Question 55 evidence tables

Question 55: What is the effectiveness of technological methods for the treatment of post-stroke aphasia?

NB Any discrepancies between reviewers in evidence quality and comment were discussed at the corresponding evidence review meeting

SLT = speech and language therapy/therapist(s)(/pathologists), PWA = people with aphasia, MICD = minimally important clinical difference, COM-B system = Capability, Opportunity, Motivation, Behaviour system, ANOVA = analysis of variance, LOT Language Orientated Treatment, IRR = Inter-rater reliability, ICCs = intraclass correlations, SR = systematic review, MA = meta-analysis, RCT = randomised controlled trial, IPDMA = individual patient data meta-analysis, MDT = multidisciplinary team, PICO = patient/population, intervention, comparison and outcomes, OR = odds ratio, CI = confidence interval, QoL = quality of life, ADL = activities of daily living, OR = odds ratio, RR = relative risk, aOR = adjusted odds ratio, cOR = crude odds ratio, CI = confidence interval, RoB = risk of bias, I^2 = heterogeneity statistic.

Outcome measures: WAB-AQ = Western Aphasia Battery Aphasia Quotient, BTACT = Brief Test of Adult Cognition by Telephone, SAQOL-39 = Stroke and Aphasia Quality of Life Scale 39, GORT-4 = Gray Oral Reading Test Fourth Edition, RCBA-2 = Reading Comprehension Battery for Aphasia Second Edition; RCEQ = Reading Confidence and Emotions Questionnaire; CADL-2 = Communication Activities of Daily Living Revised, VAMS = Visual Analogue Mood Scales, ALA = Assessment of Living with Aphasia, ORLA = Oral Reading for Language in Aphasia, TIAS = Therapeutic Instrument for Speech Apraxia, MST = Module Specific Treatment, NPEA = neuropsychological exam for aphasia, CAT = constructional apraxia test, IMA = ideomotor apraxia test, AMT = attentive matrices test, FIM = Functional Independence Measure, ARSD = Aphasia Rating Scale for Depression, CCT = conventional cognitive training, ENPA = Esame Neuropsicologico Per l'Afasia", NOMS = National Outcomes Measurement System, ASHA QCL = American Speech and Language Hearing Association Quality of Communication Life Scale, TOM activity scale = therapy outcome measure activity scale, PAPT = Pyramids and Palm Trees Test, BNT = Boston Naming Test, AAT = Aachener Aphasia Test, FOQ-A = Italian Version of Functional Outcome Questionnaire for Aphasia, FAM = Functional Assessment Measure, QLQA = Quality of Life Questionnaire for Aphasics

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
817	M. Brady et al (2016). Speech and Language Therapy (SLT) for aphasia after stroke: Cochrane systematic review evidence of therapy regimens, delivery models and theoretical approaches. European Stroke Journal. 1(1 Supplement 1): 693.	In this huge and comprehensive review, eight sub-analyses relate to computer-based approached (15.1…16.2).	Variable. Somewhat out-of-date now as there have been many more studies since.	Variable. Related to speech output, language input (listening and reading) and functional communication.	No clear advantage for digital/tech over SLT delivered therapy, however, tech is an adjuvant (not instead of).	+ Rigorous methodology applied, albeit to small N studies. Main issue is that the comparisons should not be against SLT, rather a wait-list control or 'control' digital therapy (e.g. Wertz, 1981).
818	M. Braley et al (2021). A Virtual, Randomized, Control Trial of a Digital Therapeutic for Speech, Language, and Cognitive Intervention in Post-stroke Persons With Aphasia. 12.	Setting Virtual study. participants were recruited from the United States and Canada from March 2019 to November 2019. 32 patients with aphasia. At least 4 months post stroke. Design RCT 1:1 for intervention (Constant Therapy = CT-R) versus control (aphasia workbook) working on their own. At least one session 5 days a week Subjects 32 PWA Mean age = 61; mean time since stoke = 46 months; baseline Western Aphasia Battery (WAB-AQ) ~mid 60s with variable severity of aphasia; median years of education = 15.	Participants were instructed to use CT-R for at least 30 mins a day and at least 5 days a week. Multiple tasks across several language domains. Mostly impairment-based. Tailored by the therapist. The study participation lasted ~14 weeks, which included: recruitment and baseline assessment (−2 to 0 weeks), treatment period (0–10 weeks), biweekly check-ins (weeks 2, 4, 6, and 8) and follow-up assessment (10–12 weeks).	Primary was WAB-AQ. Secondary: 1) the Brief Test of Adult Cognition by telephone (BTACT) and 2) the Stroke and Aphasia Quality of Life Scale 39 (SAQOL-39)	The primary endpoint in the study was the average change on WAB-AQ. The CT-R group showed a higher mean point change WAB-AQ (M = 6.75) than the workbook group (M = 0.38). Using a linear mixed effects model, this change was significant at the 1% level. The significant group by time interaction indicated that on average, participants in the CT-R group had WAB-AQ scores of 6.36 points higher than the control group at follow-up than at pre-treatment that was significant (p <	++ High quality Well conducted RCT which demonstrates that CT-R can improve impairment-based measures of language.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					0.01, see Tables 2, 4 and Figure 4A). Effect size is above 5 which is considered the MICD. No significant effects on 2ndary outcomes.	
818	M. Braley et al (2021). A Virtual, Randomized, Control Trial of a Digital Therapeutic for Speech, Language, and Cognitive Intervention in Post-stroke Persons With Aphasia. 12.	Phase II randomised decentralised (virtual) trial. After assessment stratified randomisation was applied to assign participants to one of two groups. Subjects received either therapy at home delivered through Constant Therapy-Research (CT-R) – a digital therapeutic software programme accessible through a tablet – or practiced aphasia therapy workbooks at home for 10 weeks. The primary hypothesis was that self-managed, digital therapy under remote supervision would result in systematic and structured reinforcement-based practice of impairment-based therapy which would ultimately lead to greater language outcomes, as compared to the control group that did not received	Experimental Group (CT-R) were instructed to use the device for a least 30 minutes a day/at least 5 days a week. Control Group (Workbooks) were provided with a regime of standard, paper workbooks used for homework practice. Control participants were asked to complete at least 1 exercise within the workbook at least 5 days a week. On a biweekly basis from Week 2 through to 8 both groups completed a videoconference check in with a member of the research staff.	Primary outcome was change in the Western Aphasia Battery-R Aphasia Quotient (WAB-R AQ) Secondary outcomes – The Language and Cortical Quotients obtained from the WAB-R Parts 1 and 2. Additional secondary measures included scores on the Brief Test of Adult Cognition by Telephone (BTACT) and the Stroke and Aphasia Quality of Life Scale 39 (SAQOL-39)	Primary endpoint (average change on WAB-AQ) – adjusted for age and time post stroke (covariates) CT-R group was associated with a 6.43 point increase in WAB-AQ score relative to the workbook group at follow up than at pre-treatment baseline. Bivariate correlations revealed a significant moderate negative relation between age and difference on the post-pre WAB-AQ score ($r=-0.45$, $p<0.01$) but no significant relation between time since stroke in months and between education. Secondary endpoints – On the BTACT only the subtest verbal fluency	**+** Acceptable - Small sample size limits generalisability - Cannot say if an adequate concealment method was used. CT-R group had the added benefit that the study staff modified or updated their homework program whereas the control group did not which may have contributed to differences in the primary outcomes for the two groups.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		systematic structured practice. Subjects – 36 stroke survivors with aphasia. Mean age 61 years (SD=10), 18 Male, ave time post stroke 46 months (SD=47), mean years of education was 15 years (SD=2.6).			showed a significant effect of time, but no significant effects of group or interaction between group and time. On the SAQOL-39, the overall mean, Communication and Energy scores showed a significant improvement as a function of time, as the main effect of group or the interaction between group and time was not significant.	
819	Y. Cao et al (2021). Effects of virtual reality in post-stroke aphasia: a systematic review and meta-analysis. Neurological Sciences. 42: 12. 5249-5259.	Systematic review and meta-analysis . PWA following stroke (time post-onset not given), 5 studies in qualitative analysis and 4 studies in quantitative analysis, 4 random parallel group and 1 cross-over design.	Different types of VR devices and techniques. PWA were divided into the treatment group (isolated VR rehabilitation or in combination with other therapies) and control group (e.g., conventional speech therapy, waitlist), with other therapies being same for the treatment and control groups.	The primary objective was to evaluate the efficacy of VR compared with conventional intervention on functional communication (primary), word finding, repetition, severity of language.	Language impairment: borderline significance; no difference detected between groups for functional communication, word finding or repetition.	**+** Acceptable
820	A. Caute et al (2019). Technology-Enhanced Reading Therapy for People With Aphasia:	Setting: City University of London SLT clinic, own home, community centre.	Intervention: Immediate Tx	Primary – Gray Oral Reading Test Fourth Edition (GORT-4) presented (alternately) on assistive	GORT-4: Scores for assisted and unassisted reading across both groups at	**-** Low quality

