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Script club: motivating change through remote delivery of group script training for people with primary progressive aphasia

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ABSTRACT

Introduction: Primary Progressive Aphasia (PPA) describes a group of language led dementias. Script training is a speech and language therapy intervention that has been shown to improve fluency and grammatical well-formedness of speech or spoken output for people with nonfluent/agrammatic variant. Research studies exploring script training have been delivered on an individual basis, both face to face and remotely, via telehealth. Group therapy has the potential to increase access to therapy whilst promoting participation and generalisation to everyday conversational contexts.

Aims: To conduct a clinical service improvement study, exploring the feasibility, acceptability, and impact on confidence and spoken script production, of an online script therapy group for people with PPA.

Methods & Procedures: Sixteen people with PPA took part in four script groups delivered via telehealth within a national speech and language therapy service in the UK. "Script Club" was delivered to four cohorts of four participants over eight one-hour sessions. Feasibility and acceptability were assessed through attendance and focus group feedback. Pre- and post-intervention outcome measures were collected to evaluate the accuracy and fluency of spoken scripts. Communication confidence was measured using the Communication Confidence Rating Scale in Aphasia pre- and post-therapy, and 3-months later.

Outcomes & Results: Fifteen people completed the intervention. Attendance at script club was 93%, and feedback overwhelmingly positive. Script production data was available for eight participants. Accuracy of personalised script production improved from 42.08% pre-treatment to 67.94% immediately post-treatment. Script fluency and intelligibility improved immediately post treatment, non-significantly. Communication confidence data was available for


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fifteen participants. Confidence improved non-significantly following therapy, reaching significance at 3-month follow up.

Conclusion: Remote group script training was feasible and acceptable to run within the National Health Service in the UK. Non-significant improvements in communication confidence and speech fluency, accuracy and intelligibility were observed immediately following group participation. Significant improvements in communication confidence were observed 3-months after participation. This is thought to be due to “enactment”, or putting into practice gains made in “Script Club” in everyday life.

Background

Primary Progressive Aphasia (PPA) describes a group of language led dementias, characterised by word finding difficulties and other expressive and/or receptive language symptoms that progress inexorably over time (Gorno-Tempini et al., 2011; Mesulam et al., 2021). Conservative estimates indicate that there are at least 3,000 people with PPA associated with frontotemporal dementia (FTD) in the UK (Coyle-Gilchrist et al., 2016), though there are likely many more. Importantly, speech and language therapists are receiving more referrals for people with PPA, both in the UK (Volkmer et al., 2019). and internationally (Battista et al., 2023; da Silva et al., 2023; Diehl-Schmid et al., 2014; Gallée et al., 2024; Taylor et al., 2009; Yasa, 2023) highlighting the need for a range of person-centred, evidence-based interventions (Volkmer, Cartwright, et al., 2023).

Three PPA variants are described in the international consensus diagnostic criteria (Gorno-Tempini et al., 2011; Louwersheimer et al., 2016; Sajjadi et al., 2012; Tippet, 2020) each associated with different underlying neuropathology. Semantic variant PPA (svPPA) is predominantly associated with pathological TDP-43-C protein aggregation and FTD tau (Montembeault et al., 2018; Spinelli et al., 2017) and is characterised by difficulties understanding the meanings of words and concepts. Nonfluent/agrammatic variant PPA (nfvPPA), predominantly associated with FTD 4R tau and TDP-43-A (Montembeault et al., 2018; Spinelli et al., 2017), results in effortful speech with difficulties with motor-speech planning and coordinating volitional, sequenced, speech sounds (verbal apraxia) and/or difficulties processing sentence structures (agrammatism). Verbal adynamia, characterised by markedly reduced initiation of propositional speech, and dysprosody, are also a prominent feature in many people with nfvPPA (Hardy et al., 2024; Rohrer et al., 2010). Logopenic variant PPA (lvPPA) is predominantly associated with Alzheimer’s pathology (Montembeault et al., 2018; Rohrer et al., 2012; Spinelli et al., 2017) and results in difficulties in word retrieval, phonological short-term memory and auditory processing (Jiang et al., 2023). However, up to a third of cases present as a “mixed” or “atypical” phenotype, either from onset or due to a convergence of symptoms (Belder et al., 2024; Mesulam et al., 2021). Unsurprisingly, these communication difficulties have a negative impact on everyday interactions, quality of life and wellbeing for people with PPA (Ruggero et al., 2019).

Given the heterogenous language difficulties that people with different PPA variants experience, several distinct speech and language interventions have been developed (or adapted from the stroke aphasia literature) all with the aim of maintaining or

compensating for the impact of PPA on everyday communication (Volkmer et al., 2020). Lexical retrieval therapies are the most studied intervention approach (Wauters et al., 2024). Research has demonstrated the positive impact on word maintenance of personally relevant target stimuli following intensive schedules of repeated practice. However, there are genuine limitations in how people with aphasia, both PPA and static post stroke aphasia, can extend word-level therapy into everyday conversations or discourse level output. Furthermore, generalisation to non-trained words is limited (Cadório et al., 2017; Wauters et al., 2024). People with svPPA have been reported to have more difficulties with generalisation (defined by Cadório et al. as results that generalize across items, tasks and contexts (Cadório et al., 2017) and maintenance of lexical-retrieval therapy compared to people with lvPPA and nvPPA (Cadório et al., 2017). Cadório and colleagues attribute this limited generalisation to cognitive inflexibility for people with svPPA. This highlights the importance of practicing personally relevant stimuli in functional, everyday settings to reduce the burden on cognitive flexibility, maximise opportunities for behaviour change and increase the likelihood of generalisation to real-life communication situations.

