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Improving efficiency through innovation in the 'real-world': feasibility of a co-designed telehealth solution for individuals with aphasia

Abstract

Background: Research indicates that speech and language therapy for individuals with aphasia delivered via telehealth is acceptable and facilitates good outcomes. Although adoption of telehealth has increased following COVID-19, it has not been implemented broadly. Telehealth could assist services to meet the recommended intensity of therapy for individuals with aphasia.

Objective: The study aimed to investigate the barriers and facilitators to adopting telehealth for individuals with aphasia at two local NHS trusts; and to co-design a telehealth solution responding to these challenges. The feasibility of this solution was also investigated. A secondary objective is to highlight the value of real-world data (RWD) collection in evaluating clinical practice.

Methods: An experience-based co-design study was conducted, which developed and piloted a bespoke telehealth solution across service pathways at two NHS sites. Feasibility was evaluated qualitatively through interviews and quantitatively from RWD collected through the telehealth software.

Results: The telehealth solution incorporated outsourcing of the service to a specialist company, provision of hardware and software and regular support for individuals with aphasia and their carers. Take up was associated with a positive impact and the RWD revealed a substantial increase in the hours of therapy the individuals with aphasia received.

Conclusion: Personalised telehealth solutions which respond to local and personal needs are feasible and an acceptable way to increase the intensity of speech and language therapy for some individuals with aphasia, bringing services more in line with evidence-based recommendations and optimising patient outcomes. Embedded RWD collection systems are valuable for evaluation.

Introduction

Aphasia is a disorder of language affecting all aspects of communication which often occurs following a stroke or head injury and is frequently demonstrated by difficulties in word finding (Lazar & Boehme, 2017). Speech and language therapy addresses the impact of aphasia on a person's everyday life by optimizing their functioning and supporting social engagement (Simmons-Mackie et al., 2017). Expanding the focus of rehabilitation beyond curative care and aiming to ensure that people can remain as independent as possible and participate in education, work and meaningful life roles is indicated in the International Classification of Functioning, Disability and Health (ICF) (World Health Organisation, 2007) which reflects these broad concepts in a bio- psychosocial framework.

Much research has explored how speech and language therapy can best optimise patient outcomes of individuals with aphasia speech and language therapy.. A comprehensive Cochrane review of speech and language therapy for individuals with aphasia reported greater benefits to patients with chronic aphasia when they received

therapy at high intensity (from 4 to 15 hours per week), high dosage (27-208 hours in total), and over a long period (up to 22 months) compared to less intensive treatment schedules (Brady et al., 2016). The Release study of 959 individual patients recruited to 25 randomised controlled trials (Brady et al., 2022) concluded that greatest language recovery was associated with frequent, functionally tailored, receptive-expressive speech and language therapy, with prescribed home practice at a greater intensity and duration than is usually available. It is also understood that post stroke aphasia can improve over many years with speech and language therapy (Brady et al., 2016; Naeser et al., 1990).

Reflecting the evidence-base, the National Institute of Health and Social Care Excellence (NICE) for rehabilitation after stroke indicates best practice for individuals with aphasia should be intensive and targeted speech and language therapy offering at least 45 minutes for a minimum of 5 days per week for people who can participate, and where functional goals can be achieved. Furthermore, it is recommended that this should be reviewed at 6 months and further therapy offered if needed (NICE, 2013). However, providing therapy at this intensity and duration is rarely achieved in many countries (Cavanaugh et al., 2021) including the UK (Bray et al., 2016) and there remains a substantial research to practice gap. In particular, speech and language therapy is often less readily available beyond a few months after stroke and patients complain of 'being abandoned' (Hersh, 2009). The Sentinel Stroke National Audit Programme (SSNAP) data further exposes the challenge of providing truly evidence-based care in the real-world (Bray et al., 2016).