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	Findings From a Quasirandomized Waitlist Controlled Study. Journal of speech, language, and hearing research. 62: 12. 4382-4416.	Design: RCT (randomised according to recruitment order and clinic schedules) Subjects: 21 people, mean age 56, with aphasia (min 4/12 post onset). No attrition.	Claro Software (PC or tablet) or Amazon Fire 7 Tablet Control: Delayed Tx (after 6/52) Claro Software (PC or tablet) or Amazon Fire 7 Tablet 14 sessions (1-2 setup sessions and 12x1hr 1:1 therapy sessions over 6 weeks) delivered by qualified and student SLTs	technology and as printed texts at all assessment points. Secondary – Reading Comprehension Battery for Aphasia Second Edition (RCBA-2); Reading Confidence and Emotions Questionnaire (RCEQ); Communication Activities of Daily Living Revised (CADL-2); Visual Analogue Mood Scales (VAMS); Assessment of Living with Aphasia (ALA). T1= baseline T2= 6 weeks T3= 6 weeks from T2 T4= 6 weeks from T3 for control only	T2 improved even though the delayed group had had no therapy. An effect for therapy on assisted reading comprehension is possible. Assisted reading scores significantly improved over time (unassisted reading did not, suggesting unassisted reading is not changed by therapy). Reading comprehension improved after therapy in the technology assisted format, and gains were maintained. RCBA-2: No evidence of change across all time points, indicating therapy benefits were compensatory rather than remedial. RCEQ: scores improved after therapy and maintained at follow-up	Results only applicable to those without severely impaired cognition or reading/auditory comprehension Several confounding variables not controlled for Short follow-up period – 6 weeks Low dose therapy Testing not blinded to group allocation or time point and carried out by the treating therapist Mean age of patients was 56

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					No treatment effect for CADL-2, VAMS or ALA	
821	L. R. Cherney et al (2019). Optimising recovery in aphasia: Learning following exposure to a single dose of computer-based script training. International journal of speech-language pathology. 21: 5. 448-458.	Non comparative study. 20 participants with chronic aphasia. Recruited from an urban freestanding rehabilitation centre.	Participants were exposed to 60 min of training, with or without a rest break, of a three-turn conversational script about either weather or traffic. Treatment was delivered via computer using a virtual clinician that visually modelled speech and guided treatment, promoting treatment fidelity.	Oral reading probes for script sentences were administered at baseline (3 times), mid-treatment, immediately post-treatment, and, at various times, up to 2 weeks post-treatment to track script acquisition and maintenance. The study also examined generalisation from a trained script to a conversation with a clinician via a generalisation probe at three time points: base line, immediately post-treatment, and 2 weeks post-treatment	Following exposure to one dose of script training, participants demonstrated statistically significant improvements in oral reading accuracy and rate of script production on trained probes. Participants also demonstrated significant change from baseline in generalisation to a conversation with a clinician.	No checklist. Non comparative study.
821	L. R. Cherney et al (2019). Optimising recovery in aphasia: Learning following exposure to a single dose of computer-based script training. International journal of speech-language pathology. 21: 5. 448-458.	Setting: USA Design: Cross-sectional study. The investigation examines the learning of conversational scripts in individuals with aphasia, in terms of short-term acquisition (i.e. immediately post-treatment) and maintenance (i.e. 2 weeks post-treatment) as measured by oral reading probes, as well as a generalisation from a trained	Comparison between participants who received 60-min doses of treatment with a 30-minute rest break and those who received continuous treatment. In addition, improvement in accuracy and rate of production on oral reading probes were measured from baseline to immediately after	To assess short-term acquisition and maintenance, oral reading probes were administered via the computer at baseline (three times), mid-treatment (MT), immediately post-treatment (PT), 30 min post-treatment (30m), 1 h post-treatment (1h), 2 h post-treatment (2h), 3 h post-treatment (3h), 1 d post-treatment (1d), 3 d post-treatment (3d), 1 week post-treatment (1w), and 2 weeks	None of the interactions were statistically significant, suggesting that changes from baseline for each outcome were similar across time points for traffic and weather training scripts. The number of sentence repetitions produced by the participants during the	No appraisal available for cross-sectional studies. Participants were randomised.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		script to a conversation with a clinician after a single dose (60-min session) of conversational script training. The script training was delivered via computer using a research version of a commercial script training programme for aphasia. Subjects: a convenience sample of 20 participants (6 females, 14 males) with chronic aphasia due to left hemisphere stroke. 17 with non-fluent and 3 with fluent aphasia. Mean age 59.6 and mean time post onset 55.1. Locations: urban free-standing rehabilitation centre.	treatment and baseline to 2 weeks after treatment as well as generalisation to a conversation at baseline and 2 weeks post treatment. The intervention included a virtual clinician online, a three-turn conversational script about either the weather or traffic was developed for this study	post-treatment (2w). intervening between the probes. To assess generalisation, the research speech-language pathologist elicited a conversation by providing the virtual clinician's lines from the trained script and allowing the participant to respond conversationally without the written script or any others cues. Generalisation probes were completed at three time points: once at baseline (B), immediately post-treatment (PT), and 2-weeks post	60 min of treatment was similar regardless of condition (i.e. rest or continuous). A mean of 153 repetitions for the rest condition and 150 repetitions for the continuous practice condition. Exposure to a single dose (60 min) of computer-based training of a three-turn script is sufficient for learning with maintenance for up to 2 weeks. The single dose of treatment resulted in statistically significant improvements in the accuracy of script production in a conversation immediately post-treatment and these were maintained for at least 2 weeks	
822	L. R. Cherney et al (2021). Web-based Oral Reading for Language in Aphasia (Web ORLA): A pilot randomized control trial. Clinical rehabilitation. 35: 7.	Setting: United States - Study procedures carried out in a rehab hospital. Treatment completed in patients' homes Design: Single blind RCT	Web ORLA (Oral Reading for Language in Aphasia) with anthropomorphically accurate virtual therapist 90 mins/day for 6 days/week for six weeks	Change in Language Quotient* of the Western Aphasia Battery-Revised a) from pre-treatment to post-treatment and b) pre-treatment to six weeks following the end of treatment	No significant differences between the groups on demographic variables or practice time. No data for control group performance at	**++** High quality

