-314	- Outcomes No relevant outcomes reported. Paralinguistic comprehension and extralinguistic comprehension.
Alashram, Anas R, Annino, Giuseppe, Padua, Elvira et al. (2019) Cognitive rehabilitation post traumatic brain injury: A systematic review for emerging use of virtual reality technology. Journal of clinical neuroscience : official journal of the Neurosurgical Society of Australasia 66: 209-219	- Study design (adults) Systematic review (adult population) with 4/9 randomised controlled trials, 5/9 non-randomised studies. Randomised controlled trials which were published 2013 or later, were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Aldridge, Danielle, Theodoros, Deborah, Angwin, Anthony et al. (2016) Speech outcomes in Parkinson's disease after subthalamic nucleus deep brain stimulation: A systematic review. Parkinsonism & related disorders 33: 3-11	- Study design (adults) Systematic review (adult population) with no included RCTs. Therefore no studies were checked against protocol.
Alfieri, P., Scibelli, F., Casula, L. et al. (2022) Cooperative parent-mediated therapy in children with fragile x syndrome and Williams Beuren syndrome: A pilot rct study of a transdiagnostic intervention-preliminary data. Brain Sciences 12(1): 8	- Population Neurodevelopmental conditions. Not relevant according to protocol population criteria.

Study	Reason for exclusion
Amatya, B; Khan, F; Galea, M (2019) Rehabilitation for people with multiple sclerosis: an overview of Cochrane Reviews. Cochrane Database of Systematic Reviews	- Intervention Systematic review with included studies of systematic reviews checked against protocol criteria. Included studies of systematic reviews investigated interventions involving physical activity and exercise, hyperbaric oxygen therapy, whole-body vibration, occupational therapy as well as cognitive and psychological interventions, nutritional and dietary supplements, vocational rehabilitation, information provision, telerehabilitation, and interventions to manage spasticity rather than interventions that were not designed to improve or support speech/ language/ communication.
Arian Darestani, Ali, Naeeni Davarani, Mahsa, Hassani-Abharian, Peyman et al. (2020) The therapeutic effect of treatment with RehaCom software on verbal performance in patients with multiple sclerosis. Journal of clinical neuroscience : official journal of the Neurosurgical Society of Australasia 72: 93-97	- Country Study conducted in Iran.
Arnold, Shelley S, Barton, Belinda, McArthur, Genevieve et al. (2016) Phonics Training Improves Reading in Children with Neurofibromatosis Type 1: A Prospective Intervention Trial. The Journal of pediatrics 177: 219-226e2	- Outcomes No relevant outcomes reported. Reports measures relating to children's literacy and reading comprehension.
Atkinson-Clement, Cyril; Sadat, Jasmin; Pinto, Serge (2015) Behavioural treatments for speech in Parkinson's disease: meta-analyses and review of the literature. Neurodegenerative disease management 5(3): 233-48	- Study design (adults) Systematic review (adult population) with no included RCTs. Therefore no studies were checked against protocol.
Augustovski, F, Pichon Riviere, A, Alcaraz, A et al. (2006) Usefulness of music therapy in clinical practice.	- Paper unavailable Not available in English.
Balzan, Pasquale; Tattersall, Catherine; Palmer, Rebecca (2022) Non-invasive brain stimulation for treating neurogenic dysarthria: A systematic review. Annals of physical and rehabilitation medicine 65(5): 101580	- Outcomes Systematic review with 3/10 studies with relevant outcomes and 7/10 studies reporting no relevant outcomes or outcomes not assessed by validated measures (reports ataxia measures, speech rhythmicity, total pause time and formants, voice intensity, speech intensity, speech rate, glottal to noise excitation, tongue movements, maximum phonation time alternating or sequential motion rates, intelligibility and reading). Included studies published 2013 or later and with relevant outcomes were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Barnish, Jean, Atkinson, Rachel A, Barran, Susannah M et al. (2016) Potential Benefit of Singing for People with Parkinson's Disease: A Systematic Review. Journal of Parkinson's disease 6(3): 473-84	- Study design (adults) Systematic review (adult population) with no included RCTs. Therefore no studies were checked against protocol.
Barnish, M.S. and Barran, S.M. (2020) A systematic review of active group-based dance, singing, music therapy and theatrical interven-	- Intervention Systematic review with 38/56 studies investigating dance which was not an intervention to im-

Study	Reason for exclusion
tions for quality of life, functional communication, speech, motor function and cognitive status in people with Parkinson's disease. BMC Neurology 20(1): 371	prove speech and language, communication, or voice. 12/56 studies investigated singing, 4/56 investigated music therapy and 2/58 investigated theatrical interventions. Potentially relevant studies were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Barwood, Caroline H S, Murdoch, Bruce E, Riek, Stephan et al. (2013) Long term language recovery subsequent to low frequency rTMS in chronic non-fluent aphasia. NeuroRehabilitation 32(4): 915-28	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Baudouin, Robin, Lechien, Jerome R, Carpentier, Louise et al. (2023) Deep Brain Stimulation Impact on Voice and Speech Quality in Parkinson's Disease: A Systematic Review. Otolaryngology--head and neck surgery : official journal of American Academy of Otolaryngology-Head and Neck Surgery 168(3): 307-318	- Study design (adults) Systematic review (adult population) with no included RCTs. Therefore no studies were checked against protocol.
Behn, Nicholas, Francis, Jill, Togher, Leanne et al. (2021) Description and Effectiveness of Communication Partner Training in TBI: A Systematic Review. The Journal of head trauma rehabilitation 36(1): 56-71	- Study design (adults) Systematic review (adult population) with 3/8 randomised controlled trials, 2/8 non-randomised controlled trials and 3/8 case studies. No randomised controlled trials were relevant as none were published 2013 or later.
Behn, Nicholas, Marshall, Jane, Togher, Leanne et al. (2019) Feasibility and initial efficacy of project-based treatment for people with ABI. International journal of language & communication disorders 54(3): 465-478	- Study design (adults) Non-randomised study design in adult population.
Behrman, A., Cody, J., Chitnis, S. et al. (2022) Dysarthria treatment for Parkinson's disease: one-year follow-up of SPEAK OUT! with the LOUD Crowd. Logopedics, phoniatrics, vocology 47(4): 271-278	- Study design (adults) Non-randomised study design in adult population.
Bekteshi, Saranda, Konings, Marco, Karlsson, Petra et al. (2023) Teleintervention for users of augmentative and alternative communication devices: A systematic review. Developmental medicine and child neurology 65(2): 171-184	- Study design (adults) Systematic review (adult population) with no included RCTs. Therefore no studies were checked against protocol.
Benjamin, M.L., Towler, S., Garcia, A. et al. (2014) A behavioral manipulation engages right frontal cortex during aphasia therapy. Neurorehabilitation and Neural Repair 28(6): 545-553	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Biddau, Federica, Brisotto, Camilla, Innocenti, Tiziano et al. (2023) Speech and Language Therapy for Acquired Central Dysgraphia in Neurological Patients: A Systematic Review to Describe and Identify Trainings for Clinical Practice. American journal of speech-language pathology 32(2): 762-785	- Publication date Systematic review with 3/11 studies published 2013 or later, and 8/11 published pre-2013. Studies published 2013 or later were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Boyle, M., Akers, C.M., Cavanaugh, R. et al. (2023) Changes in discourse informativeness and efficiency following communication-based group treatment for chronic aphasia. Aphasiolo-	- Population Adult stroke survivors. Not relevant to protocol population criteria.

