Evaluating an AI-enabled online platform for non-progressive dysarthria rehabilitation: usability, engagement and outcomes

Abstract

Background.

Dysarthria following stroke or traumatic brain injury can significantly affect intelligibility, participation and psychosocial wellbeing. Although principles of neuroplasticity and motor learning emphasise intensity, repetition and feedback, access to sufficient Speech and Language Therapy in post-acute settings is often limited. Digital platforms may offer opportunities to increase therapy intensity and personalisation, but questions remain regarding accessibility, usability and support needs.

Aims.

This study explored the accessibility and usability of an online speech rehabilitation platform for adults with non-progressive dysarthria. Specifically, we examined whether participants could engage independently or required support, how they experienced the platform, and whether preliminary changes in speech and communication outcomes were observed following use.

Methods & Procedures.

Eighteen adults with acquired dysarthria following stroke (n = 16) or traumatic brain injury (n = 2) were recruited via social media, support organisations and professional networks. Participants accessed the platform for a minimum of 8 weeks, with frequency and intensity self-directed, and exercises selected and personalised by a research Speech and Language Therapist. Retention and engagement were recorded and also measured by in-platform metrics. Usability was explored using a structured Likert-type questionnaire. Outcomes were assessed at baseline and endpoint using the Frenchay Dysarthria Assessment–2 (FDA-2), the participant self-rated Communication Outcome after Stroke (COAST), and clinician-rated Therapy Outcome Measures (TOMs). Exploratory pre–post comparisons were conducted.

Outcomes & Results.

Eleven participants completed the intervention. Most were able to use the platform independently following initial familiarisation; four required some degree of family support. Two participants withdrew due to technology-related access barriers. Usability ratings indicated generally positive perceptions of ease of use and learnability, with greater variability in responses relating to complexity and independent use.

Exploratory analyses demonstrated improvements across objective, clinician-rated, and participant-rated measures. FDA-2 scores increased by 10.9 points (d = 1.31), COAST scores increased by 5 points (d = 1.35), and TOMs ratings showed improvements across impairment, activity, participation and wellbeing domains (d = 0.58–0.79).

Conclusions & Implications.

An online speech rehabilitation platform appears acceptable and accessible for many people with non-progressive dysarthria, although support needs vary and digital exclusion remains a concern. Preliminary improvements across impairment, activity and participation domains suggest potential benefit, larger hypothesis-testing trials are required. Digital rehabilitation may represent a feasible adjunct to Speech and Language Therapy, provided that implementation models include appropriate support to avoid exacerbating inequalities in access.

Background

Dysarthria describes an impairment of speech due to weakness or coordination difficulties of the muscles used for speech. Following a stroke, around 52% of people experience dysarthria (Mitchell et al., 2021), while after traumatic brain injury around 30% of people are affected (Safaz et al., 2008). Severity ranges from a mild to a severe effect on the intelligibility of a person's speech. Even in cases of mild impairment dysarthria can have profound psychosocial impacts including social isolation, negative effects on self-identity, and fear of stigmatisation (Brady et al., 2011a).

Speech and Language Therapy can address the symptoms and impact of dysarthria in each of the three domains described in the International Classification of Functioning, Disability and Health (ICF, World Health Organisation, 2001): the impairment level, that is, the strength, speed and coordination of speech musculature; the activity level, that is, the production of intelligible speech and the use of strategies to improve communication; or the participation level, that is the ability to take part in everyday situations and social roles which may require communication.

The National Institute for Health and Care Excellence (NICE) states that following stroke a person should receive at least 3 hours a day, 5 days a week, of rehabilitation therapy relevant to their needs, and that Speech and Language therapists should provide targeted individualised therapy for impairments such as dysarthria (NICE, 2023). Draft NICE guidelines for traumatic brain injury (TBI) similarly specify that speech and language therapy should be offered if there is a need, focusing on the person's goals for rehabilitation (NICE, 2025). The rehabilitation of dysarthria is based on principles of neuroplasticity and of motor learning, which emphasise respectively the importance of intensity, repetition and salience (Ludlow et al., 2008) and of appropriate practice schedules, and the provision of feedback (Bislick et al., 2012). However the UK Sentinel Stroke National Audit Programme found that patients in need of Speech and Language intervention in post-acute settings receive on average less than 10 minutes per day of Speech and Language Therapy (Gittins et al., 2020), with swallowing safety potentially taking priority over communication disorders such as dysarthria (Mitchell et al., 2021). There are disparities in access, with women and people from ethnic minorities receiving less Speech and Language input on average (Gittins et al., 2020).