One approach to increasing the amount of therapy and thus reducing the research to practice gap is to increase home-practice/self-management, which is usual practice in rehabilitation (Jonkman et al., 2016) and self-management via telehealth is emerging in

aphasia rehabilitation research (Nichol et al., 2019). Investigations into the use of telehealth/computer-based therapy to extend exposure to aphasia rehabilitation have been reported over the last 2 decades (Des Roches et al., 2015; Gerber et al., 2019; Hickin et al., 2022; Kurland et al., 2018; Mallet et al., 2016; Palmer et al., 2019). The outcomes of these studies including the Big Cactus study (Palmer et al., 2019) found that software specifically developed to support individuals with aphasia and which was tailored to the needs of the patient e.g. by personalising the vocabulary could be successfully used in home practice. Furthermore, 57 (61%) of 94 participants in this study chose to continue using software unsupported beyond the end of the formal intervention period, indicating that many participants valued the opportunity of continuing to practice independently. Subgroup analysis showed no effect of time post-stroke (range 4 months to 36 years) on the ability to improve word finding. However, the evidence is not unequivocal. On the contrary, other studies have demonstrated a lack of impact of telerehabilitation for individuals with aphasia in a functional capacity (Woolf et al., 2016) and have signalled reservations and concerns from professionals involved in its delivery (Douglass et al., 2023). Telehealth is also impeded by practical issues such as poor audio or visual quality, availability of equipment and connectivity as well as virtual communication being simply less favoured than face-to-face communication (Shahouzaie & Gholamiyan Arefi, 2022). Whilst also calling for more robust research in the area, a systematic review and meta-analysis published in 2021 outlined that overall the evidence ‘suggests’ that telehealth for individuals with aphasia is ‘at least as effective’ as usual treatment (Cacciante et al., 2021). Despite this, and the fact that services are struggling to meet the evidence-based therapy intensity recommendations, few therapists working with individuals with aphasia outside research studies have adopted

these innovative practices, although with greater uptake anticipated following COVID-19 (Appleton et al., 2021; Chadd et al., 2021).

One further common advantage of telehealth is the automatic and routine collection and storage of real-world data (RWD) to facilitate monitoring and evaluation of treatment (Rudrapatna & Butte, 2020). This has been exploited in few studies concerning telehealth for individuals with aphasia. Palmer et al's pilot of 'Step by Step' software for individuals with aphasia did report on the software's auto-recorded data on the amount of time individuals with aphasia spent practising skills through their therapy software (Palmer et al., 2012). Another form of RWD useful for exploring therapy outcomes, understanding 'real world' clinical practice and service provision is data collated via electronic health records (Mahajan, 2015; Sherman et al., 2016). Previous studies investigating speech and language therapy utilising RWD in this form have signalled an increase in telehealth use across the profession and in neurorehabilitation (Chadd et al., 2021). Examining real-world datasets from individuals with aphasia where 'method of delivery' was recorded (*n=39)* in the Royal College of Speech and Language Therapists (RCSLT) Online Outcome Tool (ROOT) (Moyse et al., 2020) - a national collation of anonymised patient records - revealed that post-COVID the majority of speech and language therapy episodes of care (*n=29*) were still delivered 'face to face' though 5 were 'mixed' using a combination of face-to-face and telehealth approaches, and 5 were wholly via telehealth. Whilst individuals in all groups made clinically significant gains according to Therapy Outcome Measure (TOM) scores (Enderby & John, 2015, 2019, 2020, 1999), the group making most gains were those who received a mixture of face-to-face and telehealth delivery (Royal College of Speech and Language Therapists, n.d.). The inspection of this RWD demonstrates that therapy for individuals with aphasia has

and can be delivered via telehealth to support meaningful change, though this is still not often adopted.

In summary, despite the indicative evidence that telehealth is feasible and useful for individuals with aphasia, along with the challenge of meeting therapy intensity recommendations, it is surprising that telehealth adoption remains low. Exploring the barriers to telehealth in the 'real-world' and developing solutions to respond to these is thus imperative. Understanding whether, and how such solutions can bridge the research to practice gap in speech and language therapy intensity must be understood.

Objectives

The objectives of this study were to:

1) Understand the barriers and facilitators to adopting telehealth to support individuals with aphasia to receive therapy in busy publicly funded services.
2) Identify the actions necessary to improve uptake of telehealth.
3) Co-design and implement a telehealth service addressing these principles.
4) Evaluate the feasibility and acceptability of the service, and the extent to which it increased therapy time.