Study	Reason for exclusion
gy 37(3): 563-597	
Brabenec, L., Simko, P., Sejnoha Minsterova, A. et al. (2023) Repetitive transcranial magnetic stimulation for hypokinetic dysarthria in Parkinson's disease enhances white matter integrity of the auditory-motor loop. European Journal of Neurology 30(4): 881-886	- Duplicate Reports the same results as those presented in Brabenec 2021.
Brabenec, Lubos, Klobusiakova, Patricia, Barton, Marek et al. (2019) Non-invasive stimulation of the auditory feedback area for improved articulation in Parkinson's disease. Parkinsonism & related disorders 61: 187-192	- Outcomes No relevant outcomes reported. Reports speech outcomes that are not from validated measures: acoustic parameters consisting of relative standard deviation of the first formant or fundamental frequency, range of the first or second formant, speech index rhythmicity, total pause time; articulation and speech intelligibility outcomes based on speech therapist evaluation and fMRI brain region BOLD responses.
Bringas, ML, Zaldivar, M, Rojas, PA et al. (2015) Effectiveness of music therapy as an aid to neurorestoration of children with severe neurological disorders. Frontiers in neuroscience 9(nov)	- Country Study conducted in Cuba.
Bunker, Lisa D; Nessler, Christina; Wambaugh, Julie L (2019) Effect Size Benchmarks for Response Elaboration Training: A Meta-Analysis. American journal of speech-language pathology 28(1s): 247-258	- Population Systematic review including studies with all or majority of participants out of protocol (adults with stroke). No studies checked against protocol criteria as did not include any participants with chronic neurological disorders included in protocol.
Burnip, Emma, Wallace, Emma, Gozdzikowska, Kristin et al. (2020) A Systematic Review of Rehabilitation for Corticobulbar Symptoms in Adults with Huntington's Disease. Journal of Huntington's disease 9(1): 1-12	- Study design (adults) Systematic review (adult population) with 2/8 randomised controlled trials, 2/8 case series, and 4/8 cohort studies. Randomised controlled trial which was published 2013 or later, was checked against protocol criteria and was either not relevant or had been separately located by the literature search and screened.
Chaudhary, C., John, S., Kumaran D, S. et al. (2022) Technological interventions in stuttering: A systematic review. Technology and Disability 34(4): 201-222	- Publication date Systematic review with 16/57 studies published 2013 or later, and 41/57 published pre-2013. Studies published 2013 or later were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Cherney, Leora R; Kaye, Rosalind C; van Vuuren, Sarel (2014) Acquisition and maintenance of scripts in aphasia: a comparison of two cuing conditions. American journal of speech-language pathology 23(2): 343-60	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Cherney, Leora R, Lee, Jaime B, Kim, Kwang-Youn A et al. (2021) Web-based Oral Reading for Language in Aphasia (Web ORLA R): A pilot randomized control trial. Clinical rehabilitation 35(7): 976-987	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Cherney, Leora R and Van Vuuren, Sarel (2022) Complexity and Feedback During Script Training in Aphasia: A Feasibility Study. Archives of physical medicine and rehabilitation 103(7s):	- Population Adult stroke survivors. Not relevant to protocol population criteria.

Study	Reason for exclusion
205-s214	
Choi, YoungSeok and Kim, DeokJu (2022) Effects of Task-Based LSVT-BIG Intervention on Hand Function, Activity of Daily Living, Psychological Function, and Quality of Life in Parkinson's Disease: A Randomized Control Trial. Occupational therapy international 2022: 1700306	- Country Study conducted in South Korea.
Chou, Ming-Yi, Chang, Nai-Wen, Chen, Chieh et al. (2019) The effectiveness of music therapy for individuals with Rett syndrome and their families. Journal of the Formosan Medical Association = Taiwan yi zhi 118(12): 1633-1643	- Country Study conducted in Taiwan.
Conlon, Elissa L, Braun, Emily J, Babbitt, Edna M et al. (2020) Treatment Fidelity Procedures for an Aphasia Intervention Within a Randomized Controlled Trial: Design, Feasibility, and Results. American journal of speech-language pathology 29(1s): 412-424	- Country Study conducted in the US.
Crispiatico, Valeria, Baldanzi, Cinzia, Bertuletti, Martina et al. (2023) Factors Associated With Treatment-Related Changes in Voice Volume in People With Multiple Sclerosis. International journal of MS care 25(1): 1-7	- Outcomes No relevant outcomes reported. Voice intensity by monologue without validated tool.
de Lima, Marcos Felipe Rodrigues, Cavendish, Beatriz Araujo, de Deus, Juliana Silva et al. (2020) Retrieval Practice in Memory- and Language-Impaired Populations: A Systematic Review. Archives of clinical neuropsychology : the official journal of the National Academy of Neuropsychologists	- Study design (adults) Systematic review with 7/8 studies conducted in adults whereby 1/7 studies were randomised controlled trials and 6/7 were non-randomised studies. The 1/8 adult RCT and 1/8 study in children and adolescents was which were published 2013 or later, were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
DeDe, Gayle; Hoover, Elizabeth; Maas, Edwin (2019) Two to Tango or the More the Merrier? A Randomized Controlled Trial of the Effects of Group Size in Aphasia Conversation Treatment on Standardized Tests. Journal of speech, language, and hearing research : JSLHR 62(5): 1437-1451	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Del Bene, V., Marotta, D., Martin, R. et al. (2021) Subthalamic nucleus deep brain stimulation implant hemisphere differentially changes verbal fluency in patients with Parkinson disease. Movement Disorder 36(suppl1): 541	- Publication type Conference abstract.
Del Bene, Victor A, Martin, Roy C, Brinkerhoff, Sarah A et al. (2023) Differential cognitive effects of unilateral left and right subthalamic nucleus deep brain stimulation for Parkinson disease. medRxiv : the preprint server for health sciences	- Country Studied conducted in the US.
Devane, Niamh, Behn, Nicholas, Marshall, Jane et al. (2022) The use of virtual reality in the rehabilitation of aphasia: a systematic review. Disability and rehabilitation: 1-20	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Dipper, L., Marshall, J., Boyle, M. et al. (2021) Treatment for improving discourse in aphasia: a	- Population Adult stroke survivors. Not relevant to protocol