Computer-assisted personalised therapy can provide high intensity and high frequency therapy, at a time that is optimal for the user with regard to fatigue and other activities, while reducing the resources required for provision of Speech and Language Therapy. Research in a similar population of people with aphasia has shown that online provision of therapy led to language improvements (Palmer, et al.,, 2013). There is a demand for appropriately challenging, relevant and personalised, self-led rehabilitation exercises for people with dysarthria (Brady et al., 2011b), and there is evidence that computer-assisted therapy is feasible for people with dysarthria (Mitchell et al., 2018).

There are benefits to computer-assisted therapy beyond accessibility and efficiency, in the possibilities of leveraging new and emerging technologies to increase personalisation and opportunities for self-management. Automated feedback can be provided on metrics such as speech rate, loudness, and phonemic accuracy, which may be useful for self-management (Berry & Goshorn, 1983; Mendoza Ramos et al., 2021). Additionally, artificial intelligence (AI) technologies, especially large language models (LLMs), introduce new possibilities for computer-assisted speech and language therapy to provide novel personalised content using naturalistic language, and to simulate functional communication tasks. ‘Beautiful Voice’ is an online platform that incorporates automated feedback and AI to deliver speech rehabilitation, while facilitating personalisation and flexibility for the user. This paper reports early usability testing of this platform with stroke and brain-injury survivors with dysarthria to explore accessibility, usability and preliminary speech outcomes.

The aims of this study are:

1) To determine whether people with acquired dysarthria following stroke or brain injury are able to access the platform, independently, or with support.
2) To explore how users interact with and experience the platform, through a structured usability questionnaire and through metrics reported on the Beautiful Voice platform with regards to frequency and duration of engagement.
3) To identify potential improvements in clinical outcomes after using the platform by carrying out an exploratory (non-powered) comparison of baseline and post-intervention scores on standardised measures across different ICF levels (World Health Organisation, 2001).

Method

We sought to determine whether adults with acquired dysarthria could use the Beautiful Voice platform independently or with support, how accessible they found it and whether there are any indicators that it can improve speech and communication outcomes.

Participants and Recruitment

We aimed to recruit between sixteen and twenty-two participants. Recruitment was carried out via social media platforms, support groups, and professional networks, namely: posts on LinkedIn and X/Twitter, circulation via the Stroke Association, the British Aphasiology Society newsletter, and contacts through the Association of Speech and Language Therapists in Independent Practice. These participants were screened according to the following inclusion and exclusion criteria.

Inclusion criteria:

1. Diagnosis of acquired dysarthria/neurological speech disorder as given by a speech and language therapist (due to any non-progressive neurological cause, including post-stroke, traumatic brain injury, infection, brain cancer, or brain surgery).
2. Currently medically stable (at any time post-onset).
3. Judged by a research Speech and Language Therapist to be likely to benefit from speech rehabilitation.
4. English-speaking (sufficient to participate in therapy, and with English as the main or a main language used for communication premorbidly).
5. Access and ability to use an internet connected device to access the platform.
6. Ability to use the platform either independently, or with support which will be available for the duration of the study.
7. No, or mild, comorbid language or cognitive impairment.
8. Normal or corrected-to-normal vision and hearing.

Exclusion criteria:

1. Moderate or severe comorbid language or cognitive impairment.
2. Progressive neurological disorder.
3. Any other cognitive, communication or sensory impairment which would prevent access of the Beautiful Voice platform.

