

Development of an integrated smart dysphagia rehabilitation platform

Project summary report

Project period: 01/07/2024 – 31/12/2025

Project leads: Beautiful Voice Limited and City St George’s, University of London

Funder: Innovate UK Smart Grant

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Introduction

Beautiful Voice has developed a digital platform to assist with the delivery of speech and language therapy.

It quantifies users’ speech, voice, and language qualities while providing evidence-based exercises. Beautiful Voice aims to reduce workload for Speech and Language Therapists (SLTs), while helping clients receive more Speech and Language Therapy at home for better rehabilitation.

As part of Beautiful Voice’s commitment to continuous development and improvement of Speech and Language Therapy provision, research into creating a new dysphagia therapy platform has been conducted as part of Innovate UK Smart. This research was planned and organised by Dr Jackie McRae, a clinical academic Speech and Language Therapist at City St George’s, University of London, and consists of two parts: the first being co-design workshops with SLTs and service users, culminating in prototype platform testing among service users. Dr McRae obtained ethics approval from City St George’s. This report will detail the summary of those findings from each part of the research.

Dysphagia is the term used to describe difficulties swallowing food, liquid, and/or saliva. Dysphagia makes up a huge part of Speech and Language Therapy, affecting 4 million people in the UK and 400 million globally. It is linked to increased mortality, morbidity, and pneumonia, as well as higher care costs and reduced well-being. The therapy provision for dysphagia currently includes strength and skill-based exercises. Unfortunately, the national shortage of SLTs leads to long waiting lists and, in turn, poor therapeutic outcomes. It is for this reason that Beautiful Voice aims to improve this service, supporting both SLTs and clients with the creation of a computer-based therapy platform. Beautiful Voice hopes this platform can improve clients’ access to and frequency of therapy, as well as SLT efficiency.

Part 1 – Co-design workshops

Aims and Method

Co-design workshops with Dr McRae, service users, and clinicians aimed to explore opportunities and barriers for computer-based dysphagia rehabilitation.

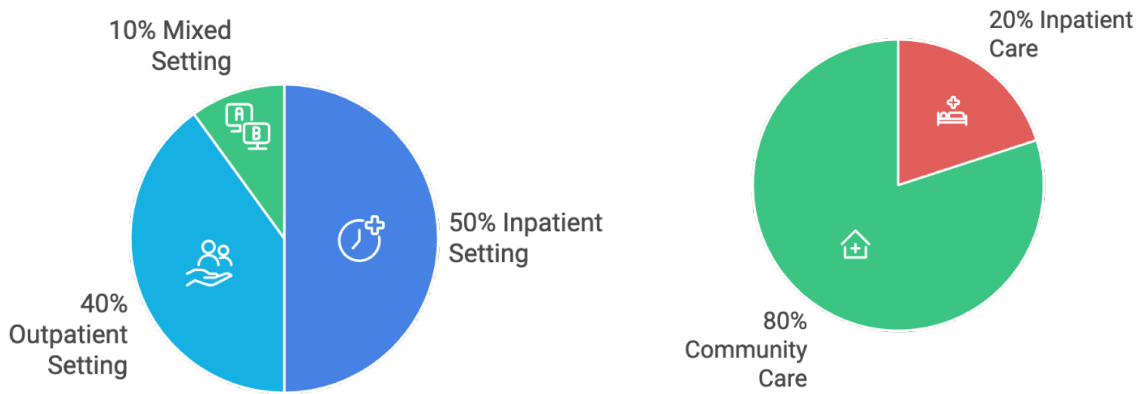
Participants were invited through public promotion to join 1-hour online co-design workshops. These sessions explored current dysphagia care and introduced participants to a mock-up of the dysphagia rehabilitation platform, discussing its utility and relevance.

Co-design Workshop flow



Participants

10 SLTs from diverse clinical settings and 5 service users (3 patients and 2 caregivers) who had undergone dysphagia rehabilitation participated in the co-design workshops to give their perspectives of the needs, challenges, and requirements for a digital dysphagia therapy platform.



Clinical settings of the SLT participants

Types of care received by service users

Results and Findings

Executive summary:

Insights from 13 sessions (service users and SLTs) show strong need and support for a dysphagia therapy platform.