Script training is an intervention which aims to improve spoken discourse (Cherney & Van Vuuren, 2022; Cherney et al., 2008, 2015; Goldberg et al., 2012; Hubbard et al., 2020; Youmans et al., 2005). Personalised scripts are developed with the person being treated, based on their personal interests and functional needs. Scripts are then repeatedly practised during therapy and often alongside home practice. Study results demonstrate improvements in the amount and accuracy of script words produced, with maintenance of gains over time (for review see (Hubbard et al., 2020)). In script training, generalisation refers to the transfer of learned skills from practiced scripts to untrained scripts, spontaneous speech, communication confidence or functional use of scripts in other communication contexts (Cherney et al., 2008; Goldberg et al., 2012; Youmans et al., 2005). Generalisation has been variously facilitated, for example via elaborating on script content, or script production with different conversational partners and in various settings (Cherney & Van Vuuren, 2022; Cherney et al., 2015; Fridriksson et al., 2012; Goldberg et al., 2012; Holland et al., 2010; Youmans et al., 2005). Access to script therapy has also been facilitated through asynchronous (i.e., computerised or avatar led therapy with no therapist present during sessions) and synchronous (i.e., real-time but on-line sessions facilitated by a therapist) telehealth delivery (Cherney & Van Vuuren, 2022; Cherney et al., 2008, 2015, 2019; Marshall et al., 2024; Rhodes & Isaki, 2018).

Henry et al. (2018) adapted script training for people with nvPPA, developing an intervention entitled video implemented script training approach (VISTA) (Henry et al., 2018). They demonstrated improved fluency and grammatical well formedness of personally relevant scripts when they trialled VISTA with 10 people with nvPPA. The study found gains for trained scripts were maintained at 3-, 6- and 12-month follow-up; as well as generalisation in overall intelligibility to untrained scripts (Henry et al., 2018). The VISTA therapy protocol requires participants to follow a set sequence of tasks including sorting lines from their scripts from foils, reading their script aloud, saying their script from memory and then in response to questions, to automatise script production. Participants are then supported to intensively practice their scripts at home by using bespoke audio-visual recordings, using a technique of “speech entrainment” (Fridriksson et al., 2012). VISTA has been delivered remotely via video conferencing with comparable results to face-to-face delivery and a modified

VISTA has also been delivered remotely to a person with PPA with significant hearing loss (Dial et al., 2019; Henry et al., 2018; Schaffer et al., 2022). More recently, Montagut et al. (2024) reported positive outcomes for participants across all three canonical PPA variants, using modified VISTA delivered on an individual basis both in-person and remotely via video conferencing, demonstrating equivalence across therapy modality (Montagut et al., 2024). Positive outcomes following the intervention included significant gains in script production and the global quality of trained scripts, with generalisation to the global production quality of untrained scripts.

Understanding the needs and perspectives of people with PPA, their opinions about different speech and language interventions and how they are delivered is vital in the development of new and existing approaches. Loizidou et al. found that people with PPA reported finding it difficult to maintain the motivation to continue independently practicing tasks such as lexical retrieval and scripts (Loizidou et al., 2023). Intervention studies found that the person with PPA and their partner experienced increased motivation to practice when they were both trained in lexical retrieval interventions (Beales et al., 2019). However, working in groups with people with similar a diagnosis is also considered a positive motivational influence (Loizidou et al., 2023; Volkmer et al., 2024; Watanabe et al., 2024). Though group therapy has been identified as a best practice principle for people with PPA, there are only a small number of studies exploring the impact of this approach (Volkmer et al., 2024; Volkmer, Cartwright, et al., 2023; Watanabe et al., 2024). These studies have shown that people with PPA can benefit from meeting others and sharing strategies in groups, demonstrating improvements in psychosocial wellbeing (Taylor-Rubin et al., 2020; Watanabe et al., 2024). Moreover, group therapy in aphasia has been shown to have therapeutic and social benefits (Taylor-Rubin et al., 2020). Importantly for people with PPA, the literature suggests that including people with different PPA variants in the same group must be carefully planned (Beales et al., 2019; Watanabe et al., 2024). This suggests further exploration of group therapy for people with PPA should usefully focus on both the therapeutic and social gains that can be made.

Remote teletherapy has the potential to enhance access to therapy for people with PPA. This is particularly relevant given people with PPA are often unable to access local speech and language therapy for guidance, support, and communication interventions equally across geographical regions in the UK (Volkmer et al., 2019, 2020). Whilst this is partially attributed to a lack of confidence and knowledge among generalist speech and language therapists (SLTs) it is felt to be primarily due to limited funding and restrictive referral criteria (e.g., some services in the UK and Australia only see people with a dementia diagnosis for swallowing input, not for communication therapy) (Bennett et al., 2019; Gallée et al., 2024; Loizidou et al., 2023; Volkmer et al., 2019).

As part of a service improvement study, and with the purpose of maximising access to therapy for people with PPA, a remote (i.e., via videoconferencing) script training group was piloted to explore the following questions:

- (1) Is it feasible and acceptable to deliver script training to people with PPA using an online group therapy format?
- (2) Will delivering script therapy in a group have an impact on the communication confidence of people with PPA?

- (3) Will delivering remote script therapy in a group improve spoken production of trained scripts in people with PPA?

Methods

This paper describes a service improvement study of a remotely delivered script training group for people with PPA, called “Script Club”. Qualitative and quantitative data were collected before and after the script groups, and at 3-months post intervention follow up, to evaluate the acceptability, feasibility and outcomes of the group.

Ethics statement

The Script Club service was one of the groups offered by the specialist speech and language therapy team in the cognitive disorders clinic at the National Hospital for Neurology & Neurosurgery (NHNN) in London and was registered as a service improvement study/audit (date of approval: 17.03.2023; reference: 64–202223-SE). In line with the UK National Health Service Health Research Authority guidance, Script Club qualified as a service improvement study as it was designed to deliver and measure improvements in the current service, without reference to a standard, patients and professionals have jointly chosen the intervention and it does not include randomisation (NHS Health Research Authority, 2022). This meant formal ethical approval was not required, and the relevant board waived the need for consent for data analysis and publication. However, confidentiality was ensured during data collection and analysis, so that no personal information was identifiable to those outside of the study. Additionally, data were stored securely in encrypted devices and National Health Service (NHS) databases, which were only accessible to clinicians directly involved with Script Club.