The purpose of this report is to demonstrate the value of developing innovative solutions to challenges in service provision. In this instance, we illustrate how an acceptable telehealth solution supported services to increase the amount of therapy individuals with aphasia received, bringing it more in line with evidence-based guidance.

Methods

Prior to conducting the study, ethical approval, and permission to carry out the work was provided by West Midlands-Coventry and Warwickshire Research Ethics Committee (IRAS project ID 259466). The study is outlined here in alignment with the SQUIRE 2.0 publication guidelines for quality improvement reporting excellence (Ogrinc et al., 2016).

Participating sites and service users

Two local speech and language therapy services in Northern Ireland participated. These sites were recruited by personal contact with service managers who had responded to a call for services who wanted to re-engineer their service to implement telehealth to meet NICE guidelines. Recruitment of patients was open to individuals with aphasia from these services, whose SLT felt met inclusion criteria of: having had a stroke, with a subsequent diagnosis of aphasia, had English as their first language, and who had the potential to participate in intensive therapy as recommended by NICE.

Design

The study was an experience-based co-design study and evaluation of a telehealth solution and was conducted through four phases.

i. Scoping phase

Qualitative methods were employed to identify the requirements for a telehealth service that would address the needs of both patients, their carers and service providers. This included semi-structured interviews with speech and language therapy managers and SLTs representing each stage of the aphasia pathway (acute to community) from the 2 participating healthcare services. These interviews were conducted by an independent experienced researcher and explored the limitations of the current service delivery in

meeting the NICE guidelines, and perceived barriers and facilitators to implementing telehealth. Interviews were videorecorded (with consent) for purposes of data analysis. This allowed for varied perspectives to be listened to and incorporated into the design of the service. Thematic analysis was undertaken by the researcher and checked by the lead therapist using the principles outlined by Braun & Clarke (Braun & Clarke, 2006, 2021). The interpretation was fedback to the interviewees to confirm the researchers' interpretations.

ii. Design phase

Experience-based co-design methods (Raynor et al., 2020) were employed to iteratively develop the service that met these requirements. This is a participatory approach to designing solutions, in which community members are treated as equal collaborators in the design process. This phase involved 3 groups:

1. Service providers (Speech and language therapy managers, SLTs specialising in treatment of aphasia and the Stroke Association)

2. Service users (individuals with aphasia selected from current caseloads and their communicative partners)

3. Steps Consulting Ltd, the company providing the telehealth solution. (Details of the provision by the company for the telehealth solution are found in Appendix 1)

This method enabled exploration of the barriers to implementation as they arose and trial solutions as the service evolved.

iii. Implementation phase

Implementation of the service was supported with iterative and agile amendments in line with co-design methods (Raynor et al., 2020; Treasure-Jones & Joynes, 2018). The telehealth company modified the telehealth service to address the barriers identified during the interviews from the stakeholders. Throughout the implementation phase, solutions to

difficulties and barriers to conducting computerised therapy were ongoing, for example, staff turnover and the requirement for additional training sessions. Informal feedback was regularly elicited from SLTs, service users and their families/carers as per the co-design methodology. Feedback was obtained via multiple channels including monthly videoconferences with staff, and with individuals with aphasia and their carers, specific feedback sessions, and comments were invited via email. Feedback informed further changes to the service on an ongoing basis.

iv. Evaluation phase

The evaluation employed quantitative and qualitative methods. RWD from the app used as part of the telehealth service provided quantitative data including engagement statistics which was used as a proxy for acceptability in this study. Usage data provided a metric of hours of additional therapy received for each patient. This was extracted and analysed descriptively using Microsoft Excel.

Further semi-structured recorded interviews with speech and language therapy managers and SLTs were held post- implementation to explore their views of the telehealth service. These were analysed in the way described above for the scoping phase.

Results

i. Scoping phase

Six SLTs and two speech and language therapy managers were interviewed. Analysis of interview transcripts showed similar issues experienced by all interviewees in meeting NICE guidelines and barriers to telehealth (Table 1). These were grouped into the themes: ‘Patient-related’; ‘Specific to COVID-19’; ‘Staffing- related’; ‘Waiting lists’ and ‘Telehealth adoption’. The latter largely related to perceived lack of skills, knowledge, and resourcing for telehealth.