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	976-987.	Subjects: 32 people with aphasia >6 months after stroke.	Control: Bejewelled 2 computer game	*Reading and Writing subtests in addition to Spontaneous Speech, Comprehension, Repetition, and Naming.	either time period is given. Significant improvement in language scores in treatment group after 6 weeks and increase in scores at 6-week follow-up. However, no significant difference in scores post treatment between groups.	
822	L. R. Cherney et al (2021). Web-based Oral Reading for Language in Aphasia (Web ORLA): A pilot randomized control trial. Clinical rehabilitation. 35: 7. 976-987.	Setting: Participants were recruited from across the United States. Study procedures, including pre- and post treatment assessments and computer training, took place at a free standing urban rehabilitation hospital. Participants completed the experimental treatment and control computer activity remotely at home from loaned laptop computers. The inclusion/ exclusion criteria were adults with chronic aphasia (at least six-month post onset). Design: RCT A single blind, randomized placebo-controlled design was used to evaluate the efficacy of	Both groups were instructed to practice 90 minutes a day, six days a week (i.e. nine hours of computer treatment per week) for a total of six weeks. Participants could practice either three 30-minute session per day or two 45-minute sessions per day, six days a week. Aiming for 54 hours in total. Almost achieved (~50 hours in total). Multiple tasks across several language domains. Mostly impairment-based. Tailored by the therapist.	The primary outcome measure was the WAB-R Language Quotient. Expectation was a 5 point change.	Main group comparison was not significant. ORLA group did improve over time pre-immediately post treatment and again at 6 week follow up. But changes in WAB-AQ were >5, which is considered the MICD.	**+** Good quality Well conducted RCT which used minimization appropriately. Unclear why 3:2 ratio used as this damaged the power to detect changes across the groups. Within group changes less impressive as no control for time effects and outcome measure may be blunt / did not investigate reading alone.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Web ORLA vs Bejeweled 2 (selected as the placebo), attention control computer task. 3:2 ratio. Subjects: 35 PWA, Mean age = 57; mean time since stoke ~50 months; baseline WAB-AQ ~60s with variable severity of aphasia; median years of education = 15.	The study participation lasted ~14 weeks, which included: recruitment and baseline assessment (−2 to 0 weeks), treatment period (0–10 weeks), biweekly check-ins (weeks 2, 4, 6, and 8) and follow-up assessment (10–12 weeks).			
823	E. De Cock et al (2021). The feasibility, usability and acceptability of a tablet-based aphasia therapy in the acute phase following stroke. Journal of Communication Disorders. 89.	Setting: Between September 2018 and December 2019, at the stroke unit of Ghent University Hospital. Design: Cohort. Feasibility Subjects: 25 PWA caused by recent stroke. Mean age = 65; median time since stoke ~ 5 days; variable severity of aphasia; median years of education = 15.	'STAPP' is a newly-developed online therapeutic application for Dutch-speaking people following brain damage and consists of two separate modules, the Therapeutic Instrument for Speech Apraxia (TIAS) and the Module Specific Treatment (MST) for language rehabilitation. The language exercise program MST is a type of cognitive-linguistic therapy, aimed at restoring specific impaired language processes according to the neurocognitive model of Ellis & Young.	Feasibility of tablet-based aphasia therapy in the acute phase following stroke was determined by measuring recruitment, adherence and retention rates. Also measured independence, usability and acceptability.	All participants but one (23/24) practiced with the language app until the end of hospitalization (retention rate = 96 %). 10 participants practiced at least 30 in/day (adherence rate = 42%). Participants reported they learned to work quickly with the app (92% agreed/totally agreed), the app was easy to use (88% agreed/totally agreed), they could work independently (79% agreed/totally agreed), practiced their language (67%	**+** Good quality Well conducted feasibility study.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					agreed/totally agreed) and wanted to continue working with the app at home (79% agreed/totally agreed). Acceptability was high (median satisfaction rate 91% agreed/totally agreed; IQR = 75–100).	
823	E. De Cock et al (2021). The feasibility, usability and acceptability of a tablet-based aphasia therapy in the acute phase following stroke. Journal of Communication Disorders. 89.	Prospective observational study Feasibility study Convenience sample Single Centre (Belgium) Small scale n=25 Patients with aphasia following stroke (< 2 weeks)	Tablet based aphasia therapy. STAPP online tool for Dutch speaking people following stroke. 2 modules; therapeutic instrument for apraxia (TIAS) and module specific treatment for language rehab (MST)	Feasibility of tablet-based aphasia therapy determined by recruitment, adherence, and retention rates	Small numbers recruited (but more than in comparable studies) Adherence good overall but for not for the required time Retention 97%.	– App for Dutch speaking people. Not sure if available in English Small numbers Single centre Feasibility study so no control/comparison. Had daily face to face SLT visits to monitor, give guidance and training. This helped with retention but is not sustainable in the 'real world'
824	R. De Luca et al (2018). Computerized Training in Poststroke Aphasia: What About the Long-Term Effects? A Randomized Clinical Trial. Journal of Stroke and Cerebrovascular Diseases. 27: 8. 2271-2276.	Setting: Presumably as outpatients at the Laboratory of Robotic and Behavioral Rehabilitation of the IRCCS Research hospital (Italy) but not specifically stated. Design: RCT	Experimental group – Computer based training with Power-Alfa PC software. Control group – standard cognitive rehab for language disorders Both groups had 3 sessions of 45 mins a week for 8 weeks	(1) TT Token Test (language comprehension) (2)NPEA neuropsychological exam for aphasia (evaluates language impairment) (3) Trail Making Test (evaluates cognitive abilities) (4) CAT (constructional apraxia test) and IMA (ideomotor apraxia test) for evaluation of praxis abilities	Data is not fully accounted for and difficult for the reader to extract any clear meaning. Scores for all outcomes at each stage are not reported. Authors report scores of FIM, ARSD, and AMT as these affected by the type of treatment.	- Low quality The translation from Italian to English makes the article difficult to read and interpret at times. The activities carried out in both groups are not explicitly stated as being identical and from description, do not appear to be the same. There is no

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Subjects: 32 patients post-stroke with first left ischaemic CVE		(5) AMT (attentive matrices test) to evaluate visual selective attention. (6) FIM Functional Independence Measure (7) ARSD Aphasia Rating Scale for Depression All above were measured at T0 – Baseline T1- Post treatment T2 – 3 months post treatment	TT, CAT, IMA scores not affected by treatment type and not reported. There was significant improvement in FIM scores for both groups over both time periods. The intervention group scored significantly better then the control at 3 months. Intervention group scored significantly better than control in ARSD and AMT for both time periods NPEA – significant improvement in repetition, denomination, and reading scores only in EG patients Trail Making Test outcome which evaluates cognitive abilities is not mentioned in the results at all which is surprising considering the important link the	data regarding within or between group compliance with therapy minutes. Any attrition is not accounted for. The data is not fully accounted for and is not presented in a way that facilitates easy scrutiny. Authors conflict of interest is not stated.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					authors make between aphasia recovery and cognition.	
824	R. De Luca et al (2021). Virtual reality as a new tool for the rehabilitation of post-stroke patients with chronic aphasia: an exploratory study. Aphasiology.	RCT. 30 patients with non-fluent aphasia due to ischemic stroke, mean 6 months post-stroke, admitted to the IRCCS Centro Neurolesi Bonino Pulejo (Messina, Italy) between January 2018 and May 2019.	Active group underwent virtual reality training (VRT) with the semi-immersive VR device "BTS Nirvana". Control group underwent conventional cognitive training (CCT). Both groups performed the training 3 days a week for 8 weeks; 24 sessions in total, each session lasting about 45 minutes.	Assessments at baseline (T0), at the end of the 8-week protocol (T1), and at 6-month follow-up (T2) using Token Test (to evaluate oral comprehension), "Esame Neuropsicologico Per l'Afasia" (ENPA) which assessed Aphasia for naming, comprehension, repetition, reading and writing, calculation	After training, at T1, the experimental group achieved a greater improvement in Token test, reading, naming, and calculation than the control group. These positive outcomes were maintained at the 6-month follow-up (T2)	- Low quality, no information given on allocation concealment or whether outcome assessors were blinded and brief information provided on randomisation
824	R. De Luca et al (2021). Virtual reality as a new tool for the rehabilitation of post-stroke patients with chronic aphasia: an exploratory study. Aphasiology.	Messina, Italy, inpatient rehab unit Small scale single site RCT n=30 (15 intervention; 15 control) non-fluent aphasia mean age 51.2 (SD 11.3) mean time post stroke 6 months (SD 1.0) "the aim of this study is to assess the efficacy and the duration of the aftereffects of a VR-based training (using an advanced semi-immersive VR system, namely BTS-	3 x 45 min sessions weekly for 8 weeks Experimental group via BTS-Nirvana. Control group performed the same tasks via face to face SLT. Tasks included phonological, semantic, morpho-syntactic and writing.	Measures taken at: T0 = baseline T1 = at end of 8 week intervention T3 = after 6 months. Token Test (auditory comprehension) "Esame Neuropsicologico Per l'Afasia" (ENPA) (naming, comprehension, repetition, reading and writing, calculation (Capasso & Miceli, 2001).	Authors report significant gains in scores at T1 in the experimental group across all measures.. Report also further gains from T1 to T2 for Token test, repetition, naming, and calculation.	- Low quality on SIGN checklist Study aim difficult to interpret due to reviewer's lack of knowledge about VR system under investigation (BTS-Nirvana) Authors report randomisation but do not report methods for this. Small scale study

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Nirvana, in comparison to conventional training) in the treatment of patients with post-stroke chronic aphasia, with particular regard to comprehension, repetition, reading, writing, naming, and calculation abilities."p.3				Authors acknowledge small sample size and conclude that findings support feasibility of VR. Inpatient setting admitting patients at 6 months so not transferable to UK context.
826	V. Fleming et al (2021). Efficacy of spoken word comprehension therapy in patients with chronic aphasia: A cross-over randomised controlled trial with structural imaging. Journal of Neurology, Neurosurgery and Psychiatry. 92: 4. 418-424.	Design: Cross-over randomised repeated measures design. Researcher was blinded to the identity of the participants during randomisation. Setting and subjects: Patients with chronic aphasia recruited from a UK database (PLORAS), a local aphasia clinic and focus groups n= 35.	Therapy (self-managed spoken word comprehension therapy app (Listen-in). Target dose 100 minutes per day versus standard care (Usual daily activities). Intervention=12 weeks	1. Spoken language comprehension on 2 standardised subtests of spoken words and spoken sentences. 2. Measure comprehension of trained and untrained spoken word.	Individuals with chronic aphasia can significantly improve their comprehension of spoken words many years after stroke.	**++** Improvements were seen but within a well-controlled RCT and a highly specific population. Listen-in needs to be trialled in the 'real world setting'. Optimal dose, intensity, and distribution is not clear from this study.
827	M. Harrison et al (2020). Factors Associated With Adherence to Self-Managed Aphasia Therapy Practice on a Computer-A Mixed Methods Study Alongside a Randomized Controlled Trial. Frontiers in Neurology. 11.	Setting: Multi-centre. The Big CACTUS trial recruited participants from National Health Service (NHS) speech and language therapy departments across the UK, aphasia support groups and advertisements displayed in public places. Design: Cohort. A concurrent triangulation mixed methods approach was	The tele-rehabilitation intervention, referred to as the StepByStep© computer therapy approach for the NHS, comprises the specialist StepByStep© aphasia software, with therapy set-up including personalization of vocabulary and tailoring of the exercises	1) Quantitative: establish which of the demographic, clinical, and intervention variables (i.e., independent variables) were associated with the dependent variable (total practice time). 2) Qualitative data were analysed using thematic analysis, to identify from the patient and carer perspective the factors associated with adherence to aphasia computer therapy.	Quantitative: 1. Males practiced more than females. 2. There was a weak positive correlation between total computer therapy practice time and number of years post-stroke (r=0.23, n=85, p=0.04). 3. Total practice time was positively correlated with	**+** Good quality Well conducted mixed methods study aimed at exploring the factors associated with adherence to self-managed aphasia computer therapy practice