Participants and recruitment

Potential participants, who were referred to the speech and language therapy service for PPA between 12th October 2021 and 9th November 2022, were offered the option of participating in the script group or continuing with individual sessions. Clinical candidacy criteria for inclusion in the group are outlined in [Table 1](#).

Table 1. Inclusion criteria for clinical candidacy for participants in the script groups.

Criteria	As assessed by
Seen by a consultant neurologist at the cognitive disorders clinic and have a diagnosis of PPA of any subtype	Clinical record
Adequate hearing to participate in a video conferencing call (corrected or uncorrected)	Self-report, clinical judgement, clinical record
Sufficient expressive and receptive language ability to engage in, and benefit from, the group intervention	Clinical judgement
Able to understand the rationale for script training in relation to their functional communication needs and could follow the intervention protocol	Pre-group discussion during one-to-one speech and language therapy session
Able to access group therapy remotely via the Zoom platform, either independently or with support at home	Pre-group trial and self-report

An outline of the remote group intervention, including time commitments for the sessions and home-based tasks, was discussed with potential participants. Supported conversation techniques, such as writing down key words, repetition and rephrasing, were used to facilitate discussions. Potential group members were then given a chance to ask questions and supported to select a therapy option. Therefore, all participants were supported to give informed consent verbally, which was then documented in clinical notes. On consenting, participants were allocated to the next available group, i.e., recruitment and group allocation was consecutive and pragmatic. Once four participants had been identified, session dates were arranged. This process reflects routine clinical practice.

Sixteen people (5 men, 11 women) with PPA chose to participate in a total of four script groups of four people. Four participants per group was chosen for pragmatic reasons including the maximum predicted number of participants to be able to benefit from script training in a 1-hour group session, and the practicality of remote group management by 1–2 speech & language therapists. Table 2 provides an overview of group composition. The mean age of participants was 67 years old. The average time between diagnosis and starting the group was eight months, with an average time of 41 months between symptom onset and starting the script group. All participants had received their PPA diagnosis in the multidisciplinary cognitive disorders clinic at the NHNN, comprising neurology, neuropsychology, speech and language therapy and specialist nursing. Date of diagnosis and symptom onset were gathered from clinical diagnostic reports. Diagnoses are routinely based on neurological and neuropsychological assessment, brain MRI, speech and language therapy assessment and where Alzheimer's disease was a likely consideration – chiefly in lvPPA – a lumbar puncture. Nine participants (56.25%) had a diagnosis of lvPPA, five participants (31.25%) had nfvPPA, and two participants (12.5%) had a mixed phenotype. Information related to diagnosis and symptom onset was available in the medical record on referral to the speech and language therapy service. No participants with a diagnosis of svPPA were recruited. This was not deliberate. There were no candidates suitable for Script Club during the period the groups were running.

Table 2. Demographic data for participants.

Group	No.	Gender	Age at the start of the group	Months between diagnosis (clinic letter) and group start	Months between symptom onset and group start	PPA subtype
A	1	F	53	3	27	lvPPA
	2	M	71	6	78	lvPPA
	3	M	74	7	27	lvPPA
	4	F	72	17	77	nfvPPA
B	5	F	69	7	13	nfvPPA
	6	F	75	1	37	nfvPPA
	7	F	57	15	24	lvPPA
	8*	M	73	30	67	nfvPPA
C	9	F	56	4	40	mixed
	10	F	55	4	64	lvPPA
	11	F	74	7	43	lvPPA
	12	F	60	48	57	mixed
D	13	M	76	18	54	nfvPPA
	14	F	62	8	20	lvPPA
	15	M	66	8	80	lvPPA
	16	F	82	16	40	lvPPA

PPA = primary progressive aphasia; lvPPA = logopenic variant PPA; mixed = mixed phenotype; nfvPPA = nonfluent variant PPA; *participant withdrew from the intervention.

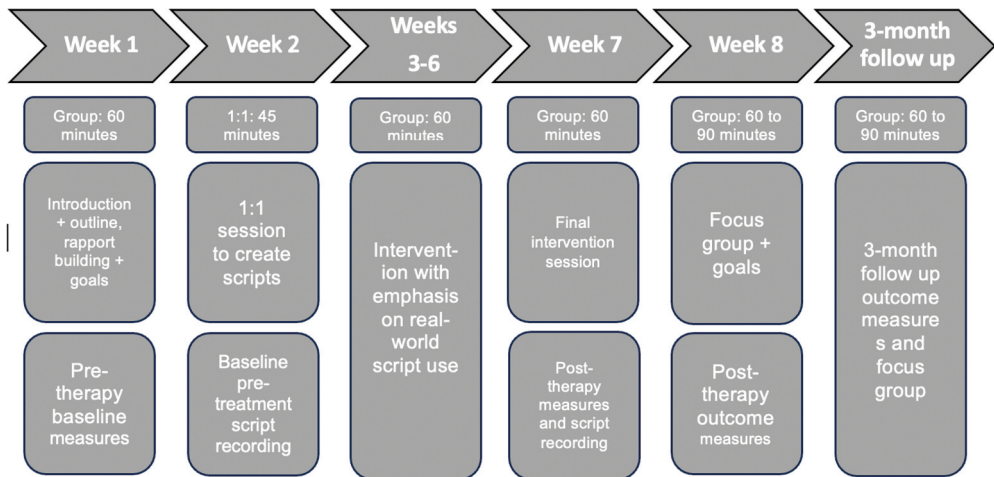


Figure 1. Session-by-session overview of group script training.

Intervention

Script Club comprised eight sessions supported by 1–2 qualified SLTs with a specialist interest in PPA (authors RT & AV). Sessions were approximately 1-hour long (range 45–90 minutes). [Figure 1](#) provides a session-by-session overview of the intervention content. Please see supplementary file 1 for detailed description of intervention sessions, and supplementary file 2 for the template for intervention description and replication (TIDieR) checklist (Hoffmann et al., 2014). Group content was the same for all participants, no matter which PPA variant they presented with. However, facilitations, prompts and script content were personalised to the needs and interests of each participant. All groups had a ninth follow up session at 3-months following the final session. The 3-month follow-up session was a further opportunity to discuss experiences and opportunities to use scripts and scripting in everyday conversations. This follow-up was also an opportunity for group members to re-connect with peers and develop social connections.