[Table 1 here].

ii. Design phase

The telehealth service which was developed addressed the barriers identified. This involved:

- Outsourcing of the provision of all equipment to the telehealth company.
- Personal and group training, and continued support through helpline and training videos for therapists and volunteers.
- Provision of impairment-based therapy apps ('Step-By-Step') that automatically adjusted the level of difficulty.
- A 'CHAT Whiteboard' app to support total communication.
- Remote monitoring of patient engagement and progress carried out by the telehealth company and exercises adjusted accordingly, plus contact being made with service managers by the external company if usage dropped.
- An integrated video conferencing feature designed specifically to address common difficulties that individuals with aphasia and their carers experience when accessing other video conferencing platforms, and to support the SLT in delivering therapy session virtually thus reducing the need for home-visits.
- Implementation of a Mobile device Management (MDM) system to provide technical support and wipe clean devices in-between patient loan and update iPad et cetera.

iii. Implementation phase

A total of 31 members of staff across the two healthcare services were recruited, who then recruited individuals with aphasia, and implemented the telehealth programme (Table 2). Stroke Association clinicians were trained in the telehealth approach, to provide extra support to the patient. All participating staff were given training from the company

providing the computerised approach, who also produced manuals and 'how-to videos' to support implementation. Remote support from the company throughout the duration of the study was also available. More detail about the telehealth package can be found in Appendix 1.

[Table 2 here]

Fifteen individuals with aphasia from across the aphasia pathway were included over a 10-month period (Table 3). They were selected by SLTs as having a communication need requiring more regular therapy than was available. Telehealth was provided alongside usual care. Support from family and friends was encouraged though this was not monitored. Ongoing feedback from individuals with aphasia and SLTs determined the modifications of the telehealth solution. For example, in response to feedback: adding personal media to apps was outsourced, ongoing monitoring through the app was conducted whilst individuals with aphasia were on the waiting list, and training materials were developed to implement 'TotalCHAT' with communication partners. TotalCHAT is a newapp – currently not available on the market - developed as part of this project, and is made up of a, picture library of salient words, a whiteboard, and a journal function, which aims to support individuals with aphasia by promoting the generalisation of targeted words and facilitating interactions.

[Table 3 here]

Evaluation phase

Acceptability

Eleven of the 15 individuals with aphasia initially engaged with the telehealth app. The four who did not engage continued with usual care but did not practice with the app in between sessions. Whilst we did not formally explore the reasons for this, anecdotally the participating SLTs reported that their non-engagement was due to various reasons including a lack of internet connection at home, a degree of recovery meaning the

additional support did not seem necessary but also motivation factors related to the lifting of lockdown in this period. In one of the cases, the patient died. Seven participants subsequently chose to continue to use the telehealth app at the point of discharge from the service indicating that these service users found it acceptable and were empowered to self-manage their long-term condition.

Additional therapy

Of those who engaged, RWD taken from the app demonstrated that in total, an additional 175 extra hours therapy was undertaken independently by individuals with aphasia through the telehealth app in addition to usual care (an average of 15.9 hours per individuals with aphasia *(n=11)*) – the equivalent of almost 4 additional months of weekly 60-minute therapy sessions or 21 days' worth of 45-minute sessions.

Interviews

Two speech and language therapy managers and 4 SLTs were interviewed post-implementation. Most of these were the same staff who had participated in the initial interviews, however 2 SLTs were different due to staff changes. The managers and speech and language therapy providers were positive regarding the telehealth approach. Key themes pertaining to this included:

- the value of being able to provide *more* therapy (with several SLTs stating that they particularly valued how it saved time)
- the positive impact of being able to provide something *while on a waiting list*
- appreciation of the *automatic adjustment* regarding level of difficulty and the capacity to provide such *personalisation* of the programme

Whilst they were not interviewed, informally, several service users indicated that they enjoyed using the apps and communication partners reported it had helped communication, had improved quality of life, and gave hope. Some of the challenges reported by staff in the

interviews included specific difficulties:

- *implementing in the acute setting* due to the throughput of patients
- *implementing in the rehabilitation setting* as in-between session 'practice' was limited by availability of staff or communication partners to support it (again, hindered more so through COVID restrictions)
- *implementing in home* virtual sessions presented difficulties pertaining to privacy.
- Challenges also related to *staff training,* notably issues of high staff turnover during this period, and time to dedicate to developing confidence and skills in using the telehealth package.