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		adopted to explore the factors associated with adherence to aphasia computer therapy. Subjects: 85 PWA caused by recent stroke. Mean age = 66; mean time post stroke = 2.4 years; variable severity of aphasia.	according to the individual's impairment provided by a SLT.		therapist time spent supporting participants. Qualitative: 3 themes influenced by the COM-B (Capability, Opportunity, Motivation, Behaviour) system: capability to use the computer therapy, having the opportunity to practice, and motivation.	
827	M. Harrison et al (2020). Factors Associated With Adherence to Self-Managed Aphasia Therapy Practice on a Computer-A Mixed Methods Study Alongside a Randomized Controlled Trial. Frontiers in Neurology. 11.	Setting: NHS settings-diagnosis 4 months before randomization. Design: Mixed methods exploration of adherence to home computer asynchronous tele-rehabilitation. The larger trial evaluated the effectiveness of self-managed aphasia computer therapy. This study reported on the secondary analysis data from participants randomized to the computer therapy group to investigate if there were ant demographics, clinical or intervention variables	The tele-rehabilitation intervention, was StepByStep computer therapy approach for the NHS, comprises the specialist StepByStep© aphasia software, with therapy set-up including personalization of vocabulary and tailoring of the exercises according to the individual's impairment provided by a SLT. On-going support was provided by a volunteer or therapy assistant to enable the PWA to carry out independent practice. PWA were	Qualitative data: The first step was to establish which of the demographic, clinical, and intervention variables (i.e., independent variables) were associated with the dependent variable (total practice time). To achieve this, bivariate analyses were conducted using a correlation matrix for continuous variables, independent samples t-tests for binary categorical variables, and one-way ANOVA for categorical variables with two or more categories. All independent variables found to be significantly associated (p <	The amounts of practice is hugely variable, adherence is influences by a number of factors. 3 themes 1) capability to use the computer 2) opportunity to practice (external influences and tech issues) 3) motivation. The sensitivity analysis found that participants were more likely to practice when they received increased support from SALTs. However,	No appraisal for mixed methods research. Limitation of using data collected for the purposes of the trial, possible important variables relating to adherence, identified in the qualitative interviews, were not measured quantitatively as the variables available were designed for the reporting of the RCT and not designed specifically for the exploration of adherence. Results from the intervention variables-interpret with caution than

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		associated to adherence to therapy practice. A subsample of the larger trial also took part in qualitative interviews exploring the factors perceived to influence the amount of aphasia computer therapy undertaken. Interviewees were analysed thematically, and a convergence coding matrix was used to analyse findings. Subjects: aged over 18 years. 85 participants for the larger study were included in the qualitative analysis. Practice data for three months had to be available for them to be included. Maximum sample variation methods were used. No statistical difference between age and group means. (although a slight gender bias towards male participants). Interviews with 11 patients and 12 informal carers. Nine interviews included the PWA and carer, three were carer only interviews and two were PWA-only interviews. All carer only interviews were conducted with the carers of low adhering	recommended to carry out 20–30 min of therapy per day over a 6-month period. This information was conveyed by the SLT and/or volunteer during a face-to-face demonstration of how to use the therapy. All support from SLTs or volunteers/assistants was provided via face-to-face contact, email, or telephone. The therapists were required to set up the computer therapy with tailored exercises and personally relevant practice items and provide a demonstration of how to use the therapy, but the number of contacts was not specified. Adherence to Computer Aphasia Therapy Volunteers or therapy assistants were asked to provide 1 h of support per month. Support was recorded for 90% of participants (86/96) and one participant declined to receive the support offered. A median of 4 h	0.05) with total practice time were included in a multiple linear regression model. The model was adjusted for age and gender. Convergence matrix: The triangulation approach combined the "following a thread" method, whereby each finding from one dataset is followed across to the other dataset and applying a "convergence coding matrix," in which the findings from each study are displayed together along with consideration of the extent to which the findings converge. Factors associated with adherence identified in the qualitative interviews acted as the thread, which was followed across and searched for in the quantitative findings. The qualitative data continued to be grouped according to the COM-B system enabling the quantitative data to be considered in light of this behaviour change model.	this was not supported by regression modelling. Caution on this finding. Greater length post-stroke was associated with higher adherence to self-managed computer therapy. Weak positive correlation between total computer time and the number of years post-stroke. A tend toward those that had not received care in the last three month practising more. No statistically significant difference between practice and different types of aphasia or between apraxia of speech and practice. Whilst there was a trend for participants using the most portable device (tablet) to practice most and the least portable device (desktop computer) to	the demographic and clinical variables as they are not time-dependent and it is possible that the amount of practice completed could have influenced the amount of support provided or length of access, rather than the other way round.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		patients. Of the PWA participating, or described in a carer-only interview, the mean age was 65 years old (ranging from 48 to 85) and 10/14 were male. The mean practice time for high adhering (HA) participants was 67 h 21 min, and for low adhering (LA) participants, 13 h 13 min. Mean time between 6-month intervention period and participation in the interview was 247 days.	15 min of support was provided.		practice least, the number of participants in the 3 groups was unequal and a one-way ANOVA showed that the difference was not statistically significant. The psychological capability of participants to adhere to regular practice was impeded by fatigue or cognitive issues.	
828	M. Jacobs et al (2021). Telepractice Treatment for Aphasia: Association Between Clinical Outcomes and Client Satisfaction. 2: 1. 118-124.	Setting: USA, Telepractice aphasia rehabilitation delivered via a videoconferencing program that allowed real-time exchange of video and audio at a designated community location. Design: Cohort study, each participant scheduled to complete completing 12 treatment sessions for a 6-week period Subjects: 22 stroke PWA. Ave 42.5 months post stroke onset (Range 1-288 months post onset). Mean Age 61, Education level average 14.0 years (post high school).	Language Orientated Treatment (LOT) delivered via videoconferencing program through Webex.	- Aphasia impairment was measure pre and post treatment using WAB-R AQ. Impairment change scores were calculated based on pre- and post- impairment. - Post-treatment satisfaction to the telepractice approach was assessed using the Client Satisfaction Questionnaire-8 (CSQ-8) among stroke survivors that reside in rural areas and potential correlations between satisfaction and patient outcomes.	- WAB-R AQ scores increased on average 4.64 points. - Mean scores on the CSQ-8 averaged 31/32. Each 1 unit of improvement in patient satisfaction was associated with 1.75 increase in WAB-R AQ.	**0** Unacceptable – Reject Heterogeneous group (aphasia severity). Small sample size which necessitated Bayesian estimation to enable statistical inference. Potential for range of confounding factors in interpretation of satisfaction scores e.g., treatment was delivered primarily by 1 therapist, potential for participants to misinterpret the outcome scales due to presence of aphasia, novelty of telepractice approach.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
828	M. Jacobs et al (2021). Telepractice Treatment for Aphasia: Association Between Clinical Outcomes and Client Satisfaction. 2: 1. 118-124.	Non-comparative study. N = 22 participants were recruited locally from local inpatient and outpatient clinics at a local hospital, Veterans Administration health care clinic, and community senior centres, All potential participants resided in rural counties in eastern North Carolina, defined as population density <80 people per square mile. Average onset post-stroke 42 months.	Participants were scheduled to complete 12 treatment sessions for a 6-week period. The general aphasia treatment used through telepractice was the language-oriented treatment (LOT). The aphasia rehabilitation treatment was delivered by Lenovo T570 ThinkPad laptop computers with 15† monitors through Webex, a cloud-based videoconferencing program that allows real-time exchange of video and audio. Participants also received individualized programmes to address aphasia-related deficits.	Impairment change scores were calculated based on pre- and post-treatment of the WAB-R AQs Western Aphasia Battery-revised (WAB-R) aphasia quotients.	Patients improved on WAB-R AQ between 0.2 and 12.4 U with an average of 4.64 U. Typically, a 5-point improvement on WAR-AQ is considered a clinically relevant change, so not clinically relevant but stated as relevant by the authors. No statistical significance calculated.	Not required. Non-comparative study.
829	M. Jacobs et al (2021). Marginal assessment of the cost and benefits of aphasia treatment: Evidence from community-based telerehabilitation treatment for aphasia. Journal of telemedicine and telecare.	Setting: USA, Community based aphasia telerehabilitation treatment delivered via a videoconferencing program that allowed real-time exchange of video and audio. Design: Cohort/economic evaluation study, each participant completed 12	Language Orientated Treatment (LOT) delivered via Webex videoconferencing program delivered at a community-based site.	- improvement on the Western Aphasia Battery-Revised (WAS-R) Aphasia Quotient (AQ) following telerehabilitation treatment. Marginal improvement indicates the additional point (s) of improvement after initial ax. - 'Marginal cost' associated with a one-point improvement in the WAB-R	- Marginal aphasia treatment outcome - 13/18 participants demonstrated improvement in WAB-R AQ score (Ave. 5.36 (SD 6.76). Significant variation by race/ethnicity, aphasia type, age and education. Compared	**0** Unacceptable – Reject Heterogeneous group (aphasia type/severity and age/education, race). Small sample size which necessitated Bayesian estimation to enable statistical inference. Intervention used a broad treatment approach rather than a specific treatment to