Study	Reason for exclusion
systematic review and synthesis of the evidence base. Aphasiology 35(9): 1125-1167	population criteria.
Douglas, J.M., Knox, L., De Maio, C. et al. (2019) Effectiveness of Communication-specific Coping Intervention for adults with traumatic brain injury: preliminary results. Neuropsychological rehabilitation 29(1): 73-91	- Study design (adults) Not comparative/randomised.
Duncan, E and Nakkawita, S (2020) Clinical feasibility of combining transcranial direct current stimulation with standard aphasia therapy. Annals of Indian Academy of Neurology 23(8): S102-S108	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Efstratiadou, Evangelia Antonia, Papathanasiou, Ilias, Holland, Rachel et al. (2018) A Systematic Review of Semantic Feature Analysis Therapy Studies for Aphasia. Journal of speech, language, and hearing research : JSLHR 61(5): 1261-1278	- Population Systematic review with included studies checked against protocol. 2/21 study with population of traumatic brain injury and 19/21 studies with population of adult stroke. Relevant studies published in or after 2013 checked against protocol criteria and was either not relevant or had been separately located by the literature search and screened.
Ehling, Rainer, Amprosi, Matthias, Kremmel, Benjamin et al. (2019) Second language learning induces grey matter volume increase in people with multiple sclerosis. PloS one 14(12): e0226525	- Study design (adults) Non-randomised study.
Finch, Emma, Copley, Anna, Cornwell, Petrea et al. (2016) Systematic Review of behavioural Interventions Targeting Social Communication Difficulties After Traumatic Brain Injury. Archives of physical medicine and rehabilitation 97(8): 1352-65	- Study design (adults) Systematic review (adult population) with 3/15 randomised controlled trials, 1/15 non-randomised controlled trial, 7/15 case studies, and 4/15 cohort studies. Randomised controlled trials were not published 2013 or later and therefore did not meet protocol criteria.
Fiori, V, Nitsche, MA, Cucuzza, G et al. (2019) High-Definition Transcranial Direct Current Stimulation Improves Verb Recovery in Aphasic Patients Depending on Current Intensity. Neuroscience 406: 159-166	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Fiori, Valentina, Cipollari, Susanna, Di Paola, Margherita et al. (2013) tDCS stimulation segregates words in the brain: evidence from aphasia. Frontiers in human neuroscience 7: 269	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Fridriksson, J, Basilakos, A, Stark, BC et al. (2019) Transcranial direct current stimulation to treat aphasia: longitudinal analysis of a randomized controlled trial. Brain stimulation 12(1): 190-191	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Gadenz, Camila Dalbosco, Moreira, Tais de Campos, Capobianco, Dirce Maria et al. (2015) Effects of Repetitive Transcranial Magnetic Stimulation in the Rehabilitation of Communication and Deglutition Disorders: Systematic Review of Randomized Controlled Trials. Folia phoniatrica et logopaedica : official organ of the International Association of Logopedics and Phoniatrics (IALP) 67(2): 97-105	- Population Systematic review including participants who are in protocol (1/10 in people with Parkinson's disease) and out of protocol (8/10 in adult stroke participants and 1/10 in people with Alzheimer's disease). The 1 study in people with Parkinson's disease was not published in or after 2013 and therefore did not meet protocol criteria.

Study	Reason for exclusion
Gage, Heather, Grainger, Linda, Ting, Sharlene et al. (2014) Specialist rehabilitation for people with Parkinson's disease in the community: a randomised controlled trial.	- Intervention Multidisciplinary rehabilitation care package including speech and language therapists and with or without Parkinson's care assistant. Not an intervention focused on improving speech and language, communication, or voice.
Gardoni, Andrea, Sarasso, Elisabetta, Agosta, Federica et al. (2023) Rehabilitative interventions for impaired handwriting in people with Parkinson's disease: a scoping review. Neurological sciences : official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology	- Study design (adults) Scoping review with 4/8 randomised controlled trials in adults and 4/8 non-randomised controlled trials. Studies published 2013 or later were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Gilbert, Christianna, Mooradian, Grace, Citorik, Anne et al. (2022) Multi-level outcomes for young adults with acquired brain injury through a remote intensive cognitive rehabilitation approach: a pilot intervention study. Brain injury 36(2): 206-220	- Country Study conducted in the US.
Gilmore, Natalie; Mirman, Daniel; Kiran, Swathi (2022) Young Adults With Acquired Brain Injury Show Longitudinal Improvements in Cognition After Intensive Cognitive Rehabilitation. Journal of speech, language, and hearing research : JSLHR 65(4): 1494-1520	- Country Study conducted in the US.
HAYES and Inc (2017) Cognitive rehabilitation therapy for traumatic brain injury (TBI).	- Intervention Cognitive rehabilitation. Not an intervention to improve speech and language, communication, or voice.
Hoover, Elizabeth; DeDe, Gayle; Maas, Edwin (2021) A Randomized Controlled Trial of the Effects of Group Conversation Treatment on Monologic Discourse in Aphasia. Journal of speech, language, and hearing research : JSLHR 64(12): 4861-4875	- Country Study conducted in the US.
James, E, Ellis, C, Brassington, R et al. (2022) Treatment for sialorrhea (excessive saliva) in people with motor neuron disease/amyotrophic lateral sclerosis. Cochrane Database of Systematic Reviews	- Intervention Systematic review with studies investigating medication, radiotherapy or surgery not interventions to improve speech and language, communication, or voice. Therefore no studies were checked against protocol criteria.
Jones, Cheryl; Richard, Nicole; Thaut, Michael (2021) Investigating music-based cognitive rehabilitation for individuals with moderate to severe chronic acquired brain injury: A feasibility experiment. NeuroRehabilitation 48(2): 209-220	- Intervention Neurocognitive/attention training intervention/ Not an intervention to improve speech and language, communication, or voice.
Jungblut, Monika, Mais, Christiane, Binkofski, Ferdinand Christoph et al. (2022) The efficacy of a directed rhythmic-melodic voice training in the treatment of chronic non-fluent aphasia-Behavioral and imaging results. Journal of neurology 269(9): 5070-5084	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Kaipa, Ramesh; Jones, Richard D; Robb, Michael P (2016) Are individuals with Parkinson's disease capable of speech-motor learning? - A preliminary evaluation. Parkinsonism & related	- Outcomes No relevant outcomes reported. Speech-motor spatial learning outcomes measured by calculating percent phonemes correct and speech-motor