These challenges may be related to the extent of engagement and continued use, as reported from the RWD.

Discussion

This study has provided insights into the barriers and facilitators to implementing telehealth for individuals with aphasia, that resonate with those reported elsewhere in the literature (for an example, see Nichol et al., 2022). It extends the current evidence-base by presenting a case of co-design and implementation of a new telehealth solution which responds directly to practitioner concerns. Furthermore, the findings show that the solution developed is feasible and indeed beneficial to individuals with aphasia and systems (speech and language therapy services), though there may be specific barriers to telehealth adoption in acute and inpatient settings. This confirms similar concerns highlighted in the literature (e.g. Curtz et al., 2021). Future research could implement experience-based co-design approaches in these settings specifically which may lead to the creation of more feasible telehealth solutions. An important result from the study was that implementation

of the telehealth service extended the hours of therapy that individuals with aphasia engaged with, which brought services more in line with national guidelines and evidence-based practice and echoes findings from earlier studies (Palmer et al., 2019).

The strengths of this study lie its collaborative approach, guided by principles of experience-based co-design. Development of the telehealth solution involved a range of stakeholders including individuals with aphasia from across the aphasia pathway and service providers, and utilised ongoing feedback to make modifications and improvements. This allowed for a range of considerations to be taken onboard which is reflected in the multi-faceted telehealth solution and included varied components to tackle specific issues such as tutoring for practitioners, mobile device management and self-directed therapy apps with auto-adjusted difficulty levels.

Incorporating real-world data from the app was advantageous in this study, as it provided crucial information about individuals' engagement with the therapy and hours of use: data that would have been especially challenging to collect accurately without such automatic means. Thus, the RWD was critical for examining the feasibility of the telehealth service, and the potential that it has for extending the hours of therapy beyond the point of discharge. Future research may explore how hours of telehealth therapy is associated with therapy outcomes, which would be well suited to exploration through a RWD study.

Limitations

Our study had strengths in that it involved all key stakeholders, however it was only trialled with two services, in a single region of the UK, Northern Ireland. Regional variation in service provision is known to exist across and within the UK (Chadd et al., 2023). Therefore, generalising the experiences of the SLTs and service users involved in this study to other healthcare providers needs careful consideration.

Additionally, individuals with aphasia who participated in the study were selected by the SLTs from their caseload, which may have introduced a bias and thus reduces the internal validity of the study. Other factors e.g. severity of aphasia and cognitive ability would be important when considering the engagement of individuals with aphasia with the therapy app, which have been demonstrated to have interaction effects with outcomes from aphasia teletherapy in other studies (Kurland et al., 2018). These variables were not controlled for in the analysis. Further research exploring these issues on a wider scale, with more individuals with aphasia and across more services would be valuable and is planned in the next phase of this study.

Conclusion

Despite the limitations, this investigation usefully contributes to the evidence-base on telerehabilitation for individuals with aphasia by describing the process, product and feasibility of a co-designed telehealth service. The study expands on previous work, for example, Burke et al. (2022) who found that computerised therapy is advantageous due to the combined potential of maximising therapy time once therapy has begun, bridging the gap between the provision from different services, potentially maintain or develop further progress and enables patients to be discharged with clear self-management support (Burke et al., 2022).

Our findings are valuable for informing clinical practice both in the empirical context but also further afield, with the potential for spread to other contexts, given that the barriers specifically addressed in the project are largely issues commonly reported with telehealth adoption in speech and language therapy, and specifically aphasia therapy, elsewhere (Cuperus et al., 2023). The study is especially useful at times where there is exceptional pressure to work through waiting lists, and to inform sustainable service

developments. We have also demonstrated innovative use of RWD to complement the evidence base by utilising the usage-based statistics that are easily obtained through app-based therapy. Together, these findings have provided useful recommendations for future research including specifically exploring telehealth options in inpatient settings.

As society's capacity and capabilities in technology accelerate in the UK, and where innovations in health service delivery are desperately sought to tackle unprecedented demands, it is imperative that SLTs and service users embrace telehealth but not without knowledge and attention to adequate training and support; providing computer based therapy will not do it alone.