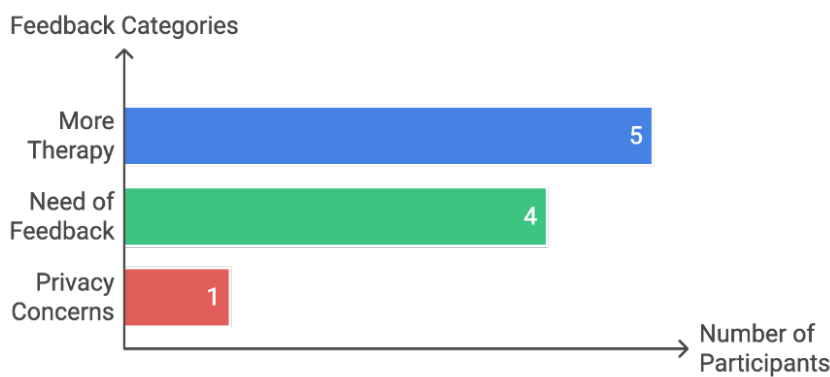
In the current clinical practice, the focus of interventions is greater for dysphagia management (e.g. food modification) than treating the impairment.

Exercise prescription seems to be more common in the inpatient setting, where it can be delivered more frequently, than in the community setting. There is also a lack of confidence and consistency in prescribing exercises by SLTs, in particular less experienced ones.

Patient needs:

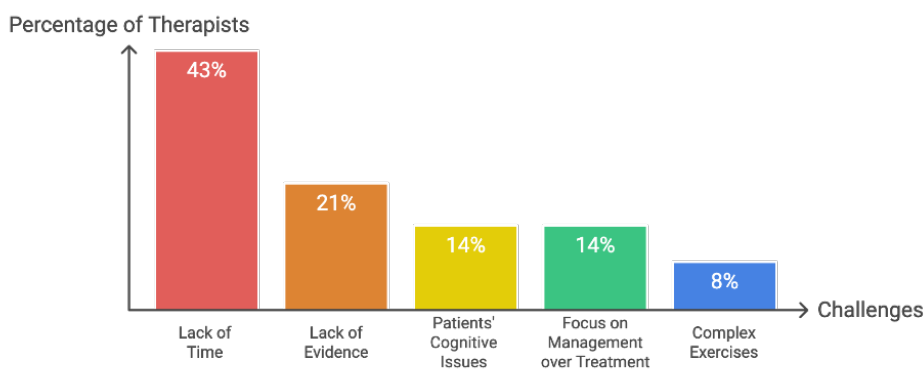
There is a desire for more therapy/exercises to improve the impairment instead of compensatory management via food modifications.

4 of 5 participants believe that a key feature of a home-based therapy tool is receiving feedback on performance during self-practice. 1 of 5 participants mentioned the concerns of privacy using a digital tool.



Challenges faced by SLTs:

SLTs commonly think there is lack of evidence/resources to deliver dysphagia therapy. Exercises can be difficult to explain to patients, thus requiring repeated demonstration.



User reported potential benefits of a digital dysphagia therapy platform:

- Increased therapy frequency
- Opportunities for self-management
- Enhanced information and knowledge sharing
- Remote monitoring with clinician feedback

Proposed features:

- Meaningful interpretation of results for patients
- Easy to use for patients, particularly for patients with cognitive impairment
- Video instructions and description on exercises
- Mirroring of the exercises through video cameras
- Swallow diary with prompts
- Stepping up and down of exercises
- Remote clinician monitoring of patients' performance

Conclusion

Based on the above feedback, a prototype platform was developed that included strength and skill training and then tested amongst service users to investigate its usability, acceptability and potential to improve dysphagia symptoms, as discussed below in Part 2 of this research.

Part 2 – Testing the prototype

Aims and Method

With the findings from the workshops in mind, a prototype dysphagia rehabilitation platform was developed. This part of the research aimed to test the usability of such a platform for people with dysphagia. Usability scores and adherence to self-led exercises, as well as patients' subjective feedback on their user experience was collected.