Study	Reason for exclusion
disorders 28: 141-5	temporal learning outcomes measuring synchronicity of speech phrase via an acoustic analysis software tool.
Kearns, Aine; Kelly, Helen; Pitt, Ian (2021) Self-reported feedback in ICT-delivered aphasia rehabilitation: a literature review. Disability and rehabilitation 43(9): 1193-1207	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Kendall, Diane L, Moldestad, Megan Oelke, Allen, Wesley et al. (2019) Phonomotor Versus Semantic Feature Analysis Treatment for Anomia in 58 Persons With Aphasia: A Randomized Controlled Trial. Journal of speech, language, and hearing research : JSLHR 62(12): 4464-4482	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Khan, F, Amatya, B, Ng, L et al. (2015) Multidisciplinary rehabilitation after primary brain tumour treatment. Cochrane Database of Systematic Reviews	- Intervention Systematic review with studies investigating multidisciplinary rehabilitation and not interventions to improve speech and language, communication, or voice. Therefore no studies were checked against protocol criteria.
Kolk, A., Saard, M., Rostsinskaja, A. et al. (2022) Power of combined modern technology: Multitouch-multiuser tabletops and virtual reality platforms (PowerVR) in social communication skills training for children with neurological disorders: A pilot study. Applied neuropsychology. Child: 1-10	- Outcomes No relevant outcomes reported. Executive function, social performance and behaviour.
Konnai, Ramya; Van Harn, Meredith; Silbergleit, Alice (2021) Conversational Vocal Intensity in Parkinson's Disease: Treatment and Environmental Comparisons. Journal of voice : official journal of the Voice Foundation	- Country Study conducted in the US.
Kurfess, C; Beushausen, U; Grotzbach, H (2020) Effects of transcranial direct current stimulation on naming abilities and spontaneous speech of aphasic patients. Neurologie und rehabilitation 26(2): 93-103	- Paper unavailable Not available in English
Kurland, Jacquie, Stanek, Edward J 3rd, Stokes, Polly et al. (2016) Intensive Language Action Therapy in Chronic Aphasia: A Randomized Clinical Trial Examining Guidance by Constraint. American journal of speech-language pathology 25(4s): 798-s812	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Lai, W.V., Silkes, J.P., Minkina, I. et al. (2019) Generalisation and maintenance across word classes: comparing the efficacy of two anomia treatments in improving verb naming. Aphasiology 33(7): 803-820	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Lam, Jordan, Lee, Justin, Williams, Marcus et al. (2021) Cognitive effects of theta frequency bilateral subthalamic nucleus stimulation in Parkinson's disease: A pilot study. Brain stimulation 14(2): 230-240	- Country Study conducted in the US.
Lanyon, Lucette E; Rose, Miranda L; Worrall, Linda (2013) The efficacy of outpatient and community-based aphasia group interventions: a systematic review. International journal of	- Publication date Systematic review with all included studies published before 2013 (or 2010 for qualitative reviews). Therefore no studies checked against

Study	Reason for exclusion
speech-language pathology 15(4): 359-74	protocol.
Lee, D.J., Drummond, N.M., Saha, U. et al. (2021) Acute low frequency dorsal subthalamic nucleus stimulation improves verbal fluency in Parkinson's disease. Brain Stimulation 14(4): 754-760	- Study design (adults) Non-randomised study.
Lehman Blake, Margaret; Frymark, Tobi; Venedictov, Rebecca (2013) An evidence-based systematic review on communication treatments for individuals with right hemisphere brain damage. American journal of speech-language pathology 22(1): 146-60	- Study design (adults) Systematic review (adult population) with no included RCTs. Therefore no studies were checked against protocol.
Levine, CB; Fahrbach, KR; Siderowf, AD (2003) Diagnosis and treatment of Parkinson's Disease: a systematic review of the literature.	- Publication date Systematic review with all included studies published before 2013. Therefore no studies checked against protocol.
Levy, Erika S, Moya-Gale, Gemma, Chang, Young Hwa M et al. (2020) The effects of intensive speech treatment on intelligibility in Parkinson's disease: A randomised controlled trial. EClinicalMedicine 24: 100429	- Country Study conducted in the US.
Madden, E.B.; Torrence, J.; Kendall, D.L. (2021) Cross-modal generalization of anomia treatment to reading in aphasia. Aphasiology 35(7): 875-899	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Maddy, K M; Capilouto, G J; McComas, K L (2014) The effectiveness of semantic feature analysis: an evidence-based systematic review. Annals of physical and rehabilitation medicine 57(4): 254-67	- Study design (adults) Systematic review (adult population) with no included RCTs. Therefore no studies were checked against protocol.
Magee, Wendy L, Clark, Imogen, Tamplin, Jeanette et al. (2017) Music interventions for acquired brain injury. The Cochrane database of systematic reviews 1: cd006787	- Study design (adults) Systematic review including participants who are in protocol (4/29 in people with acquired brain injuries) and not in protocol (25/29 in adult stroke survivors). Studies with population in protocol that were published in or after 2013 were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Marangolo, P., Fiori, V., Gelfo, F. et al. (2014) Bihemispheric tDCS enhances language recovery but does not alter BDNF levels in chronic aphasic patients. Restorative Neurology and Neuroscience 32(2): 367-379	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Marchese, M.R., Proietti, I., Longobardi, Y. et al. (2022) Multidimensional voice assessment after Lee Silverman Voice Therapy (LSVT) in Parkinson's disease. Acta otorhinolaryngologica Italica : organo ufficiale della Societa italiana di otorinolaringologia e chirurgia cervico-facciale 42(4): 348-354	- Study design (adults) Non-randomised study.
McDonald, Brenna C, Flashman, Laura A, Arciniegas, David B et al. (2017) Methylphenidate and Memory and Attention Adaptation Training for Persistent Cognitive Symptoms after Traumatic Brain Injury: A Randomized, Placebo-Controlled Trial. Neuropsychopharmacology :	- Country Study conducted in the US.