Intervention

The speech rehabilitation intervention was delivered via the Beautiful Voice platform (https://beautifulvoice.co.uk/) for a minimum of 8 weeks through any Internet enabled device, with laptop, computer or tablet with a large screen being recommended. Exercises include reading text of various lengths aloud (from single phonemes to paragraph length), describing pictures, responding to audio prompts. Cues can be provided, such as visual or audio pacing cues, or video models. The exercises incorporate feedback, including phonemic or word accuracy, loudness, and speech rate. Many exercises can be personalised both with regard to matching the format and feedback of the task to the speech goals and the needs of the user (e.g. producing words containing particular consonants), and with regard to AI-generated content being aligned to user interests (e.g., Manchester United football team, science fiction, fashion, or the Roman Empire). Additionally, custom modules can be produced by the Speech and Language Therapist, for example in this trial a custom module targeting nasal and non-nasal consonant minimal pairs and providing feedback on phonemic accuracy was created for a participant with hyper-nasality.

The research Speech and Language Therapist selected and personalised the exercises available to each participant at the start of the trial according to need and interests, and provided support and further updates and personalisation during the trial, with a scheduled mid-point check-in and ad hoc availability to respond to participants' queries or requests. The platform allows both participants and the Speech and Language Therapist to see platform metrics on each participant's engagement with, and performance for, each exercise.

The platform was available to participants for a minimum of 8 weeks; no maximum duration of access was imposed within the trial period. Frequency and intensity of use were not prescribed, allowing participants to engage with the platform according to their needs.

Data Collection and Analysis

Recruitment and retention data were collected throughout the trial, with reasons for withdrawal documented. Demographic data was collected for all participants. A usability questionnaire with Likert-type items was administered in a videoconference session at the trial endpoint, along with an open-ended questionnaire about participants' experiences of using the platform, and of their speech and communication.

Speech measures were carried out during video conference sessions at baseline and endpoint to include intelligibility, conversational ability, and impact on daily life (Mitchell et al., 2024). Measures included:

Baseline only:

- Demographic data (age and sex),
- neurological information (aetiology, time post onset), symptoms, and previous experience of therapy,
- comorbid language, cognitive, sensory or motor symptoms (e.g. mild aphasia, limb apraxia, hemineglect).

Baseline and endpoint:

- The Frenchay Dysarthria Assessment-2 (FDA-2; Enderby & Palmer, 2012) measures dysarthric symptoms according to speech subsystem, and intelligibility at word, sentence, and conversation level.
- The Communication Outcome after Stroke (COAST; Long et al., 2008) scale consists of self-rated communication effectiveness, including both intelligibility-related items (e.g. speaking in a group) and participation-related items (e.g. taking part in hobbies).
- Therapy Outcome Measures (TOMs; Enderby & John, 2019) were used by the Speech and Language Therapist to assign scores in each domain of Impairment, Activity, and Participation.

Two additional measures were taken at endpoint:

- An acceptability and usability questionnaire with 5-point Likert-type items (see Appendix), including positive and negatively framed statements, to explore participants' experience of using the platform.
- A questionnaire about participants' experience of dysarthic symptoms and of using the Beautiful Voice platform, including frequency of platform usage.

To explore clinically-relevant changes effect size of improvements (Cohen's d) was calculated with 95% confidence intervals for FDA-2 and COAST. Intelligibility and mechanism sub-scores of the FDA-2 were also examined separately to provide separate clinician-determined measures of impairment and activity (with the COAST measuring activity, participation and well-being from the participants' perspective). While this analysis is exploratory, this was not a powered study to explore efficacy, it may inform the design of future hypothesis-testing efficacy trials with a larger number of participants.

Results

1. Recruitment and Retention

Eighteen participants with acquired dysarthria were recruited, sixteen following stroke, and two following TBI. Of the eighteen recruited, eleven completed the trial. Attrition was primarily due to personal or health-related circumstances, for two participants it was due to access barriers in using technology. Figure 1 shows the flow of participants through the trial, including numbers assessed, excluded, consented, withdrawn, completing the intervention, and included in the final analysis.

[insert Figure 1 around here]

Table 1 shows the demographic characteristics of participants who completed the trial, and those who completed the initial assessment only.

[insert Table 1 around here]

2. Accessibility

Of the eleven participants who completed the intervention, most were able to access and use the platform independently following initial familiarisation. Two participants required ongoing support from a partner to access the platform. A further two participants received some family support during early use of the platform (one from a spouse and one from a parent) but reported that they could have managed independently once familiar with the system.