Groups were made up of participants with a mixture of PPA subtype diagnoses. To facilitate this, early sessions focussed on education and members getting to know each other's communication strengths, needs, and goals (Watanabe et al., 2024). The group format was also predicted to achieve greater throughput (i.e., increased volume of people seen within the service in a shorter timescale) and harness the social benefits of group interventions (Taylor-Rubin et al., 2020).

All sessions were delivered via the teleconferencing platform Zoom – chosen due to participant familiarity, audio and visual quality, accessibility, and support options (e.g., screen sharing, interactive whiteboards, remote sound and camera support). Also, Zoom has been successfully used before in a telehealth group intervention for people with aphasia (Dunne et al., 2023). All participants attended sessions on their own devices from their own homes. All participants were familiar with attending remote sessions, having all previously attended at least one speech and language therapy appointment on Zoom before attending the group. No information was collected about the devices used by each participant. All participants attended independently without care-partners present during

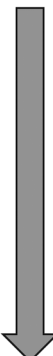
Script Group procedure		VISTA procedure
1. Read script aloud with support	Structured treatment  Functional application	1. Recognise scripts from foils
2. Produce script from memory, with prompts		2. Put script sentences in order
3. Answer questions on script to expand script content (on-topic / off-script group discussion)		3. Read script aloud
4. Use portions of script 'in real life' and report back		4. Produce script sentences in response to questions
5. Produce entire script from memory		5. Produce entire script from memory
6. Use entire script 'in real life' and report back		6. Respond to questions with scripted sentences (not in scripted order)

Figure 2. Hierarchy of tasks used in treatment sessions to promote memorisation and conversational usage (i.e., generalisation) of script, as compared to the VISTA (Henry et al., 2018) procedure.

the sessions. However, 4 participants required care-partner assistance prior to sessions to connect to the Zoom calls. The four groups took place between 23rd November 2021 and 20th December 2022.

The group script training shifted in focus from structured and supported script practice at the start, to generalised use of the scripts in day-to-day activities by the end of the 8-week intervention. Figure 2 provides an overview of how content progressed across sessions and compares the Script Club treatment steps with those in VISTA (Henry et al., 2018). Facilitation of the intervention in a UK NHS clinical setting motivated the changes to delivery of VISTA. There were no facilities to create audio-visual recordings of scripts for home practice within the NHS setting. With feedback from previous participants, we also focused on different home challenge tasks to VISTA. These had a focus on generalisation of script use, or parts of scripts, in everyday real-life situations. For example, using a script to change your address over the phone with different companies following a house move, or using parts of a script about recent family events with other dog walkers when out walking the dog. Co-planning script use challenge tasks as a group, then together sharing and discussing how these tasks had gone was predicted to be facilitative and motivating, harnessing the camaraderie and peer support that can be gained from group interventions (Beales et al., 2019; Watanabe et al., 2024). All participants received aphasia-friendly session summaries and challenge tasks via e-mail following the sessions.

Assessment of acceptability

Attendance data (number and percentage of group sessions attended by participants) were collected throughout. Where participants gave reasons for non-attendance this was recorded.

Group members' experiences of the script group were probed in a focus group in session eight of the intervention. The topic guide questions for the focus group were:

- (1) What was the most useful thing about the script group?
- (2) What was the least useful thing?
- (3) What would you change or modify about the script group?
- (4) What is the one thing that springs to mind/the best thing about the script group?

During the three-month follow-up session (the ninth session) the same questions were asked with the addition of:

- How have you used any of your scripts in the last three months?

The discussion was facilitated, and responses were transcribed by the group facilitator (RT) during the focus group meetings.

Pre- and post-intervention measures

As shown in [Figure 1](#) outcome measure data were collected during script group sessions 1, 2, 7 and 8. Outcome measure data were also collected from each group three months following the final session (session 9). Script recordings were only collected at 2 timepoints, before and after the interventions (sessions 2 and 7) due to time and resource constraints. Therefore, the service improvement study only explored maintenance of communication confidence, alongside qualitative feedback about script usage.

Communication confidence: The Communication Confidence Rating Scale for Aphasia (CCRSA) is a patient reported outcome measure (PROM) which probes feelings of confidence across ten communication contexts (Babbitt et al., 2011; Cherney et al., 2011). The CCRSA has been used as an outcome measure in PPA intervention studies (Rogalski et al., 2022; Volkmer, Walton, et al., 2023) and in stroke aphasia telehealth intervention studies (Marshall et al., 2016; Steele et al., 2015). Each participant completed the CCRSA as a group activity in session 1 (pre-therapy), at the end of session 8 (post-therapy) and at 3-month follow up (session 9). Participants were supported, using a 0–100 visual analogue scale and supported conversation, to signal how confident they felt in the ten different communication contexts. This resulted in a score out of 1000 for each participant at each timepoint. Although the CCRSA has been used in previous PPA intervention studies, it has not been validated for use in a group environment (Babbitt et al., 2011; Cherney et al., 2011; Rogalski et al., 2022; Volkmer, Walton, et al., 2023).

Script fluency: Participants were video recorded, via Zoom, speaking their scripts during session 2 (pre-therapy) and session 8 (post-therapy). For the purposes of this service improvement study, all viable videos of pre- and post- script recordings were transcribed and timed, to identify:

- The total number of words uttered. All words, fillers (e.g., “um”, “ah”), false starts and word attempts were included in this figure. Attempts and fillers were included as

they are factors in subjective ratings of fluency and intelligibility, they impact measures of speech rate and represent effort in spoken output (Park et al., 2011).