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		telerehabilitation sessions of 45-60 mins within 6 weeks. Subjects: 18 stroke PWA. Variety of aphasia types (anomic, Broca's, Conduction, Global). Mean Age 58.78, Ethnicity predominantly white, Education level average 14.22 years (post high school).		AQ. Marginal costs refers to the additional cost incurred above the baseline value. Therapeutic benefit and marginal cost improvement across all participants and separately for those who improved versus those who did not.	to anomic aphasia (reference group) those with global aphasia had the largest improvement. Marginal cost – Cost of improvement in 13 individuals with an increase in WAB-R AQ ranged from US$89 to US$864 (Mean=US$200) for each one point of improvement for those who improved. Those with mild aphasia symptoms exhibited the highest cost per improvement point (i.e., least cost effective group). The best cost per point of improvement was achieved by individuals within the first 18 months of aphasia onset and those with the most severe aphasias.	address a specific aphasia modality. No control group. Cost measured from the provider perspective. Cost analysis limited to cost of improvement and did not account for other costs. Generalisations should be made with caution.
829	M. Jacobs et al (2021). Marginal assessment of the cost and benefits of aphasia treatment: Evidence from community-based	Non-comparative study. Assessed the benefit of telerehabilitation in N= 18 of chronic PWA, large range of post-onset times, recruited from the eastern region of North Carolina (NC). Local	Telerehabilitation using LOT approach delivered by Webex videoconferencing program. Designed to address a range of	Change in the WAB-R aphasia quotient (AQ) pre- and post-treatment. Evaluated cost by calculating the change in WAB-R AQ with	13/18 participants demonstrated improvement showed an average of 5.36 (SD ¼ 6.76) points of improvement on the WAB-R AQ, which is	Non -comparative study so no checklist. Not scored/ completed fully. Please note I have no experience in analysing economic studies and did

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	telerehabilitation treatment for aphasia. Journal of telemedicine and telecare.	inpatient and outpatient clinics at a local hospital, Veterans Administration healthcare clinic and community senior centres. Also cost evaluation	language issues among individuals with aphasia. Each participant completed 12 telerehabilitation rehabilitation sessions within a six-week time frame and sessions lasted 45–60 min. Evaluating cost of providing telerehabilitation using LOT approach in patients of different ages, ethnic groups and aphasia severities.	average cost per treatment (cost to provider)	considered clinically significant change but no comment on statistical significance. The best cost per point of improvement was achieved by individuals within the first 18 months of aphasia onset and those with the most severe aphasias (conduction and global aphasia).	not feel I could score all the questions.
830	M. Jacobs; C. Ellis (2021). Estimating the cost and value of functional changes in communication ability following telepractice treatment for aphasia. PLoS ONE. 16.	Setting: USA, Telehealth aphasia rehabilitation delivered via a videoconferencing program that allowed real-time exchange of video and audio. Design: Cohort/economic evaluation study, each participant completing between 5-12 telehealth rehabilitation sessions of 45-60 mins within 6 weeks. Subjects 20 stroke PWA. Variety of aphasia types (anomic, Broca's, Conduction, Global). Mean	Intervention Language Orientated Treatment (LOT) delivered via videoconferencing program delivered at a community-based site.	- Change in functional outcome measured by NOMS (National Outcomes Measurement System) - Quality of communication life measured by ASHA QCL (American Speech and Language Hearing Association Quality of Communication Life Scale). - Aphasia costs – total cost of all treatment sessions attended. Value – Pre and post ASHA QCL used to calculate the value of treatment and a monetary value was derived as the relative cost of care.	African Americans (OR=2.0917) twice as likely as White Americans to experience improvement after treatment. Likelihood of improvement increases with each additional year of education (OR=1.02) but decreases with age (OR=0.963). 15 PWA showed improvement in NOMS comprehension. 9 showed improvement	**0** Unacceptable – Reject Heterogeneous group (aphasia type/severity and age/education, race). Small sample size which necessitated Bayesian estimation to enable statistical inference. Generalisations should be made with caution.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Age 60.9, Ethnicity 75% (N=15) white, Education level ave. 14.6 years (post high school).			in NOMS verbal expression. Average cost of improvement in NOMS comprehension was US$1,152 per patient and NOMS verbal expression was US$1,128 per patient with individual treatment costs varying between US$540 and US $1,296. Monetary equivalent in patients improved QCL was between US$1,709.39 to US$3,912.54.	
830	M. Jacobs; C. Ellis (2021). Estimating the cost and value of functional changes in communication ability following telepractice treatment for aphasia. PLoS ONE. 16.	Non-comparative study N=20 participants (PWA)	Individuals with aphasia received the Language-Oriented Treatment (LOT) at a remote community-based site (local school or senior centre). Each participant completed between 5 and 12 telehealth rehabilitation sessions of 45–60 minutes within a 6-week time frame.	National Outcomes Measurement System (NOMS) to measure change in functional communication and American Speech Language and Hearing Association Quality of Communication Life Scale (ASHA QCL)	Statistical pre- and post- change not given. Authors note that mean values are not adequate to determine the statistical relevance of these observations given that the measurements were completed on a Likert scale and a range of sociodemographic characteristics contribute to clinical outcomes. Bayesian modelling used to look	Non-comparative study. No checklist. Economic part not scored