Two participants withdrew from the study due to technology-related access barriers. One withdrew prior to baseline assessment because of difficulties setting up videoconferencing software. The second was unable to reliably access the platform during the intervention phase due to a combination of physical and cognitive comorbidities; although he could use the platform with in-person support, this could not be arranged consistently during the trial period. This participant lived in a residential care setting, with support provided by staff rather than family members.

3. Acceptability and Usability

Usability questionnaire items were rated on a 5-point Likert-type scale (1 = strongly agree, 5 = strongly disagree), with items phrased in both positive and negative directions. Responses indicated high acceptability of the platform, with all participants agreeing or strongly agreeing that they would like to use it more often (M = 1.91, SD = 0.29).

Mean responses to usability-related items indicated generally positive perceptions of ease of use and learnability. Participants tended to agree that the platform was simple and easy to use (M = 2.00, SD = 0.60), that most people could learn to use it quickly (M = 1.82, SD = 0.57), and that they understood what they were doing when using the platform (M = 1.55, SD = 0.50). These items showed relatively low variability across participants.

In contrast, responses were more variable for items relating to perceived complexity, need for assistance, learning demands, and technical smoothness. Standard deviations exceeded 1.0 for several items, including perceived complexity (M = 3.82, SD = 0.94), need for help to use the platform at home (M = 3.73, SD = 1.42), desire for parts of the platform to work differently (M = 2.64, SD = 1.30), perceived difficulty learning to use the platform (M = 3.91, SD = 0.67), and perception that there were many things to learn before starting (M = 3.45, SD = 1.08), indicating mixed experiences across participants.

4 Preliminary Clinical Outcome Measures

FDA-2 scores improved from a mean of 139.91 (out of a maximum of 184, some tasks were omitted from the online assessment; SD 12.91) to 150.82 (SD 10.73), with a mean increase of 10.91, 95% CI [5.33-16.49], Cohen's d = 1.31. [Insert Figure 2 around here]

The participant-rated COAST (0–100, higher scores indicating better perceived communication) showed improvement from 74.10 (SD 6.71) to 79.10 (SD 8.50), with a mean increase of 5, 95% CI [2.50–7.50], Cohen's d = 1.35.

[Insert Figure 3 around here]

Clinician ratings of TOMs showed mean Impairment scores increasing from 2.50 (where 5 = no impairment; SD 0.39) to 2.82 (SD 0.60), with a mean change of 0.32, 95% CI [0.05–0.59], Cohen's d = 0.79. Activity scores increased from 3.18 (SD 0.96) to 3.59 (SD 0.74), with a mean increase of 0.41, 95% CI [–0.06–0.88], Cohen's d = 0.58. Participation increased from 2.86 (SD 0.71) to 3.23 (SD 0.90), mean change 0.36, 95% CI [–0.01–0.73], Cohen's d = 0.66. Wellbeing increased from 3.14 (SD 0.64) to 3.54 (SD 0.85), mean change 0.41, 95% CI [0.02 - 0.80], Cohen's d = 0.70. Clinically significant improvement (≥0.5 points) was observed in 45% of participants for Impairment (5/11), 36% for Activity (4/11), 36% for Participation (4/11), and 55% for Wellbeing (6/11).

[Insert Figure 4 around here]

Platform Usage

Internal data on platform usage showed a range of frequencies of usage, from just under once a week, to four times a week. Most participants accessed the platform between two and three times per week on average. Platform usage data indicated that participants engaged with a range of exercise types, including updating content, static content, and personalised modules. While participants were able to explore a broad set of exercises available on the platform, usage patterns showed that practice time was concentrated on exercises recommended by the Speech and Language Therapist, with additional exploration of other exercises occurring less frequently.

Discussion

This study explored the accessibility and usability of an online, AI-enhanced speech and language rehabilitation platform for people with dysarthria, including whether participants were able to engage with the platform independently or required support. We also examined user experiences of the platform and whether any preliminary changes in speech outcomes were observed following access.