Study	Reason for exclusion
official publication of the American College of Neuropsychopharmacology 42(9): 1766-1775	
McDonnell, Michelle N, Rischbieth, Briony, Schammer, Tenille T et al. (2018) Lee Silverman Voice Treatment (LSVT)-BIG to improve motor function in people with Parkinson's disease: a systematic review and meta-analysis. Clinical rehabilitation 32(5): 607-618	- Outcomes No relevant outcomes reported. Reports motor function outcomes.
Mirkowski, M., McIntyre, A., Faltynek, P. et al. (2019) Nonpharmacological rehabilitation interventions for motor and cognitive outcomes following pediatric stroke: a systematic review. European Journal of Pediatrics 178(4): 433-454	- Intervention Systematic review with studies investigating interventions for rehabilitation of the upper limb or memory training based interventions and not interventions to improve speech and language, communication, or voice. Therefore no studies were checked against protocol criteria.
Mitchell, Claire, Bowen, Audrey, Tyson, Sarah et al. (2017) Interventions for dysarthria due to stroke and other adult-acquired, non-progressive brain injury. The Cochrane database of systematic reviews 1: cd002088	- Population Systematic review including participants out of protocol (adults with stroke). No studies checked against protocol criteria as did not include any participants with chronic neurological disorders included in protocol.
Mohr, Bettina, Stahl, Benjamin, Berthier, Marcelo L et al. (2017) Intensive Communicative Therapy Reduces Symptoms of Depression in Chronic Nonfluent Aphasia. Neurorehabilitation and neural repair 31(12): 1053-1062	- Population The majority of the sample were adult stroke patients (15/17) and results are not reported separately for the non stroke patients.
Monroe, Penelope, Halaki, Mark, Kumfor, Fiona et al. (2020) The effects of choral singing on communication impairments in acquired brain injury: A systematic review. International journal of language & communication disorders 55(3): 303-319	- Study design (adults) Systematic review (adult population) with 1/11 randomised controlled trials, 9/11 non-randomised studies and 2/11 mixed method, studies. The randomised controlled trial was checked against protocol criteria and was either not relevant or had been separately located by the literature search and screened.
Moya-Gale, Gemma, Spielman, Jennifer, Ramig, Lorraine A et al. (2022) The Acoustic Voice Quality Index (AVQI) in People with Parkinson's Disease Before and After Intensive Voice and Articulation Therapies: Secondary Outcome of a Randomized Controlled Trial. Journal of voice : official journal of the Voice Foundation	- Country Study conducted in the US.
Moya-Galé, G, Keller, B, Escorial, S et al. (2021) Speech Treatment Effects on Narrative Intelligibility in French-Speaking Children With Dysarthria. Journal of speech, language, and hearing research 64(6s): 2154-2168	- Population Sample comprised of children with cerebral palsy. Not relevant to protocol population criteria.
Munasinghe, Thushani Umesha; Ariyasena, Akila Dinethra K; Siriwardhana, Dhammika Deepani (2023) Speech Therapy Interventions for Acquired Apraxia of Speech: An Updated Systematic Review. American journal of speech-language pathology: 1-24	- Study design (adults) Systematic review (adult population) with 1/27 randomised controlled trials, 2/27 non-randomised controlled studies, 19/27 before and after studies, 2/27 case series studies, and 3/27 case studies. 5/14 non-randomised studies, 2/14 case studies, and 1/14 retrospective cohort studies. Randomised controlled trial was checked against protocol criteria and was either not relevant or had been separately located by the literature search and screened.

Study	Reason for exclusion
Munoz-Vigueras, Natalia, Prados-Roman, Esther, Valenza, Marie Carmen et al. (2021) Speech and language therapy treatment on hypokinetic dysarthria in Parkinson disease: Systematic review and meta-analysis. Clinical rehabilitation 35(5): 639-655	- Publication date Systematic review with 6/15 studies published 2013 or later, and 9/15 published pre-2013. Studies published 2013 or later were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Nackaerts, E, Heremans, E, Vervoort, G et al. (2016) Relearning of Writing Skills in Parkinson's Disease After Intensive Amplitude Training. Movement disorders 31(8): 1209-1216	- Outcomes No relevant outcomes reported. Amplitude and COV(ampl).
Nackaerts, Evelien, Broeder, Sanne, Pereira, Marcelo P et al. (2017) Handwriting training in Parkinson's disease: A trade-off between size, speed and fluency. PloS one 12(12): e0190223	- Outcomes No relevant outcomes reported. Amplitude and COV(ampl).
Nackaerts, Evelien; Nieuwboer, Alice; Farella, Elisabetta (2017) Technology-Assisted Rehabilitation of Writing Skills in Parkinson's Disease: Visual Cueing versus Intelligent Feedback. Parkinson's disease 2017: 9198037	- Study design (adults) Cross-sectional design.
Namasivayam, A.K., Huynh, A., Granata, F. et al. (2021) PROMPT intervention for children with severe speech motor delay: a randomized control trial. Pediatric Research 89(3): 613-621	- Population Development speech sound disorders. Not relevant to protocol population criteria.
Narayana, Shalini, Franklin, Crystal, Peterson, Elizabeth et al. (2022) Immediate and long-term effects of speech treatment targets and intensive dosage on Parkinson's disease dysphonia and the speech motor network: Randomized controlled trial. Human brain mapping 43(7): 2328-2347	- Country Study conducted in the US.
Nejati, Vahid; Pouretemad, Hamid Reza; Bahrami, Hajar (2013) Attention training in rehabilitation of children with developmental stuttering. NeuroRehabilitation 32(2): 297-303	- Country Study conducted in Iran.
Nunn, Kristen; Vallila-Rohter, Sofia; Middleton, Erica L (2023) Errorless, Errorful, and Retrieval Practice for Naming Treatment in Aphasia: A Scoping Review of Learning Mechanisms and Treatment Ingredients. Journal of speech, language, and hearing research : JSLHR 66(2): 668-687	- Study design (adults) Systematic review (adult population) with 12/12 non-randomised studies.
Ogawa, Mayuko, Oyama, Genko, Morito, Ken et al. (2022) Can AI make people happy? The effect of AI-based chatbot on smile and speech in Parkinson's disease. Parkinsonism & related disorders 99: 43-46	- Country Study conducted in Japan.
Paice, Leah; Aleligay, Annalle; Checklin, Martin (2020) A systematic review of interventions for adults with social communication impairments due to an acquired brain injury: Significant other reports. International journal of speech-language pathology 22(5): 537-548	- Study design (adults) Systematic review (adult population) with 3/6 randomised controlled trials, 3/6 non-randomised studies. Randomised controlled trials which were published 2013 or later, were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Pennington, L, Parker, NK, Kelly, H et al. (2016)	- No RCTs identified in SR