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Appendices

Details of the telehealth provision

Computer programmes:

- A specialised computer program (Step-by-Step) provides a suite of impairment based computerised exercises which can be tailored to meet the personal preferences of the therapist and patient and can be linked to specific functional goals.
- These can be personalised by the speech-language therapist with the patient's own photos to reflect important relevant vocabulary and modified with relevant local dialect if required.
- The incorporated smart adaptive features automatically respond to performance by changing levels of difficulty i.e., get harder or easier according to performance and incorporate motivating interfaces to encourage independence that can accommodate the accessibility requirements, both physically and cognitively of a particular stroke survivor.
- There is a particular app (CHAT whiteboard) aimed at promoting total communication to help the person with aphasia to use and expand their remaining language and communication abilities which aims to facilitate socialisation and participation with family, friends, care givers.

Outsourced service:

- Development of an outsourced Telehealth service provided by Steps Consulting Ltd to provide remote monitoring of therapy utilisation and progress, integrated video conferencing to enable remote interactions with professional teams and alerts to therapy teams of those patients not using the Apps as per protocol.

- The Telehealth company provided:
  - Loan equipment (iPads) to therapist and patients configured to use the NHS Service guest WiFi, so no input was required from Service IT.
  - Maintenance of all equipment using a Mobile Device Management Service (MDM) so devices could be remotely wiped completely in-between patient loan.
  - Technical support was provided virtually to both clinicians and patients in their own home when needed.
  - Training to all staff involved in the aphasia pathway.
  - telehealth manuals and “how to videos” on request for service providers and users on the telehealth approach.
  - consultancy from a Specialist SLT from the company to assist with implementation.

Tables

Table 1. Overview of themes related to barriers for telehealth uptake.

Theme	**Examples**
Patient-related	individuals with aphasia being too medically unstable or with concomitant difficulties
Specific to COVID-19	individuals with aphasia and families not wanting home visits, limited hospital visits, staff being seconded to Nightingale ward, and PPE restraints
Staffing- related	SLTs being stretched too thinly, staff shortages, and an imbalance in demand for dysphagia rather than communication input
Long waiting lists	In one trust, there was a waiting list of 12 weeks to access community speech and language therapy team. In both trusts, once discharged from community services, patients were waiting approximately a year for any further services.
Telehealth adoption	Limited IT equipment, lack of support from IT and connectivity issues in the hospitals, lack of knowledge of Apps and how they can be used to elicit functional goals

Table 2. Table showing the details of the 31 staff trained during the field trial across the Aphasia Pathway.

Setting	Trust 1	Trust 2	Stroke Association	Total
Acute setting	1	4	0	31
Inpatient rehabilitation	2	5		
Community Stroke Team (CST)	6	4		
Stroke Recovery Assistants	3	0		
Stroke Association SLT	0	0	3	
Stroke Association volunteers	0	0	3	
Total	12	13	6	**31**

1 Table 3. Participant details.

Participant	Gender	Age	Time post stroke	Living situation	Primary support	Part of aphasia pathway recruited	Ipad source
1	M	63	7 weeks	lives alone	2 daughters visit regularly	inpatient rehab	loan
2	F	81	6 months	lives with husband	daughter living close by	CST	loan
3	F	73	8 weeks	lives with husband	2 daughters live close by	inpatient rehab	own
4	M	65	8 months	lives with wife	Wife	core community	own
5	M	83	1 month	lives with wife	Wife	CST	own
6	F	72	6 weeks	lives with husband	husband	CST	own
7	M	46	7 weeks	lives with wife and children	Wife	CST	own
8	M	68	9 weeks	lives alone	Son	CST	loan
9	F	42	8 weeks	lives with husband & children	husband	CST	loan
10	F	63	3 years	lives with husband	husband	core community	own
11	F	73	4 months	lives alone	daughter living close by	CST	loan
12	F	75	2 months	lives with husband	husband and daughter	CST	loan
13	F	77	4 months	lives alone	daughter living close by	CST	own
14	M	59	2 months	lives alone	daughter living close by	CST	loan
15	F	24	1 week	lives with parents	parents	acute	loan

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