Access to technology is a challenge in digital healthcare; exclusion has been associated with age (Ge et al., 2025), disability (Pettersson et al., 2023), ethnic minority status (Islam, Bailey, & Netto, 2024), and socioeconomic disadvantage (Latulippe et al., 2017). Research in a similar population of people with aphasia has shown that support is an important aspect of access to self-managed computer-based Speech and Language Therapy (Palmer, et al., 2013; Burke et al., 2021). The current study found, in line with this, that support was a key factor in the ability to access the intervention. We found that two of the eighteen participants withdrew due to technological barriers coupled with a lack of support, and this will need to be considered in future trials. Two people were able to access the platform with support from a spouse, and felt they would not have otherwise been able to access the platform. A further two participants had some family support with access, one from a spouse and one from a parent, but felt that they could have managed independently once familiar with the platform. The NHS long-term plan is focused on moving towards digital opportunities (UK Government, 2023), so it is important to consider how to ensure a computer-based intervention is feasible for as wide a range of people as possible, including through provision of in-person or remote support through NHS services themselves for patients who have less access to family or community support.

The details of how social history and impairment interacted in making access possible or not in this trial will need to be considered in a larger trial within NHS services. The participant who discontinued the intervention after initial assessment, due to barriers to access, lived in a residential care setting. He was able to access the platform with in-person support but this could not be reliably arranged, despite high motivation and perseverance on his part. The dysarthria and co-morbidities of this participant and of one of the participants who could access the platform with the support of a partner were of similar severity, indicating that reliable and engaged social support may be the key factor in overcoming such access barriers. The participant with similarly severe co-morbidities but who also had support in accessing the platform made the greatest gains in intelligibility of all participants in the trial, despite his significant access needs and ongoing health issues which affected his concentration, energy levels and ability to use a computer. This indicates that patients with high support needs can benefit from the platform if these needs are met.

Overall, usability findings suggest that the platform was experienced as learnable and understandable by most participants, but that aspects relating to complexity, independent use and initial learning demands were more challenging for some users. Cognitive, physical, language, and executive impairments are common in post-stroke or brain injury populations, and may affect the ability to navigate digital interventions independently. The variability observed in the present study suggests that while many participants could use the platform with confidence, a subset experienced difficulties that may require additional support or adaptation of the interface. For some people remote support with initial use and familiarisation is adequate to ensure usability throughout the intervention period, but for others, in-person and ongoing support will be required to engage with this type of digital healthcare.

There are some early indications that access to the platform led to individuals improving on certain domains, including in the participant-rated measures of their communication outcomes. The development of a Core Outcome Set for dysarthria after stroke highlights the importance of including patient-reported outcome measures such as the COAST (Mitchell et al., 2024), which captures perceived communication effectiveness and participation in everyday life (Long et al., 2008). Although this study was not powered to explore effectiveness, we can see some encouraging trends that merit further exploration.

Conclusion

This study suggests that an AI-enabled, online speech rehabilitation platform is acceptable to people with acquired dysarthria and can be accessed independently by many users following initial familiarisation. For individuals with more substantial physical and/or cognitive co-morbidities, ongoing support from a family member facilitated access and engagement, whereas a lack of such support meant that access barriers were not overcome. These findings highlight the importance of considering social and environmental supports, alongside individual impairment, when evaluating digital rehabilitation interventions, and considering how services can support access for those at risk of digital exclusion.

Across clinician-rated and participant-reported outcome measures, improvements were observed at the levels of impairment, activity, and participation. The pattern of change across multiple ICF domains provides preliminary indications that sustained engagement with the platform may support meaningful communication outcomes for some users.

The Beautiful Voice platform incorporates features that align with established principles of dysarthria rehabilitation, including opportunities for high-intensity practice, feedback on relevant speech parameters, and personalisation of therapy content. The use of AI-generated, regularly updating material may help maintain engagement and relevance, although the specific contribution of individual platform features could not be isolated within the current study. Qualitative findings exploring user experiences of personalisation and content adaptation will be reported separately.

Taken together, these results indicate that AI-enabled digital platforms may represent a feasible adjunct to speech and language therapy for people with non-progressive dysarthria who are able to access and use digital technology, particularly where appropriate support is available.