Study	Reason for exclusion
Speech therapy for children with dysarthria acquired before three years of age. Cochrane Database of Systematic Reviews	Systematic review with 0 studies identified for the review.
Pennington, L, Stamp, E, Smith, J et al. (2019) Internet delivery of intensive speech and language therapy for children with cerebral palsy: a pilot randomised controlled trial. BMJ open 9(1): e024233	- Population Cerebral palsy. Not relevant to protocol population criteria.
Pennington, Lindsay, Akor, Wanwuri A, Laws, Kate et al. (2018) Parent-mediated communication interventions for improving the communication skills of preschool children with non-progressive motor disorders. The Cochrane database of systematic reviews 7: cd012507	- Outcomes No relevant outcomes reported. Reports children's speech intelligibility measure as pre and post intervention, not comparative between 2 groups.
Pereira, Joana B, Junque, Carme, Bartres-Faz, David et al. (2013) Modulation of verbal fluency networks by transcranial direct current stimulation (tDCS) in Parkinson's disease. Brain stimulation 6(1): 16-24	- Intervention Transcranial direct current stimulation. Not an intervention to improve speech and language, communication, or voice.
Perez-Martin, Maria Yaiza, Gonzalez-Platas, Montserrat, Eguia-Del Rio, Pablo et al. (2017) Efficacy of a short cognitive training program in patients with multiple sclerosis. Neuropsychiatric disease and treatment 13: 245-252	- Intervention Neuropsychological rehabilitation. Not an intervention to improve speech and language, communication, or voice.
Pichon Riviere, A, Augustovski, F, Cernadas, C et al. (2003) Deep brain stimulation in the treatment of Parkinson's disease.	- Country Study conducted in India.
Pierce, John E, O'Halloran, Robyn, Menahemi-Falkov, Maya et al. (2021) Comparing higher and lower weekly treatment intensity for chronic aphasia: A systematic review and meta-analysis. Neuropsychological rehabilitation 31(8): 1289-1313	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Poirier, S.-E.; Fossard, M.; Monetta, L. (2023) The efficacy of treatments for sentence production deficits in aphasia: a systematic review. Aphasiology 37(1): 122-142	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Pouplin, S, Bensmail, D, Vaugier, I et al. (2019) Influence of training protocols on text input speed on a computer in individuals with cervical spinal cord injury: a randomised controlled trial. Spinal cord 57(8): 636-643	- Outcomes No relevant outcomes reported. Reports number of errors, rate of WPS use, perception of cognitive load, perception of speed, and satisfaction.
Pu, Tingting, Huang, Min, Kong, Xiangyu et al. (2021) Lee Silverman Voice Treatment to Improve Speech in Parkinson's Disease: A Systemic Review and Meta-Analysis. Parkinson's disease 2021: 3366870	- Publication date Systematic review with 6/10 studies published 2013 or later, and 4/10 published pre-2013. Studies published 2013 or later were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Quique, Yina M; Evans, William S; Dickey, Michael Walsh (2019) Acquisition and Generalization Responses in Aphasia Naming Treatment: A Meta-Analysis of Semantic Feature Analysis Outcomes. American journal of speech-language pathology 28(1s): 230-246	- Population All studies included post stroke aphasia in adults. Not relevant to protocol population criteria.
Ramig, Lorraine, Halpern, Angela, Spielman,	- Country

Study	Reason for exclusion
Jennifer et al. (2018) Speech treatment in Parkinson's disease: Randomized controlled trial (RCT). Movement disorders : official journal of the Movement Disorder Society 33(11): 1777-1791	Study conducted in the US.
Rey-Ares, L, García Martí, S, Pichon-Riviere, A et al. (2016) Eye tracking speech-generating devices in disorders involving language, speech and motor skills.	- Language Spanish
Richardson, K, Huber, JE, Kiefer, B et al. (2022) Respiratory Responses to Two Voice Interventions for Parkinson's Disease. Journal of speech, language, and hearing research 65(10): 3730-3748	- Country Study conducted in the US.
Richardson, K, Huber, JE, Kiefer, B et al. (2022) Perception of Physical Demand, Mental Demand, and Performance: a Comparison of Two Voice Interventions for Parkinson's Disease. American journal of speech-language pathology 31(5): 1963-1978	- Country Study conducted in the US.
Richter, Kim Merle, Modden, Claudia, Eling, Paul et al. (2015) Working memory training and semantic structuring improves remembering future events, not past events. Neurorehabilitation and neural repair 29(1): 33-40	- Intervention Working memory training. Not an intervention to improve speech and language, communication, or voice.
Rick, C, Clarke, CE, Ives, N et al. (2017) A reflection on the management of a trial of speech and language therapy. Trials 18	- Publication type Conference abstract.
Rietdijk, Rachael, Power, Emma, Attard, Michelle et al. (2020) A Clinical Trial Investigating Telehealth and In-Person Social Communication Skills Training for People With Traumatic Brain Injury: Participant-Reported Communication Outcomes. The Journal of head trauma rehabilitation 35(4): 241-253	- Study design (adults) Partially randomised controlled trial.
Rilo, Oiane, Pena, Javier, Ojeda, Natalia et al. (2018) Integrative group-based cognitive rehabilitation efficacy in multiple sclerosis: a randomized clinical trial. Disability and rehabilitation 40(2): 208-216	- Intervention Group based cognitive rehabilitation. Not an intervention to improve speech and language, communication, or voice.
Roesch, A.D., Gschwandtner, U., Handabaka, I. et al. (2021) Effects of Rhythmic Interventions on Cognitive Abilities in Parkinson's Disease. Dementia and Geriatric Cognitive Disorders 50(4): 372-386	- Intervention Neuropsychological intervention. Not an intervention to improve speech and language, communication, or voice.
Roper, A.; Marshall, J.; Wilson, S. (2016) Benefits and limitations of computer gesture therapy for the rehabilitation of severe aphasia. Frontiers in Human Neuroscience 10(nov2016): 595	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Rose, M.L., Attard, M.C., Mok, Z. et al. (2013) Multi-modality aphasia therapy is as efficacious as a constraint-induced aphasia therapy for chronic aphasia: A phase 1 study. Aphasiology 27(8): 938-971	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Rosti-Otajärvi, EM and Hämäläinen, PI (2014) Neuropsychological rehabilitation for multiple sclerosis. Cochrane Database of Systematic	- Intervention Neuropsychological rehabilitation. Not an inter-