- Total narrative words extracted from the total words, using the criteria from Quantitative Production Analysis (Rochon et al., 2000). Narrative words are the spoken, propositional words used to tell a story, or in this case, to say a script. This excludes all false starts, fillers, repetitions, corrections, or comments extraneous to the script content. From these scores the percentage of narrative words as compared to total words could be calculated. The higher the percentage of narrative words spoken, the more efficient and informative the script production.
- A count of all the script words produced, enabling calculation of the percentage of script words spoken. Only verbatim script word attempts were scored, i.e., not synonyms, but phonetic or articulatory errors were accepted so long as they were comprehensible target attempts. In the case of verbs, any verb form uttered was counted (e.g., if “drive” was in the written script, then “driving” was accepted as a script word from the spoken sample).
- Spoken words per minute and spoken narrative words per minute.

“Naïve”-listener intelligibility ratings (global quality): An experienced and qualified speech and language therapist (author CFD), who was blinded to time of the script recordings (i.e., pre- or post- intervention) assessed the global quality of the spoken script, according to the scoring system used in Montagut et al.’s study on script training in PPA (Montagut et al., 2024). The rater listens to the script and assigns an overall qualitative score corresponding to severe (1), moderate-severe (1.5), moderate (2), mild-moderate (2.5), mild (3), normal-mild (3.5) and normal (4). In rating they must consider 4 domains:

- Pronunciation: Clarity of word production
- Vocabulary: Correct use of words to express what is meant
- Fluency: Whether speech sound natural, consistent and fluently
- Speech coherence: Expression of ideas in an organized and logically connected way

Analysis

Attendance data, CCRSA and script fluency data were analysed using descriptive statistics. Data from the CCRSA and recorded scripts were entered into statistics software SPSS Version 28 (IBM, 2016). Given the small sample size ($N = 16$) a Shapiro-Wilk test was undertaken to determine the distribution of participant CCRSA scores, with subsequent statistical tests chosen appropriate to the normality of the data. Due to the small sample size and predicted variability in discourse production across PPA subtypes, script data were predicted to not follow a normal distribution. Therefore, a 2-tailed Wilcoxon signed rank test was used to evaluate the difference between pre- and post- intervention script accuracy and fluency data.

Focus group transcripts were analysed using “conventional content analysis” (Braun & Clarke, 2006, 2019). Given the aim to summarise and describe data, rather

than probe any underlying meanings, content analysis was felt to be most appropriate (Braun & Clarke, 2006). The lead author (RT) read the transcription several times and coded for initial categories derived directly from that data (inductively). Where meanings were unclear, data was left uncoded. All data within each code was re-examined by author AV and both authors RT and AV met to discuss if codes needed to be split, combined or abandoned. Finally, authors RT and AV discussed and assigned theme names.

Results

Recruitment and retention

In total 36 scheduled script group sessions took place (four groups, delivered over 9 sessions). 15 of 16 recruited participants completed the intervention (94%). One participant with nvPPA (participant 8) discontinued after 3 sessions due to intercurrent ill health. Of the 15 participants who completed the intervention, 126 of a maximum 135 sessions across participants were attended (93%). No participant missed more than 1 session. Reasons for session absence included ill health, prior engagements and forgetting the scheduled session. Reported technical and sensory barriers (see acceptability section below) did not preclude session attendance.

Acceptability of the intervention

Four key themes were identified in the data, 1. Promoting engagement; 2. Functional script use; 3. Benefits of meeting others; 4. Suggested improvements.

1. Promoting engagement: Participants required more time and pictorial support during sessions to assist with difficulties in understanding, particularly comprehension of speech in on-line video calls:

Hearing – difficult to hear and understand sometimes, especially online ... interruptions.
[Participant 10]

They also reported not initially understanding the rationale for practicing scripts, in the group setting. They found that over time this improved, as they spent more time in the group.

At the beginning [I] was not sure. Kept looking at it [the script] but didn't seem to flow.
[Participant 15]

2. Functional script use: Participants reported benefits of script use in the real world. They practiced in and outside of the group meetings and several participants continued to use scripts and scripting techniques after the group had finished.

I use them every day – I prepare little scripts. I make sure what I'm going to say before making a phone call. [Participant 2]

3. Benefits of meeting others: Participants reported that meeting others with PPA was a positive experience, and they made several social connections. They found the on-line

format useful for meeting other people who had PPA, given the rare nature of the disease. They reported finding support within the group, which maintained their sense of self.

It is a privilege to share time with people with lots of talents. We all have a PPA diagnosis, we are all patients, but we are all people as well, it is a privilege to have met everyone, we are all muddled together – it's an amazing experience for us to be in a safe place – we are different, but we have the same challenges in different ways. It makes me happy when I see how competent we all are. [Participant 11]

4. Suggested improvements: Participant suggested having the on-line groups augmented by occasional in-person sessions, such as a pre- or post-group in person meeting. They also flagged their desire for more time and more therapy:

Would like to carry on [in the group]. [Participant 9]

Communication confidence

Fifteen participants completed the CCRSA measure at the three time-points. The mean total CCRSA score pre-treatment was 633 (range 380–810). At post-treatment the mean total score rose to 659 (range 490–770), rising again at 3-month follow-up to 727 (range 410–880). [Figure 3](#) provides an overview of CCRSA results.