Limitations and Future Directions

The sample size of the study was small, and participants were self-selecting, limiting generalisability. While most participants reported that the platform was simple and easy to use, a subset experienced difficulties related to learning demands, perceived complexity, or technical smoothness. These findings suggest that further refinement of onboarding, interface design, and support mechanisms may be required to improve accessibility for users with cognitive or physical co-morbidities.

Following iterative changes as a result of this study further feasibility trials are required to determine the effectiveness of the platform, identify which users are most likely to benefit, and establish optimal models of support and implementation.

Future research should also examine how AI-enabled features such as personalisation, adaptive content, and automated feedback contribute to engagement and outcomes. A service-level evaluation is currently underway, and further work informed by MRC guidance on complex interventions will be needed to support equitable and sustainable integration of digital rehabilitation platforms into routine clinical care.

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Appendix

Usability Questionnaire

I think I would like to use this platform more often

I think the platform looks complex/overwhelming

I think the platform was simple and easy to use

I would need help from someone else to use this platform at home

I found the platform working smoothly, ie, no big errors.

There are some parts of the platform that I would want to work differently

I think most people can learn to use this platform quickly

I think it was hard to learn how to use this platform

I feel I knew what I was doing when using the platform

I think there are a lot of things to learn before I can start using this platform

Figure 1

Flow of participants through the feasibility study (diagram adapted from CONSORT guidelines; Schulz, Altman, & Moher, 2010)

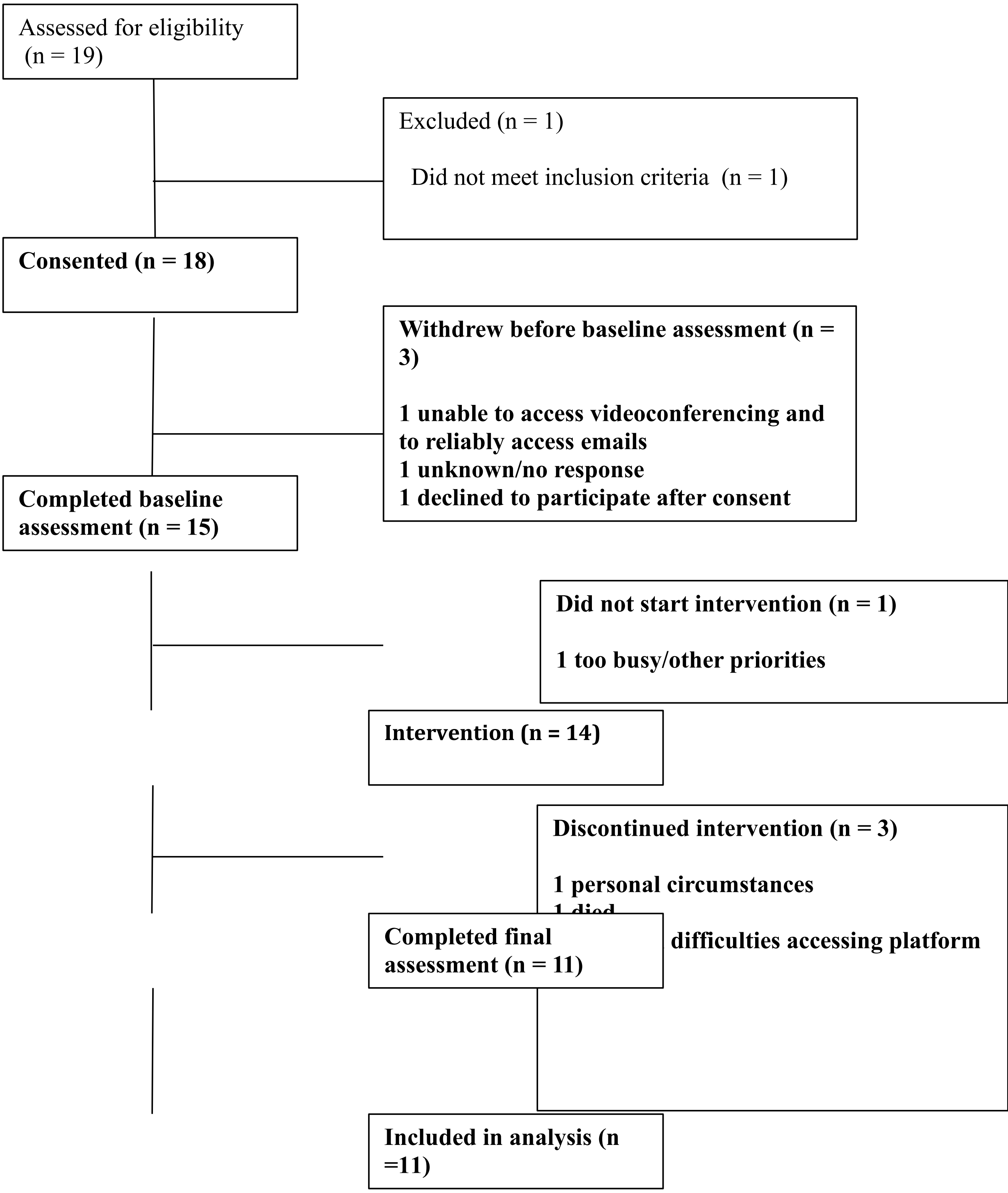
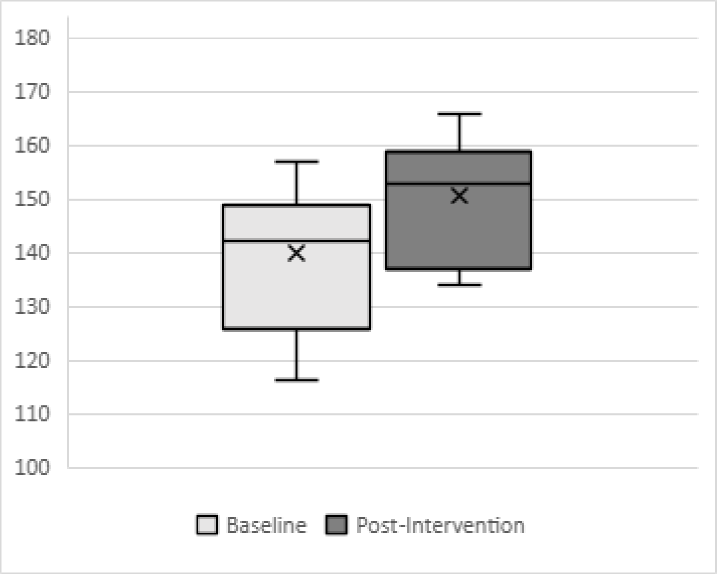