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					at likelihood of improvement based on various factors such as age.	
831	C. Johansson-Malmeling et al (2022). Using a digital spelling aid to improve writing in persons with post-stroke aphasia: An intervention study. International journal of language & communication disorders. 57: 2. 303-323.	Setting – Sweden, location unclear although participants reported to attend sessions. Design - Multiple baseline single-case experimental design replicated across 6 participants. 5 dependent variables were measured on 16 occasions; 8 with and 8 without the spell checker activated during writing. Pre and Post assessments involving various tests and questions were also performed. Participants were also interviewed about their experiences after the intervention. Subjects – 6 males aged between 62-76 years with mild-moderate non-fluent aphasia, with an above average level of education	Investigate the impact of a digital/computerised spell checker on text writing which consisted of 60 min sessions x 2 a week for 8 weeks. Key stroke logging tool was used for all written tasks and the spell checker software was integrated with the logging tool. Treatment protocol documented how the training was organised, how each participant handled the software, what pictures were used, and whether any special circumstances had affected a day's session.	- Primary outcome measures: (i) spelling accuracy (ii) syntactical complexity (iii) rated syntax (iv) writing speed (v) proportion of unedited text. To capture generalisation effects, all measures were also collected in text writing without the spell checker active. Secondary outcome measures were: scores on tests (spelling to dictation, written naming, spoken naming and word fluency), findings on a questionnaire on self-rated quality of life, findings from a questionnaire on reading and writing habits administered before and after the intervention and findings conducted 1 month after the intervention.	- At group level statistically significant improvements were seen for spelling accuracy (Diary entry, p=0.002; Picture elicited test (PET), p=0.002), rated syntax (PET, p=0.025), writing speed (DE, p<0.001; PET, p=<0.001) and proportion of unedited text during writing (DE, p=<0.001; PET, p=0.025) but not syntactical complexity when using the spell checker. - Statistically significant generalisation effect on group level to writing without the spell checker for writing speed (DE, p=<0.001; PET, p=<0.001) and proportion of unedited text (DE, p=<0.001; PET, p=0.013).	**+** Adequate No appropriate SIGN checklist therefore JBI guidance was used. Clear inclusion/exclusion criteria and method of measurement was clearly described/visualised. Not all measurement tools were validated. Questionnaire used to evaluate change in reading and writing habits was not validated for PWA. Did not have consecutive/complete inclusion of participants. Partial reporting of demographics/clinical information of the participants. Outcome of the results were clearly reported. Statistical analysis appeared appropriate.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					- No significant differences at group level for the written naming, spoken naming and word fluency scores. Analysis of logged dictation task showed significantly significant higher scores after the intervention than before it (p=0.027) bit no significant difference in terms of the amount of editing was found. - Analysis of the responses of SAQoL-39 although there was an increase this was not statistically significant. In the interviews all participants expressed the opinion that participating in the intervention had been a positive experience.	Clearly focused questions. Aims and objectives are clearly stated. Limitations of the study are clearly stated. Small sample size (N=6) which may limit the generalisability of the findings.
832	N. R. Latimer et al (2021). Self-managed, computerised word finding therapy as an add-on to usual care for chronic aphasia post-	Setting and subjects: PWA who took part in the BIG CACTUS study. Design: A Markov model was used. The model had the following compartments: Aphasia (where all started),	The tele-rehabilitation intervention, referred to as the StepByStep© computer therapy approach for the NHS, comprises the specialist	Incremental cost-effectiveness ratios (ICER) were calculated, comparing the cost per quality adjusted life year (QALY) gained for each intervention. Credible intervals (CrI) for costs and QALYs, and probabilities of	Adding computerised word finding therapy to usual care had an ICER of £42,686 per QALY gained compared with usual care alone (incremental QALY	- Poor quality Nothing wrong with the analysis, but using the EQ-5D-5L to estimate QUALs is fundamentally flawed as the measure is insensitive to language function.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	stroke: An economic evaluation. Clinical rehabilitation. 35: 5. 703-717.	Good response 6mo, Good response 9mo, Good response 12mo, dead. Patients moved between compartments based on response to Step-by_step therapy. Model was also informed by QALYs gained*time spent in each compartment. The QUALYs were measured using the EQ-5D-5L.	StepByStep© aphasia software, with therapy set-up including personalization of vocabulary and tailoring of the exercises according to the individual's impairment provided by a SLT.	cost-effectiveness, were obtained using probabilistic sensitivity analysis.	gain: 0.02 per patient (95% CrI: −0.05 to 0.10). Speech and language therapist time was the predominant cost driver – the 7.13 hours per-patient spent setting up and supporting computerised therapy contributed 44% of the total computerised therapy cost.	
833	M. Lavoie et al (2017). Effectiveness of technologies in the treatment of post-stroke anomia: A systematic review. Journal of Communication Disorders. 65. 43-53.	Systematic review n=23 studies Subjects: people with post stroke anomia (some included post TBI), total 170 participants, time since onset 1 month - 29 years.	Treatments for anomia delivered by technology. Mixed self management and directed by clinician approaches. Most used computers, a few used tablets, none used smart phones.	Outcomes data extracted from studies: 1) improvement in naming abilities; 2) generalisation to untrained items; 3) functional impact of the therapy in everyday life (e.g., impact of treatment on communication quality, transfer to conversational speech).	2x RCTs 20 x single case studies 1 x group study 1) all studies showed improvements in trained items 2)generalisation and 3)maintenance results more mixed (either not studied or variable results). Very wide variation in time post-onset and type of treatment administration.	+ SIGN checklist criteria met and quality overall good. However, authors noted 21/23 studies included of low quality. Followed PRISMA statement Clear inclusion criteria. Grey literature searched Studies selected by two people Reasons for exclusion given in PRISMA flow chart Two people extracted data Included studies described and quality assessed.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					Authors conclude that computer/tablet approaches are "efficient" but results do not show sufficient evidence of effectiveness, particularly generalisation to functional communication.	
833	M. Lavoie et al (2017). Effectiveness of technologies in the treatment of post-stroke anomia: A systematic review. Journal of Communication Disorders. 65. 43-53.	Setting: Clinical or home setting with or without the clinician Design: Systematic review of 23 studies (randomised or non-randomised trials or case studies, with or without control groups) Subjects: 170 people diagnosed with post stroke aphasia	Treatments delivered by technology (computer or smart tablet) in the management of post-stroke anomia.	1) improvement in naming abilities. 2) generalisation to untrained items. 3) functional impact of the therapy in everyday life.	All studies showed a significant improvement with trained words, regardless of the technology used and administration method. Patients post-stroke with computer therapy improved significantly more than participants without therapy. Tech therapies focus mostly on noun retrieval (more verb therapies needed). Improvements maintained for up to 1 year with computer	**+** Acceptable Studies included 2x RCT (class I evidence, both treatment with computer) 1Xgroup, 20 x single subject (class III evidence) Heterogeneity in reporting of variables known to influence a) treatment outcomes and b) measures of the magnitude of change. Only time post-onset and type of treatment administration could be accurately compared between the studies Technological methods for treatment of anomia are

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					regardless of clinician presence. Treatment by computer or smart tablet is effective, regardless of the time post-onset.	effective compared to no treatment regardless of time post-onset in chronic aphasia. Both clinician and self-administered treatment are effective
834	Cacciante, L et al (2021). Telerehabilitation for people with aphasia: A systematic review and meta-analysis. 92.	Systematic review and MA. Participants with post-stroke aphasia and mixed impairments in linguistic functions and remotely provided treatments of linguistic functions and communication abilities. 5 studies were included (3 RCTs and 2 non-randomised RCTs) with 132 participants.	Telerehabilitation versus face-face-therapy.	Auditory comprehension, naming accuracy, Western Aphasia Battery Aphasia Quotient WAB AQ, generalization post-intervention, functional communication post-intervention.	TR seemed to be non-inferior to conventional treatment, suggesting speech and language treatment provided via videoconference could bring similar benefits as those obtained from the conventional face-to-face treatment.	**++** High quality
835	R. Palmer et al (2019). Self-managed, computerised speech and language therapy for patients with chronic aphasia post-stroke compared with usual care or attention control (Big CACTUS): a multicentre, single-blinded, randomised controlled trial. The Lancet Neurology. 18: 9. 821-833.	Setting Multi-centre. The Big CACTUS trial recruited participants from National Health Service (NHS) speech and language therapy departments across the UK, aphasia support groups and advertisements displayed in public places. Design: RCT. Participants were randomly assigned (1:1:1) to either 6 months of	The telerehabilitation intervention, referred to as the StepByStep© computer therapy approach for the NHS, comprises the specialist StepByStep© aphasia software, with therapy set-up including personalization of vocabulary and tailoring of the exercises according to the individual's impairment provided by a SLT.	Co-primary outcomes were the change in ability to retrieve personally relevant words in a picture naming test (with 10% mean difference in change considered a priori as clinically meaningful) and the change in functional communication ability measured by masked ratings of video-recorded conversations, with the use of Therapy Outcome Measures (TOMs), between baseline	1. Word finding improvement was 16·2% (95% CI 12·7 to 19·6; p<0·0001) higher in the CSLT group than in the usual care group and was 14·4% (10·8 to 18·1) higher than in the attention control group 2. No significant change in Tom measure between groups.	**++** Excellent quality RCT Well conducted study

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		usual care (usual care group), daily self managed CSLT plus usual care (CSLT group), or attention control plus usual care (attention control group) with the use of computer-generated stratified blocked randomisation (randomly ordered blocks of sizes three and six, stratified by site and severity of word finding at baseline based on CAT Naming Objects test scores). Subjects: 278 PWA caused by recent stroke. Mean age = 66; mean time post stroke = 2.4 years; variable severity of aphasia.		and 6 months after randomisation (with a standardised mean difference in change of 0·45 considered a priori as clinically meaningful) Secondary outcomes Communication Outcomes After Stroke (COAST) questionnaire; the CAT Naming Objects test; the CarerCOAST questionnaire, self-rated by the carer about themselves and the patient; For the health economic outcome evaluation, an accessible (aphasia-friendly) variant of the EuroQoL instrument, a five-dimensional 5-level generic instrument (EQ-5D-5L).	3. No significant differences for secondary outcomes by group.	
835	R. Palmer et al (2019). Self-managed, computerised speech and language therapy for patients with chronic aphasia post-stroke compared with usual care or attention control (Big CACTUS): a multicentre, single-blinded, randomised controlled trial. The Lancet Neurology. 18: 9.	Pragmatic, superiority, three-arm, individually randomised, single-blind, parallel group, randomised controlled trial. 278 participants with chronic aphasia, mean post-onset 2.8-3.6 years. Eligible patients were identified by practising speech and language therapists from past and current caseloads	Allocated to usual care (N=86) , daily self - managed Computer Speech and Language Therapy plus usual care (CSLT group, N =83), or attention control plus usual care (attention control group, N=71)	Co-primary outcomes: change in ability to retrieve vocabulary of personal relevance (impairment), measured by a picture naming test of 100 personally relevant words and the change in functional communication ability (activity) measured by masked ratings of videoed conversations, with the use of the TOM activity scale,	Participants in the CSLT group had improved word finding of 16·2% more than those in the usual care group (95% CI 12·7–19·6; p<0·0001) and 14·4% more than those in the attention control group. The effect was in excess of the prespecified, minimal, clinically	++ RCT high quality