Total CCRSA scores were normally distributed pre-therapy ($W = 0.915, p = 0.16$) and post-therapy ($W = 0.887, p = 0.6$). However, CCRSA scores at the 3-month follow-up point deviated significantly from a normal distribution ($W = 824, p = 0.006$). Inspection of histogram plots demonstrated data were not normal distributed at the post-therapy outcome timepoint and significantly deviated from normal distribution at 3-month follow-up. This was due to increasing CCRSA scores across timepoints, resulting in a clear negative skewness co-efficient (-1.268) as scores clustered at the higher end of the scale. Given this, and the relatively small number of participants, the non-parametric Wilcoxon signed ranks test (2-tailed) was used to assess the significance of differences between CCRSA scores at the three paired timepoints. Between pre- and post-therapy, CCRSA scores increased, but not

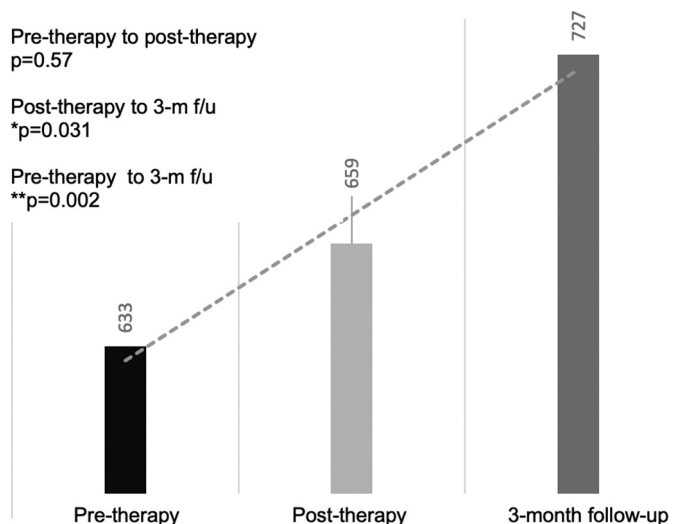


Figure 3. Mean CCRSA scores for all participants across timepoints.

significantly ($Z = -1.904$, $p = 0.057$). Between the post-therapy and 3-month follow-up CCRSA scores continued to increase, and the difference was statistically significant ($Z = -2.160$, $p = 0.031$). Finally, when comparing CCRSA scores from pre-therapy to 3-month follow-up, the difference was highly significant ($Z = -3.126$, $p = 0.002$).

On examination of mean group scores for each CCRSA item, results indicate maintenance across all communication contexts probed, across timepoints. Figure 4 shows this maintenance, with gains observed on questions 1, 6 and 8, which probe participant's confidence that they feel understood, can talk to others, and can talk for themselves, respectively.

Individual CCRSA scores increased across the three timepoints for 13 of the 15 participants. Two participants' CCRSA scores increased immediately post therapy, but then decreased again at the 3-month follow up (participants 13 and 14).

Script fluency

Of the 15 participants who completed the intervention, eight complete sets of pre- and post-spoken script videos were viable to be transcribed and analysed (53%), including recordings from six people with lvPPA, and two with nfvPPA. Recordings were excluded due to a technical error on the part of the clinician (e.g. only part of a script being recorded) ($n = 4$) and participants choosing to not be recorded ($n = 3$). In the latter case, three clients reported feeling under pressure when the camera was on, meaning they did not perform as well. To remove any chance of distress and ensure engagement in the group session, recording did not take place. Without consulting with the SLT assessor Participant 2 chose to produce a different script at the post-therapy timepoint to pre-therapy. Whilst difficult to know, it is possible that Participant 3 may have read their script aloud pre-therapy as opposed to saying it from memory, reflected in the high pre-therapy spoken script percentage. Neither sets of data have been excluded from the results. Given that the data reduces mean script percentage scores, rather than inflate them, it was felt that it would provide a more conservative estimate of the treatment effect. See Table 3 for full script fluency results.

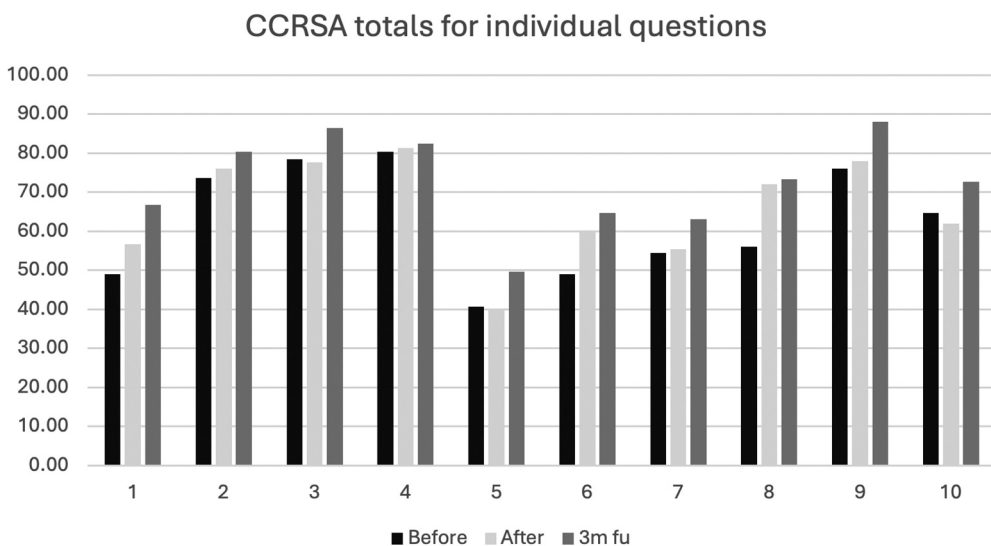


Figure 4. Mean CCRSA scores per individual question across timepoints.

Table 3. Script fluency results pre- and post-intervention per participant.

Participant	PPA subtype	Pre-intervention						Post-intervention					
		Script words	Time (s)	Narrative words spoken	Script words spoken	% script words spoken	Narrative WPM	Spoken WPM	Words	Time (s)	Narrative words spoken	Script words spoken	% script words spoken
4	nfvPPA	66	104	216	62	66.67%	17	29	96	72	67	66	100.00%
13		110	45	91	40	24.55%	26	30	121	136	111	83	75.45%
nfvPPA mean		88	75	154	51	40.43%	22	30	109	104	89	75	84.66%
1	lvPPA	57	135	58	46	26.32%	48	140	164	140	88	15	26.32%
2*		60/220	280	211	178	46.67%	51	80	391	268	262	134	66.34%
3**		115	129	97	121	95.65%	75	80	297	181	194	70	60.87%
14		94	103	56	82	30.85%	88	110	150	72	133	59	62.77%
15		77	238	122	84	15.58%	41	117	230	152	93	33	42.86%
16		108	340	193	187	50.00%	58	106	520	265	279	55	50.93%
lvPPA mean		99	204	123	116	41.96%	60	106	292	180	175	61	61.93%
Overall mean		95	172	131	100 (58.22% [‡])	42.08%	46	79	246	161	153 (62.32% [‡])	64	67.94%

*participant 2 chose to produce a different script at the post-therapy point to pre-therapy.