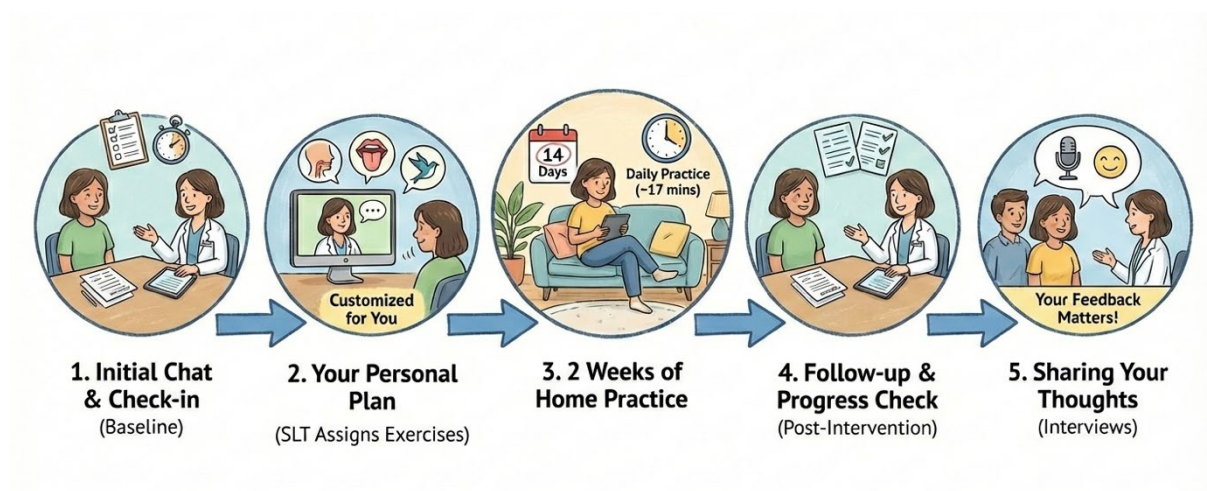
Dr Jackie McRae met with each volunteer individually for an initial session (acting as the baseline measure), conducting assessments such as Dysphagia Handicap Index (DHI) and Functional Oral Intake Scale (FOIS) as well as collecting other relevant demographic information.

The DHI is a validated assessment method designed to evaluate the impact of dysphagia on an individual's quality of life, considering three areas: emotional, physical, and functional. This assessment is based on patient-related outcomes. The FOIS is a clinician-managed scoring scale with seven levels, used to assess an individual's eating, drinking and swallowing capabilities. The scale starts at Level 1 (nothing by mouth – the individual is tube-dependent to receive nutrition and hydration) and continues up to Level 7 (total oral diet with no restrictions – the individual has no swallowing difficulties and can safely have a regular diet).

During this initial session, Dr McRae introduced the volunteer to the dysphagia rehabilitation platform, deciding (based on the assessments conducted) which exercises to allocate for them to do at home and guiding patients on how to use the platform.

For the next two weeks, the volunteer used the platform to do the exercises Dr McRae assigned them. After these two weeks had passed, a second session (follow-up measure) was organised for each volunteer, in which Dr McRae conducted the same assessments again (DHI and FOIS) as well as an interview, in order to gather subjective feedback from the patient about the platform. A Modified System Usability Score (MSUS) was used: a standard usability scale to quantitatively measure how user-friendly a product is to the target population.

Our 2-Week Home Practice Journey



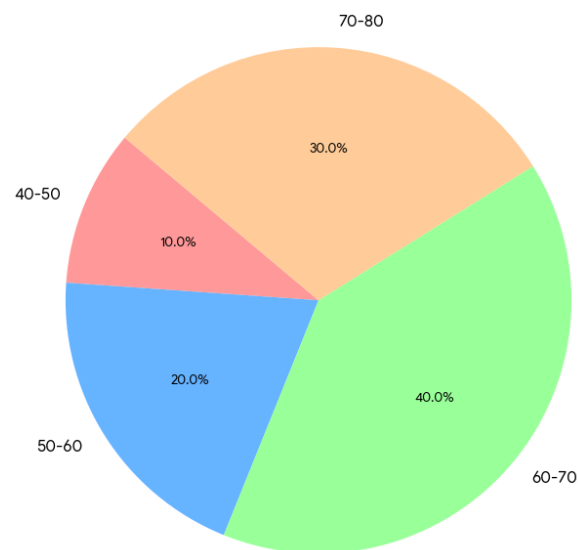
Participants

A total of 13 participants were recruited through public promotion, with 10 participants completing the study.