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	821-833.	and voluntary sector support groups. Recruited from 21 community SLT services in NHS Trusts.		between baseline and 6 months after randomisation. key secondary outcome was change in self-perception of communication, social participation, and QoL. Plus additional outcomes (see paper).	important difference of 10%. Improvement was maintained at 9 and 12 months. There was no significant difference detected between groups for Change in functional communication or change in participant's perception of communication, social participation, and quality of life	
836	C. Penaloza et al (2021). Telerehabilitation for Word Retrieval Deficits in Bilinguals With Aphasia: Effectiveness and Reliability as Compared to In-person Language Therapy. *Frontiers in Neurology*. 12.	Setting USA, telerehabilitation vs in person therapy to compare treatment effectiveness. Telerehabilitation group received therapy via videoconference. The in-person group attended therapy sessions at one of the recruiting institutions pre COVID-19. Design: Retrospective analysis of patients who completed in person therapy or telerehabilitation. *Telerehabilitation protocol was part of an ongoing prospective parallel-group, double blind, phase II RCT that aimed to determine the capacity of BiLex	(1) Assessment of Pre-stroke Bilingual background – Language Use Questionnaire (2) Language Assessments included Western Aphasia Battery – Revised (WAB-R), Boston Naming Test (BNT), a 60 item naming screener developed by the laboratory and Pyramids and Palm Trees Test (PAPT) (3) Stimuli – Item Selection Naming Test (ISTN) used to create six 15 word sets including treatment words, untreated semantically related words, and control items for	- Treatment effectiveness was evaluated by computing effect sizes (ES) for direct treatment effects (i.e. trained items in the treated language) and indirect treatment effects (i.e. untrained translations in the untreated language). Effect sizes were computed as [(mean of post-treatment probes minus mean of baseline probes)/standard deviation of baseline], and defined small (4.0), medium (7.0), and large (10.1). ES focused on lexical retrieval. Evaluation of treatment effects on secondary outcome measures (i.e., standardised language assessments) computed	- In person and telerehabilitation groups were comparable on critical demographic and clinical variables that may influence between-group differences in treatment effectiveness and reliability analyses. - ES was computed for 15 patients for the between group comparisons of treatment effects. The evaluation of direct treatment effects indicated that 13 out of 15 patients	**+** Acceptable - Retrospective analysis using randomisation to determine effectiveness of computational model i.e patients randomised as per model prescribed experimental group or to model opposite control group, rather than being randomly assigned to either treatment delivery modality i.e., in person versus teletherapy. - Small sample size - Excellent IRR Absence of patient satisfaction measure.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		computational model to predict language outcomes in 48 Spanish English BWA. Patients were randomised to a model-prescribed experimental group (optimal language) as defined by the computational model or to a model-opposite control group receiving therapy not prescribed by the model. Each participant completing between 20 sessions of therapy. Treatment conducted on a laptop using the Internet-based Qualtrics survey software. Subjects: 16 Spanish-English Bilinguals with post stroke aphasia (BWA). Mean age 56.93, educational years = 14.56 with chronic post stroke aphasia (mean time post onset) 69.27 months. 8 patients per group to compare treatment effectiveness. 6 patients per group to measure treatment reliability.	therapy, and their corresponding sets of translations in the untreated language. All 6 word sets were included in naming probes and administered before, during and after treatment to evaluate primary treatment outcomes in both languages. (4) Treatment – Therapy in one language targeting critical semantic features of the targeted trained items which involves retrieving the critical semantic features of the objects targeted in therapy. All items that could be potentially selected from ISTN had a maximum of 24 semantic features. Treatment comprised of 20 sessions in total (2 h sessions twice per week). There were 6 treatment steps. Step 1 Naming a picture; Step 2 Feature classification comprising of 2A Feature selection and 2B Feature assignment; Step 3	treatment-related change scores (post treatment score minus pre-treatment score) for each patient on the WAB-AQ, BNT, 60-item naming screener) and PAPAT in the treated and the untreated language separately. Treatment fidelity was the measure employed to assess the reliability of the administration of treatment in each modality and the equivalence of procedures delivered across in person therapy and telerehabilitation. Conducted by 2 independent raters. Inter-rater reliability (IRR) was assessed using two-way mixed average measures, intraclass correlations (ICCs) for absolute agreement. For interpretation of IRR: poor for values <0.40; fair for values between 0.40 and 0.59, good for values between 0.60 and 0.74, and excellent for values between 0.75 and 1.0.	demonstrated significant improvement on trained items in the treated language (i.e., ES>4.0), with 3 patients showing medium ES (i.e., ES> 7.0) and 10 patients showing large ES (i.e., ES>10.1) - No significant difference in ES for treated items in the treated language between the telerehabilitation group (M=14.57, SD=5.48) and the in-person therapy group (M=11.78, SD=8.62) [t (13) =0.734, p=0.476]. - No significant differences in ES for translations in the untreated language between the telerehabilitation group (M=5.11, SD=6.19) and the in-person therapy group (M=3.79, SD=8.04) [t (13) =0.353, p=0.73). - No significant differences in ES for control items in the	

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
			Association; Step 4 Yes/No questions; Step 5 naming and Step 6 Sentence production.		treated language between the telerehabilitation group (M=2.81, SD=2.95) and the in-person therapy group (M=1.43, SD=2.26) [t=(13)=1.029, p=0.322] or in ES for their corresponding translations between the telerehabilitation group (M=0.62, SD=2.07) and the in-person therapy group (M=1.49, SD=2.61) [t(13)= -0.711, p=0.49]. - No significant difference on treatment related change scores on secondary treatment measures between groups. Treatment fidelity – the difference between the average % of treatment steps correctly conducted by clinicians according to the protocol in the telerehabilation modality and in the in person modality was statistically non-	

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					significant [t(10)=1.103, p=0.296]. IRR analyses on clinician's adherence to treatment procedures in each delivery modality revealed high ICC values of 0.990 [95% CI (0.937-0.999] for the telerehabilitation modality and 0.997 [95% CI (0.983-1) for the in person modality.	
836	C. Penaloza et al (2021). Telerehabilitation for Word Retrieval Deficits in Bilinguals With Aphasia: Effectiveness and Reliability as Compared to In-person Language Therapy. Frontiers in Neurology. 12.	Setting: USA Context: in-patient treatment sessions at a recruiting site or online interventions via zoom. Design: Retrospective analysis of data from a RCT study (prospective parallel-group, double blinded, phase 11 RCT). This study is part of a large RCT to determine the capacity of a computational model BiLex to predict language outcomes in 48 English-spanish speaking bilingual people with aphasia (BWA). Semantic treatment for word retrieval deficits in BWA.	16 BWA received 20 treatments. 2-hour sessions per week. N=8 in-person and N=8 telerehab. Assessments- language use questionnaire, western battery (aphasia), Boston naming test, Palm trees test, 60 item naming test. Stimulate item naming test, selection naming test. Twenty Qualtrics surveys were developed for each patient, one per treatment session. Each survey presented 15 treatment items in a	The primary outcome was the measurement of the effect size (ES). Calculated for direct treatment effects (trained items in the treated language) and indirect treatment effects (untrained translations in the untreated language). Analysis of treatment fidelity conducted for both delivery methods showed high clinician adherence to treatment protocol for both delivery modalities and no significant differences in the percentage of correctly implemented treatment steps in the treatment sessions conducted with patients	Summary: Significant improvements in most patients, no differences in treatment effect size or secondary outcomes between both groups. The average % of correctly delivered steps was high in both groups. No significant differences between telerehab and in-person, suggesting essential components of treatment can be delivered in both modalities.	+ Acceptable Randomisation using a computational model rather than usual methods. Slight concern about those having online intervention described as 'unable to complete F2F sessions due to stroke related difficulties' potential for participants being more disabled but the groups characteristics were comparable for mean age, educational years and onset of stroke. IRR was excellent.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Employing linguistic and culturally relevant therapy materials to target both languages. Subjects: n=16 mean age 56.93 8 patients per group for treatment effective comparison and 6 patients per group to measure reliability. N=6 females n=10 males Randomisation: a computational tool was used to randomise participants. I) Model-prescribed experimental group (optimal language) as defined by the computational model 2) Model-opposite control group receiving therapy not prescribed by the model.	randomized order in the language chosen for treatment, with one treatment step displayed on the screen at a time In both delivery modalities, a clinician guided each patient throughout six treatment steps emphasizing the semantic feature attributes of each treated item.	receiving telerehabilitation compared with those receiving in-person therapy. IRR was comparable for both telerehabilitation and in-person therapy, high agreement between raters and consistency in their judgment of correct implementation of treatment procedures in the two service delivery modalities. IRR: poor for values <0.40; fair for values between 0.40 and 0.59, good for values between 0.60 and 0.74, and excellent for values between 0.75 and 1.0.	The in-patient and online groups had comparable characteristics and were comparable for clinical characteristics. The evaluation of direct treatment effects indicated that 13 out of 15 patients demonstrated significant improvement on trained items in the treated language (i.e., ES > 4.0), with three patients showing medium ES (i.e., ES > 7.0) and 10 patients showing large ES (i.e., ES > 10.1). No significant differences in ES for treated items in the treated language between the telerehabilitation group (M = 14.57, SD = 5.48) and the in-person therapy group (M = 11.78, SD = 8.62) [t (13) = 0.734, p = 0.476]. The assessment of indirect treatment effects revealed that five out of 15 patients showed	