**participant 3 may have read their script aloud pre-therapy as opposed to saying it from memory, hence the high %script words correct at this point.

[‡] as a percentage of total words spoken.

nfvPPA = nonfluent variant PPA.

lvPPA = logopenic variant PA.

Each written script was on average 95 words long. When re-telling their scripts pre-therapy, participants spoke a mean of 172 words over 131 seconds, of which 100 words were narrative words and 40 were script words. This resulted in a mean speed of 79 words-per-minute, and 46 narrative words-per-minute. Post-therapy, the mean number of words used to retell a script rose significantly to 246 words ($Z = -2.103, p = 0.35$), over 161 seconds. Words spoken now included 153 narrative words, and 64 script words. There was a statistically significant rise in the use of narrative words ($Z = -2.100, p = 0.36$) but not correct script words produced ($Z = -1.351, p = 0.176$). However, mean percentage of accurate script words spoken pre-therapy was 42.08%, rising to 67.94% post-therapy. Considering speaking rate, there was a non-significant 14.04% increase to 92 words-per-minute post therapy ($Z = -0.840; p = 0.401$), with a non-significant 19.66% increase to 57 spoken narrative words-per-minute ($Z = -0.070; p = 0.944$).

Considering the 6 clients with a lvPPA diagnosis, the average script length was 99 words. Pre-therapy people with lvPPA used on average 204 words to retell their scripts, of which 41 were script words (41.96%) and 60 were narrative words. Immediately following the intervention, people with lvPPA said more when retelling their script, using on average 292 words, of which 61 were script words (61.93%) and 62 were narrative words. Speaking rate was 106 words-per-minute pre-therapy, reducing to 98 words-per-minute following therapy. Therefore, speaking rate reduced slightly, and efficiency stayed approximately the same before and after therapy, alongside the increase in script accuracy.

Taking only the 2 nonfluent clients in isolation, the average prepared script length was shorter at 88 words. Pre-therapy the two participants used on average only 75 words to re-tell their script of which 36 were script words (40.34%) and 51 were narrative words. Following the script group intervention these two individuals were markedly more efficient and fluent when re-telling their script using on average 109 words of which 75 were script words (84.66%) and 89 were narrative words. Average speaking rate also more than doubled pre-therapy (30 words-per-minute) to post-therapy (67 words per-minute) for the two individuals with nvPPA.

Script intelligibility was maintained by all participants. The average intelligibility score across all participants rose slightly, and there was not a significant difference in the intelligibility scores at the pre-therapy ($M = 2.5, SD = 0.65465$) and post-therapy ($M = 2.75, SD = 0.59761$) time-points ($t(8) = -1.871, p = 0.104$). Table 4 provides pre- and post-intervention script intelligibility scores per participant.

Table 4. Global quality of intelligibility* pre- and post-therapy.

Participant	Pre-therapy	Post-therapy
1	2	2
2	2.5	3
3	3.5	3.5
4	1.5	2.5
13	2.5	2.5
14	3	3.5
15	2	2
16	3	3
Mean	2.5	2.75

*rated by a naïve rater using the scoring system of Montagut et al. (2024).

Discussion

The findings from this service improvement study demonstrated the feasibility and acceptability of the Script Club group intervention, delivered via telehealth. Attendance data and qualitative feedback demonstrated that it was feasible to deliver remote script training in a group of mixed composition to people with lvPPA, nfvPPA and mixed PPA subtypes, at various stages of their disease journey, and that they found the experience acceptable. Despite several participants in the script group having experienced symptoms of their disease for more than six years they demonstrated improvements in script production (participants 2, 4 and 15 were 77-, 78- and 80-months post symptom onset respectively), albeit they prepared the three shortest scripts. Further considering candidacy, the one participant who discontinued participation in the study had experienced symptoms for 67 months, whilst not the longest, this and the participants intercurrent health issues certainly represents a more advanced disease stage. Similar to prior mixed composition groups described in the research literature, providing PPA education and getting to know other group members' communication skills and needs in early sessions was planned to facilitate group cohesion (Beales et al., 2019; Watanabe et al., 2024). This expands on previous evidence supporting mixed aetiology groups, to groups of mixed variants and disease stages (Watanabe et al., 2024). It also highlights the importance of the PPA practice principle of "knowing people deeply" (Volkmer, Cartwright, et al., 2023).

The current study highlights the different needs of people with different PPA variants within a group setting. Firstly, no participants with svPPA were recruited to the group. Given that the speech and language therapy service for people with PPA at the NHNN delivered person-centred care, in-line with best practice guidelines (Volkmer, Cartwright, et al., 2023), it is possible that script group aims did not align with appropriate person-centred goals for potential group members with a svPPA diagnosis. This is also consistent with the leading symptoms in svPPA being difficulties with word and concept meaning, which is not the main training target in script therapy (Goldberg et al., 2012; Gorno-Tempini et al., 2011; Hardy et al., 2024; Mesulam et al., 2021). Although people with svPPA have successfully participated in group interventions previously, the absence of participants with svPPA in the current study poses the question of candidacy for people with svPPA to participate in telehealth script training groups (Beales et al., 2019; Watanabe et al., 2024). Secondly, several participants with lvPPA reported auditory difficulties during the online groups. It is possible that this may have been a manifestation of their auditory processing difficulties and future research exploring methods of maximising their auditory experience would be useful (Jiang et al., 2023). Additionally, the devices that participants were using may have contributed to these difficulties. Future service improvement and implementation research should explore feasibility of implementation solutions to support participation in remote groups (e.g., external speakers, hearing aid optimisation) and make direct comparisons between in-person and remote attendance.