Figure 2

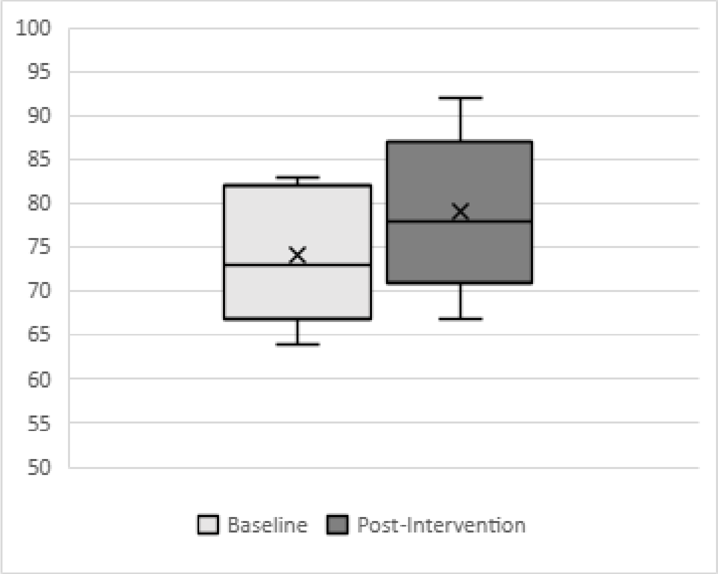
FDA-2 (Enderby & Palmer, 2012) scores at Baseline and Post-Intervention



Note. Therapist administered objective assessment, examining mechanism and intelligibility, with a maximum score of 184 (some tasks were omitted from the online assessment).