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					significant improvement on translations in the untrained language (i.e., ES > 4. No significant differences in ES for translations in the untreated language between the telerehabilitation group (M = 5.11, SD = 6.19) and the in-person therapy group (M = 3.79, SD = 8.04) [t (13) = 0.353, p = 0.73]. ES for untrained control items was minimal for most patients in the telerehabilitation and the in-person groups and were within the range of ES reported in previous treatment research with BWA using the same semantic-based intervention There were no significant differences in ES for control items in the treated language between the telerehabilitation group (M = 2.81, SD = 2.95) and the in-	

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					person therapy group (M = 1.43, SD = 2.26) [t (13) = 1.029, p = 0.322] or in ES for their corresponding translations between the telerehabilitation group (M = 0.62, SD = 2.07) and the in-person therapy group (M = 1.49, SD = 2.61) [t (13) = −0.711, p = 0.49].	
837	C. Repetto et al (2021). Innovative technology-based interventions in aphasia rehabilitation: a systematic review. Aphasiology. 35: 12. 1623-1646.	Design: Systematic review. The present review aims to investigate the use and efficacy of innovative technology-based interventions for language rehabilitation in post-stroke patients. We consider innovative technologies as those implementing either virtual reality or mobile software applications. Subjects 13 studies, but a rather odd mix as includes apps requiring therapist input (Constant Therapy), self-supporting apps and therapist delivered SLT (EVA park). Varies therapy types, dose and regimes.	Variable: 10 out of 13 of the selected studies are based on trainings delivered through mobile applications installed on tablets, mainly iPads. Three studies employed VR. The treatments usually lasted between 1-6 months. The most intense programs included a treatment regimen ranging between 4-30 hours per week, whereas the least intense ones included a treatment program ranging between 2 and 3.5 hours per week. In two studies, the technology-based	The second aim of the present review was to investigate the efficacy of these innovative methods of aphasia rehabilitation involving new technologies. All the selected papers highlighted, unanimously, the possibility to obtain a successful innovative technologies based treatment to reduce linguistic deficits in aphasic patients.	1. Word finding improvement was 16·2% (95% CI 12·7 to 19·6; p<0·0001) higher in the CSLT group than in the usual care group and was 14·4% (10·8 to 18·1) higher than in the attention control group 2. No significant change in Tom measure between groups. 3. No significant differences for 2ndary outcomes by group.	Neutral Reasonable review but heterogenous so hard to come to any specific conclusions for individual digital therapies.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
			treatment program was not scheduled a priori; instead, it was left to the patients' choice (free use).			
837	C. Repetto et al (2021). Innovative technology-based interventions in aphasia rehabilitation: a systematic review. Aphasiology. 35: 12. 1623-1646.	Setting: Italy Design: Systematic Review Aim: to investigate the use and efficacy of innovative technology-based interventions for language rehabilitation in post-stroke patients. Innovative technologies as those implementing either virtual reality or mobile software apps.	PRISMA guidelines were followed. The articles were selected by computer-based searches in three high-profile databases: PubMed, PsycINFO, and Web of Science. 13 studies met the inclusion criteria. Studies were also rated along the efficacy-effectiveness spectrum (RITES). Most of the studies used a tablet to deliver the therapy, and only a few of them implemented VR-based treatments.	There was preliminary evidence that the rehabilitation with mobile applications and VR was effective. The RITES tool was used to explore whether the interventions were focused more towards clinical efficacy (protocol/ideal conditions) or clinically effective (real world conditions). The RITES scores indicate the 13 studies were predominantly more towards efficacy rather than real-world application.	New-technologies-based aphasia rehabilitation programs mainly leverage the portability of tablets, with two exceptions employing virtual reality.	- Low quality Limitations: The review results were small a result of a tight search strategy. Only three databases were searched, no grey literature. Only 13 papers were found. They excluded quite a few different types of papers and any reporting with combined technologies. Some studies did not report the technology design and implementation, therefore cannot rule out the possibility to have excluded papers that used mobile applications but did not state it clearly. Only a bias assessment was conducted- no other appraisal for assessing the quality of the included studies. All 12 of 13 studies were found to have risks of bias across multiple dimensions. There were methodological issues

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
						while evaluating the studies, such as the lack of control groups and the small sample sizes.
838	S. Spaccavento et al (2021). Effects of computer-based therapy versus therapist-mediated therapy in stroke-related aphasia: Pilot non-inferiority study. Wendy Longley. Journal of Communication Disorders. 94.	Setting: 45 adults with acute (first month) aphasia consecutively admitted to the neurorehabilitation unit of Clinical Scientific Institutes "Maugeri" SPA SB IRCCS were enrolled in this study Design: RCT. Participants were randomly assigned to either Therapist-Mediated (n= 9) Computer-Based (n= 13) intervention Subjects: 22 PWA caused by recent stroke. Mean age = 60; mean days from stroke onset to hospitalization, M = 23.5; variable severity of aphasia, with >54% sever; mean years of education = 9.	Computer-Based = a range of specific software programs edited by Erickson (Edizioni Centro Studi Erickson, S.p.A.) for rehabilitation language skills training. Each program included exercises of verbal and written naming of nouns, verbs, single word and sentence level spoken word, naming of visual target, word retrieval, sentence building, and language comprehension. Exercises were graded based on level of difficulty, thus providing considerable flexibility in providing rehabilitation to persons with low to severe neuropsychological deficits NB: Computer-based exercises were performed in the	Co-primary outcomes 1. Aachener Aphasia Test (AAT) 2. Italian Version of Functional Outcome Questionnaire for Aphasia (FOQ-A) 3. Functional Assessment Measure (FAM) Cognitive Subscale 4. Quality of Life Questionnaire for Aphasics (QLQA)	Participants in both computer-based and traditional therapist-mediated aphasia intervention showed significant gains in language skills, functional communication and quality of life from pre- to post-treatment. Statistically significant within-group differences were found across all outcome measures. In contrast, no significant between-group and group x time interaction effects were found across language skills, functional communication and quality-of-life measures	+ Good quality RCT Perhaps should have used minimisation on severity to balance groups better +/- block randomisation for better power.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
			presence of the speech and language therapist Therapist-Mediated For the therapist-mediated treatment group, the same types of exercises were administered by the speech and language therapist without the use of a personal computer. Similar to computer-mediated tasks, therapist tailored the difficulty and complexity of exercises based on the specific language impairments of participants and their severity. The speech and language therapist provided oral and written feedback to each person with stroke. Different acoustic reinforcements (i.e., different sounds) signaled correct and wrong answers. Moreover, therapy sessions included contextual and naturalistic conversation about the individual's activities during the previous day.			

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
			Both interventions consisted of 1 session per day lasting approximately 50 min for 5 days a week over an eight-week interval.			
839	Z. V. J. Woodhead et al (2018). Randomized trial of iReadMore word reading training and brain stimulation in central alexia. Brain. 141: 7. 2127-2141.	Randomised control trial with crossover. n=21. UK based Recruited from a national aphasia database (PLORAS) and a local aphasia group. 20 participants had phonological (n=11) or deep alexia (n=9). 1 had surface alexia.	Novel training app (iReadMore) administered concurrently with anodal tDCS (transcranial direct current stimulation of left inferior frontal gyrus) or sham tDCS. Participants completed two 4 week blocks of IReadMore training, one with tDCS and one with sham stimulation.	Primary outcome: word reading accuracy, word reading reaction times, core word reading accuracy, core word reading reaction times. Secondary outcomes: Written semantic matching, sentence reading, text reading, sustained attention to response task, self-report measures	iReadMore paired with anodal tDCS had a positive effect on some but not all the measured outcomes. It increased gains in reading accuracy for both trained and untrained words.	++ Small study n=21 but recruited more than the recommended 18 required to detect a change. Design good. Anodal tDCS is an emerging clinical research tool that is not available to the wider UK population.