Study	Reason for exclusion
Reviews	vention to improve speech and language, communication, or voice.
Saffarian, Arezoo, Amiri Shavaki, Yunes, Shahidi, Gholam Ali et al. (2019) Lee Silverman voice treatment (LSVT) mitigates voice difficulties in mild Parkinson's disease. Medical journal of the Islamic Republic of Iran 33: 5	- Country Study conducted in Iran.
Saiyed, Masnoon, Hill, Anne J, Russell, Trevor G et al. (2022) Cost analysis of home telerehabilitation for speech treatment in people with Parkinson's disease. Journal of telemedicine and telecare 28(7): 524-529	- Duplicate Primary RCT by Theodoros 2016 included in review.
Savage, Meghan C and Donovan, Neila J (2017) Comparing linguistic complexity and efficiency in conversations from stimulation and conversation therapy in aphasia. International journal of language & communication disorders 52(1): 21-29	- Country Study conducted in the US.
Schaible, Fabian, Maier, Franziska, Buchwitz, Timo Marcel et al. (2021) Effects of Lee Silverman Voice Treatment BIG and conventional physiotherapy on non-motor and motor symptoms in Parkinson's disease: a randomized controlled study comparing three exercise models. Therapeutic advances in neurological disorders 14: 1756286420986744	- Intervention LSVT® BIG - physiotherapy based intervention. Not an intervention to improve speech and language, communication, or voice.
Schulz, Geralyn, Halpern, Angela, Spielman, Jennifer et al. (2021) Single Word Intelligibility of Individuals with Parkinson's Disease in Noise: Pre-Specified Secondary Outcome Variables from a Randomized Control Trial (RCT) Comparing Two Intensive Speech Treatments (LSVT LOUD vs. LSVT ARTIC). Brain sciences 11(7)	- Country Study conducted in the US.
Shrubsole, Kirstine, Worrall, Linda, Power, Emma et al. (2018) The Acute Aphasia IMplementation Study (AAIMS): a pilot cluster randomized controlled trial. International journal of language & communication disorders 53(5): 1021-1056	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Silkes, JoAnn P, Fergadiotis, Gerasimos, Graue, Kasey et al. (2021) Effects of Phonomotor Therapy and Semantic Feature Analysis on Discourse Production. American journal of speech-language pathology 30(1s): 441-454	- Country Study conducted in the US.
Simmons-Mackie, Nina; Raymer, Anastasia; Cherney, Leora R (2016) Communication Partner Training in Aphasia: An Updated Systematic Review. Archives of physical medicine and rehabilitation 97(12): 2202-2221e8	- Outcomes Narrative summary of outcomes.
Siponkoski, Sini-Tuuli, Pitkaniemi, Anni, Laitinen, Sari et al. (2023) Efficacy of a multicomponent singing intervention on communication and psychosocial functioning in chronic aphasia: a randomized controlled crossover trial. Brain communications 5(1): fcac337	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Spitzer, Lena, Binkofski, Ferdinand, Willmes, Klaus et al. (2021) The novel cognitive flexibility in aphasia therapy (CFAT): A combined treatment of aphasia and executive functions to im-	- Population Adult stroke survivors. Not relevant to protocol population criteria.

Study	Reason for exclusion
prove communicative success. International journal of speech-language pathology 23(2): 168-179	
Stark, Brielle C and Warburton, Elizabeth A (2018) Improved language in chronic aphasia after self-delivered iPad speech therapy. Neuropsychological rehabilitation 28(5): 818-831	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Stegemoller, Elizabeth L, Radig, Hollie, Hibbing, Paul et al. (2017) Effects of singing on voice, respiratory control and quality of life in persons with Parkinson's disease. Disability and rehabilitation 39(6): 594-600	- Country Study conducted in the US.
Steurer, Hanna, Korner Gustafsson, Joakim, Franzen, Erika et al. (2021) Using Portable Voice Accumulators to Study Transfer of Speech Outcomes Following Intervention - A Feasibility Study. Journal of voice : official journal of the Voice Foundation	- Outcomes No variability estimates (SD or SE) for duration of registrations (continuous outcome). Mean voice band levels reported as bar chart and unable to input data into statistical package.
Szelag, Elzbieta, Dacewicz, Anna, Szymaszek, Aneta et al. (2015) The Application of Timing in Therapy of Children and Adults with Language Disorders. Frontiers in psychology 6: 1714	- Population Development speech sound disorders. Not relevant to protocol population criteria.
Tamplin, Jeanette, Baker, Felicity A, Grocke, Denise et al. (2013) Effect of singing on respiratory function, voice, and mood after quadriplegia: a randomized controlled trial. Archives of physical medicine and rehabilitation 94(3): 426-34	- Publication date Original study published in 2012.
Tamplin, Jeanette, Morris, Meg E, Marigliani, Caterina et al. (2020) ParkinSong: Outcomes of a 12-Month Controlled Trial of Therapeutic Singing Groups in Parkinson's Disease. Journal of Parkinson's disease 10(3): 1217-1230	- Study design (adults) Non-randomised controlled trial.
Tamplin, Jeanette, Morris, Meg E, Marigliani, Caterina et al. (2019) ParkinSong: A Controlled Trial of Singing-Based Therapy for Parkinson's Disease. Neurorehabilitation and neural repair 33(6): 453-463	- Outcomes Original study published in 2012.
Tilley, Erica, McLoughlin, James, Koblar, Simon A et al. (2016) Effectiveness of allied health therapy in the symptomatic management of progressive supranuclear palsy: a systematic review. JBI database of systematic reviews and implementation reports 14(6): 148-95	- Study design (CYP) Systematic review with 1/6 quasi-randomised controlled trial, 5/6 non-comparative studies. Quasi-randomised controlled trial, which was published 2013 or later, was checked against protocol criteria and was either not relevant or had been separately located by the literature search and screened.
Valero-Cabre, Antoni, Sanches, Clara, Godard, Juliette et al. (2019) Language boosting by transcranial stimulation in progressive supranuclear palsy. Neurology 93(6): e537-e547	- Study design (adults) Healthy controls used as comparative group.
Valinejad, V., Mehri, A., Khatoonabadi, A. et al. (2022) Treatment of verb tense morphology in agrammatic aphasia: A systematic review. Journal of Neurolinguistics 62: 101045	- Country Study conducted in Iran.
van Bruggen-Rufi, Monique C H, Vink, Annemieke C, Wolterbeek, Ron et al. (2017) The Ef-	- Outcomes No relevant outcomes reported, Behavioural