Figure 3

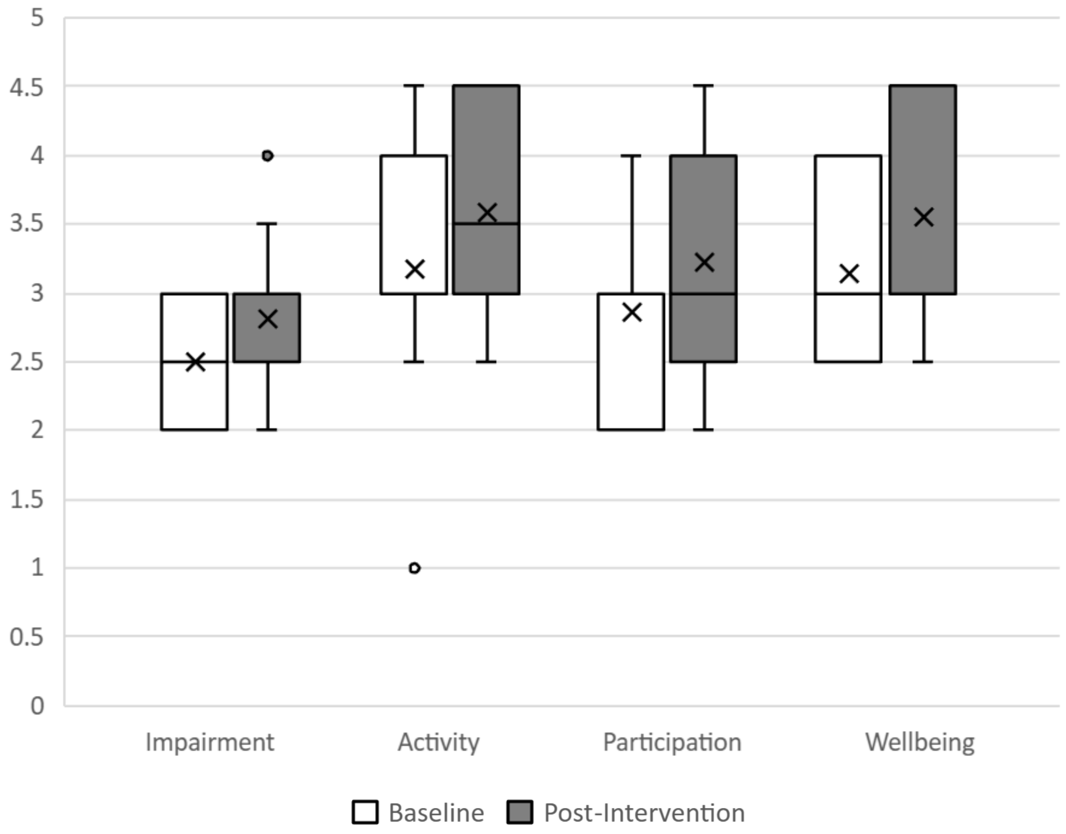
COAST (Long et al., 2008) scores at Baseline and Post-Intervention



Note. Self-rated from 0–100, higher scores indicating better perceived communication.

Figure 4

TOMs Ratings at Baseline and Post-Intervention



Note. Impairment: 5 = No impairment, 0 = Profound dysarthria. Activity: 5 = Communicates effectively in all situations, 0 = Unable to communicate in any way. Participation: 5 = Achieving potential, 0 = Unable to fulfill any social/educational/family role. Wellbeing: 5 = Not inappropriate, 0 = Severe constant.

Table 1

Demographic and Impairment Characteristics of Participants

Group	N	Age range (years)	M (SD) age	Ethnicity	Diagnosis	Time post-onset range	M (SD) time post-onset (years)	FDA-2 initial assessment M (SD)
Completed trial	11	29–78	57.9 (14.6)	9 White British, 1 White Irish, 1 Irish/Indian	9 stroke, 2 TBI	2 weeks–13 years	3.1 (4.2)	139.9 (12.9)
Initial assessment only	4	44–73	60 (10.4)	4 White British	3 stroke, 1 TBI	7 months–23 years	8.7 (8.6)	126.3 (20.3)