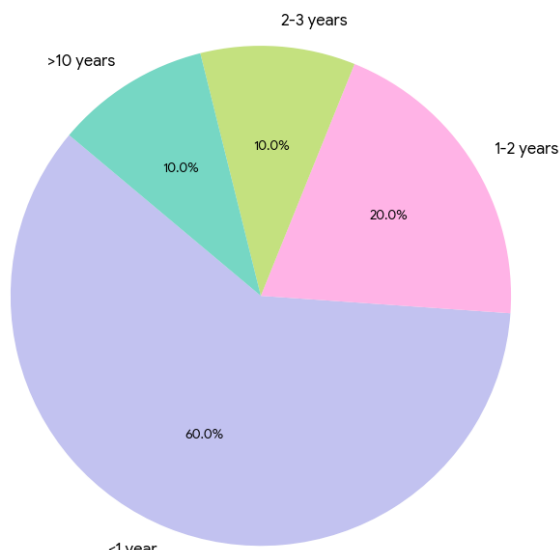
Age Range: Primarily 60–80 years old (70% of participants).

Diagnosis: 60% were within their first year of diagnosis of dysphagia issues. However, the majority believe that they had the symptoms long before diagnosis.

Gender balance: 6 female participants and 4 male participants.



Participants' age distribution



Time since dysphagia diagnosis

Results and Findings

Adherence:

Participants showed a strong commitment to self-led practice using the platform. The average study duration was 15.9 days, where participants practiced on average 9.1 days (more than once every 2 days). There were some scheduling issues which affected being able to organise the patient's second session exactly two weeks after the first.

The average number of hours practiced was found to be 2.611 (minimum 0.7 – maximum 5.39), equivalent to 17.2 mins per day.

Dysphagia Handicap Index (DHI):

The average DHI pre-intervention was 32.6, indicating moderate difficulties in daily life due to swallowing problems. The average DHI post-intervention score was 26.7 (mild swallowing difficulties), demonstrating 19% reduction post 2 weeks of practice with the platform

6 participants showed improvement, 1 showed no change, 3 showed negligible decrease in DHI. Overall, DHI scores showed a significant improvement post therapy (paired t-test, $p < 0.05$, Cohen's $d = 0.768$).

Adherence (percentage of days practiced) had a small positive correlation with DHI improvement. The total time spent practicing demonstrated a small-to-moderate positive association with DHI improvement.

Functional Oral Intake Scale (FOIS):

The average FOIS score was 6.7 out of 7, indicating a good overall oral intake capability amongst participants. 1 person who had a lower oral intake capability showed 1 grade improvement on the FOIS.

Modified System Usability Score (MSUS):

The mean score was found to be 78.5, placing the platform's usability as 'good' (this consists of scores in the 70-84 range).

The main issues reported by users were related to bugs/glitches on the platform.

User feedback:

Users reported challenges following certain exercises, including the chin tuck (due to a 1-minute wait) and shaking head (due to trying to watch the video and copy the exercise while laying down).

Users requested more information regarding what is required in terms of equipment (e.g. spoon). Users suggested trying to reduce the number of clicks and for the split of the exercises to be reviewed.

Users also suggested including explanations on the benefits of each exercise, which has since been updated on the platform.

Selection of quotes from users and their carers:

"I have to say by practicing for 2 weeks I got more confident and I do cough less, thank you for the opportunity to improve my swallowing"

"Yesterday... he swallowed three times in a row, quite quickly and quite normally. And I just looked at him and I thought, wow, that is such an improvement."

"I think it's hugely valuable. So thank you."

"I've managed to sort of weave them into my everyday routines."

"I'll be grateful if I can keep it, keep using it, that'd be good."

Conclusion

Feedback and findings collected overall showed good usability of the platform. Improvements to be made included fixing bugs/glitches, as well as enhancing details and layout of the platform. Although this research did not intend to assess the clinical outcomes of using the platform, it was possible to see improvement already, particularly from the DHI results. In the future, Beautiful Voice will conduct a study to specifically measure clinical outcomes from a larger cohort of patients on the effects of the dysphagia rehabilitation platform.