This study demonstrates that group therapy sessions for people with PPA provides both social, emotional and therapeutic benefits. Previous research has emphasised the psychosocial benefits of meeting other people with PPA and sharing strategies (Taylor-Rubin et al., 2020; Watanabe et al., 2024). Qualitative data collected from participants in this study are consistent with these previous findings. The findings from this study also emphasise that meeting on-line was a useful way to access this peer support, given the geographical distance

between peers. Despite this there remained a tension between the opportunity that online meetings provide and the desire to meet in person, with participants promoting the idea of a one-off in person meeting for future group improvements. Group feedback did however emphasise the motivation to practice that the group instilled in them. The authors can testify that two of the four groups have continued to meet independently of the therapists and have continued practising their old and new scripts (in one case adding in reading aloud poems) together in these groups. Further research should explore the active ingredients within group therapy for people with PPA, that promote this novel form of generalisation and perhaps more valuable ecologically valid approach.

Participants in this study demonstrated modest improvements compared to other studies of remote script therapy for people with PPA. In Henry et al.'s (2018) VISTA study (Henry et al., 2018) 5 of 10 participants with nvPPA received the intervention remotely, and averaged 38.01% script accuracy pre-treatment, rising to 89.78% accuracy immediately post-treatment. The current study results demonstrate a smaller improvement, though in the intended direction, with an average 42.08% script accuracy pre-therapy rising to 67.94% post-therapy. Given that the participants in the current study were not provided with script practice videos, it is perhaps not surprising that they achieved lesser gains than Henry et al.'s participants who all had videos to support their practice. The script group protocol focussed on getting the gist of the script across, and generalisation of functional script use in real life. Thus, the increase in script accuracy, as well as script speed (words-per-minute) and script efficiency (narrative words) for the eight participants with available recordings, demonstrate surprising improvements in fluency.

Importantly, this study demonstrated that the script group resulted in improvements in accuracy and fluency for people with lvPPA and nvPPA. Six of the eight participants whose scripts were recorded (75%) in the current study presented with lvPPA. This may have accounted for the higher mean accuracy of scripts pre-intervention and a consequent lesser change post-intervention, nevertheless the improvement is still notable. Interestingly, individual analysis of script accuracy and fluency results in this study demonstrate that the two participants with nvPPA (participants 4 and 13) both had the highest script accuracy scores post treatment (100% and 75.56% respectively). Those with lvPPA were more likely to say far more and have longer scripts. Furthermore, the 2 participants with nvPPA had the biggest increase in fluency and efficiency pre- to post- intervention as measured by increase in speaking rate and narrative words used.

This study also demonstrated improved communication confidence across all participants after attending Script Club, that continued to increase 3-months post intervention. Importantly, confidence scores should be interpreted with caution and may have been inflated by group administration. It is also possible that continued improvement at follow up may reflect the explicit focus on generalisation, and scripts use in real life. Youmans et al. (2005) suggest that learning a script can improve discourse in less structured social contexts by improving communication confidence (Youmans et al., 2005). Being armed with a set of relevant phrases and chunks of rehearsed discourse to expand upon or to fall back on in the event of difficulties, may improve confidence and spoken communication beyond the rote learned script itself. Having succeeded with this task during the group, several participants reported having been encouraged to continue to independently develop, practice and apply scripts in real life settings such as phone calls. Script group

may therefore be facilitating “enactment” (Borrelli, 2011). This theory suggests that improvements in using a new skill are not observed immediately after acquiring it, but rather only after a period of actively putting the skill into practice.

Limitations

Whilst no participants with svPPA were recruited to the script group, this service improvement study does demonstrate that a small number of participants with lvPPA, nvfPPA and mixed PPA were all able to benefit from script therapy, delivered in a group format via telehealth. Although an adaptable therapy, engagement with a remote script training intervention in group format may not be accessible to some people with PPA at more advanced disease stages. A future full trial of a remote script group would benefit from a larger sample of participants and should collect data on participants’ language and extra-linguistic cognitive profiles to better inform our understanding of benefits at different disease stages. The analysis of outcomes is limited in this service improvement study, as several participants declined to be recorded, and no script production measures were recorded at all at the three-month follow up session. Considering CCRSA score administration was undertaken in a group setting, by the group facilitator, it is possible participants may have biased one another’s responses. Additionally, no intra-rater reliability was measured for intelligibility ratings. Future research, undertaken with unbiased assessors, in individual sessions pre- and post-intervention would provide a more rigorous design to extrapolate findings to the wider population of people living with PPA. Additional outcomes measures should be considered, for example Goal Attainment Scaling for a rigorous examination of goals, or a more targeted PROM developed with and by people with PPA (Turner-Stokes, 2009). Given this was a service improvement study, there were several other limitations that should be addressed in a future full trial including an assessment of fidelity of treatment delivery, inclusion of double baseline measures to avoid potential placebo bias, randomisation to a comparator control intervention, such as remote individual script therapy or a less structured social group intervention. In the context of a clinical evaluation this approach was not ethically appropriate. Additionally, it was not appropriate to record and transcribe the focus group feedback, limiting analysis to extraction from notes made by the facilitator during the session.

Conclusions

This study demonstrates that a script training group was feasible and acceptable to run within a national speech and language therapy service for people with PPA, in the NHS in the UK. Improvements in speech fluency and accuracy were observed immediately following group participation, and improvements in confidence continued to improve 3-months after participation. Importantly, several participants reported how much they valued the focus on generalisation as well as the support they received from group members that motivated them to make long-term functional changes in how they managed communication difficulties. Given that PPA is a relatively rare disease, it is likely that a script group should be delivered across larger regional areas to ensure participants fully benefit from this intervention. Future research in the form of a full trial should focus on comparing script groups to another intervention, such as individual script training, exploring fidelity of intervention delivery and ensuring outcome measures are collected by a blinded assessor.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data that support the findings of this study are openly available in the open science framework repository at <https://osf.io/d8whf/> <https://doi.org/10.17605/OSF.IO/D8WHF>

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