Study	Reason for exclusion
fect of Music Therapy in Patients with Huntington's Disease: A Randomized Controlled Trial. Journal of Huntington's disease 6(1): 63-72	Observation Scale for Huntington's Disease.
Vestri, A., Peruch, F., Marchi, S. et al. (2014) Individual and group treatment for patients with acquired brain injury in comprehensive rehabilitation. Brain Injury 28(8): 1102-1108	- Intervention Neuropsychological rehabilitation programme. Not an intervention to improve speech and language, communication, or voice.
Vogel, Adam P; Folker, Joanne; Poole, Matthew L (2014) Treatment for speech disorder in Friedreich ataxia and other hereditary ataxia syndromes. The Cochrane database of systematic reviews: cd008953	- Publication date Systematic review with 13/13 studies published pre-2013.
Vogel, Dimitri, Ostermann, Thomas, Vogel, Hannah et al. (2022) Recommendation of Neurorehabilitation according to the Padovan-Method Neurofunctional Reorganization R for Treating Neurodevelopmental Disorders: A Systematic Review. Complementary medicine research 29(4): 330-361	- Country Systematic review with 10/17 of the included studies conducted in Brazil and 7/17 Europe. European studies were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Vos, Sandra H, Kessels, Roy P C, Vinke, R Saman et al. (2021) The Effect of Deep Brain Stimulation of the Subthalamic Nucleus on Language Function in Parkinson's Disease: A Systematic Review. Journal of speech, language, and hearing research : JSLHR 64(7): 2794-2810	- Outcomes Outcomes reported narratively.
Wambaugh, Julie L, Nessler, Christina, Wright, Sandra et al. (2017) Effects of Blocked and Random Practice Schedule on Outcomes of Sound Production Treatment for Acquired Apraxia of Speech: Results of a Group Investigation. Journal of speech, language, and hearing research : JSLHR 60(6s): 1739-1751	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Wang, Guandong, Ge, Li, Zheng, Qingxiang et al. (2020) Constraint-induced aphasia therapy for patients with aphasia: A systematic review. International journal of nursing sciences 7(3): 349-358	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Watter, Kerrin; Copley, Anna; Finch, Emma (2017) Discourse level reading comprehension interventions following acquired brain injury: a systematic review. Disability and rehabilitation 39(4): 315-337	- Publication date Systematic review with 10/23 studies published 2013 or later, and 13/23 published pre-2013. Studies published 2013 or later were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Wenke, Rachel, Cardell, Elizabeth, Lawrie, Melissa et al. (2018) Communication and well-being outcomes of a hybrid service delivery model of intensive impairment-based treatment for aphasia in the hospital setting: a pilot study. Disability and rehabilitation 40(13): 1532-1541	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Whillans, Chelsea, Lawrie, Melissa, Cardell, Elizabeth A et al. (2022) A systematic review of group intervention for acquired dysarthria in adults. Disability and rehabilitation 44(13): 3002-3018	- Study design (adults) Systematic review (adult population) with 1/21 randomised controlled trials, 20/21 non-randomised studies. Randomised controlled trials which were published 2013 or later, were checked against protocol criteria and were either not relevant or had been separately located by

Study	Reason for exclusion
	the literature search and screened.
Wilssens, Ineke, Vandenborre, Dorien, van Dun, Kim et al. (2015) Constraint-induced aphasia therapy versus intensive semantic treatment in fluent aphasia. American journal of speech-language pathology 24(2): 281-94	- Population Adult stroke survivors. Not relevant to protocol population criteria.
Wiseman-Hakes, Catherine, Ryu, Hyun, Lightfoot, David et al. (2020) Examining the Efficacy of Communication Partner Training for Improving Communication Interactions and Outcomes for Individuals With Traumatic Brain Injury: A Systematic Review. Archives of rehabilitation research and clinical translation 2(1): 100036	- Study design (CYP) Qualitative systematic review.
Wyman-Chick, Kathryn A (2016) Verbal Fluency in Parkinson's Patients with and without Bilateral Deep Brain Stimulation of the Subthalamic Nucleus: A Meta-analysis. Journal of the International Neuropsychological Society : JINS 22(4): 478-85	- Intervention Deep brain stimulation of subthalamic nucleus. Not an intervention to improve speech and language, communication, or voice.
Xu, Hongyan, Bao, Zhuohua, Liang, Daye et al. (2020) Speech and Language Therapy for Voice Problems in Parkinson's Disease: A Meta-Analysis. The Journal of neuropsychiatry and clinical neurosciences 32(4): 344-351	- Country Systematic review with 5/10 studies conducted in US, 2/10 studies conducted in China, and 3/10 studies conducted in Europe. European studies were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Yuan, F, Guo, X, Wei, X et al. (2020) Lee Silverman Voice Treatment for dysarthria in patients with Parkinson's disease: a systematic review and meta-analysis. European journal of neurology 27(10): 1957-1970	- Publication date Systematic review with 3/8 studies published 2013 or later, and 5/8 published pre-2013. Studies published 2013 or later were checked against protocol criteria and were either not relevant or had been separately located by the literature search and screened.
Zhang, Xiao-Ying, Song, Yi-Chuan, Liu, Chang-Bin et al. (2021) Effectiveness of oral motor respiratory exercise and vocal intonation therapy on respiratory function and vocal quality in patients with spinal cord injury: a randomized controlled trial. Neural regeneration research 16(2): 375-381	- Country Study conducted in China.
Zhang, Xiaoying, Song, Yi-Chuan, Yang, De-Gang et al. (2022) The Effect of Vocal Intonation Therapy on Vocal Dysfunction in Patients With Cervical Spinal Cord Injury: A Randomized Control Trial. Frontiers in neuroscience 16: 860127	- Country Study conducted in China.
Zheng, C.; Lynch, L.; Taylor, N. (2016) Effect of computer therapy in aphasia: a systematic review. Aphasiology 30(23): 211-244	- Publication date Systematic review with 6/6 studies published pre-2013.
Zhou, Qiumin, Lu, Xiao, Zhang, Ying et al. (2018) Telerehabilitation Combined Speech-Language and Cognitive Training Effectively Promoted Recovery in Aphasia Patients. Frontiers in psychology 9: 2312	- Country Study conducted in China.
Zumbansen, A., Peretz, I., Anglade, C. et al. (2017) Effect of choir activity in the rehabilitation	- Population Adult stroke survivors. Not relevant to protocol

Study	Reason for exclusion
of aphasia: a blind, randomised, controlled pilot study. Aphasiology 31(8): 879-900	population criteria.
Zumbansen, A. and Tremblay, P. (2019) Music-based interventions for aphasia could act through a motor-speech mechanism: a systematic review and case-control analysis of published individual participant data. Aphasiology 33(4): 466-497	- Population Systematic review including participants who are in protocol (13/40 studies had people with CND), and out of protocol (27/40 studies had adults with stroke). The study including participants with CND was checked against protocol criteria and was either not relevant or had been separately located by the literature search and screened.

Excluded economic studies

See supplement 2 for the list of excluded studies across all reviews.

Appendix K Research recommendations – full details

Research recommendations for review question: What is the effectiveness of interventions and approaches for improving or supporting speech, language, and communication?

No research recommendations were made for this review question.