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ICT usage in aphasia rehabilitation – beliefs, biases, and influencing factors from the perspectives of speech and language therapists

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ABSTRACT

Background: The use of digital technology is promoted as an efficient route for the delivery of intensive speech and language therapy in aphasia rehabilitation. Research has begun to explore the views of people with aphasia (PwA) in relation to Information and Communication Technology (ICT) usage in the management of aphasia but there is less consideration of the prescribers' views, i.e., speech and language therapists (SLTs).

Aims: We aimed to explore SLTs' views of ICT use in aphasia management and identify factors that influence their decisions to accept and integrate ICT in aphasia rehabilitation. In addition, we considered the findings in the context of the Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis & Davis, 2003).

Methods & Procedures: Speech and language therapists (n = 15) from a range of clinical and geographical settings in the Republic of Ireland were invited to participate in one of four focus groups. Focus group discussions were facilitated by an SLT researcher and were audio-recorded and transcribed. Analysis was completed following Braun and Clarke's six phases of thematic analysis (Braun and Clarke, 2006).

Outcomes & Results: Four key themes were identified; i. Infrastructure, Resources, and Support, ii. SLT beliefs, biases and influencers, iii. Function & Fit, and iv. ICT and Living Successfully with Aphasia. The SLTs discussed a wide range of factors that influence their decisions to introduce ICT in aphasia rehabilitation, which related to the person with aphasia, the SLT, the broad rehabilitation environment, and the ICT programme features. In addition, several barriers and facilitators associated with ICT-delivered aphasia rehabilitation were highlighted.

Conclusion: This research highlights a range of issues for SLTs in relation to the use of ICT in aphasia rehabilitation within an Irish context. The potential benefits of using ICT devices in rehabilitation and in functional everyday communication were discussed. However, SLTs also identified many barriers that prevent easy implementation of this mode of rehabilitation.

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Supplemental data for this article can be accessed here.

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Background

Information and communication technology (ICT) is a growing field of research in health care generally and in aphasia specifically, with many foci, e.g., synchronous and asynchronous telerehabilitation, technology-based interventions and therapy applications, eHealth records, and administration. ICT-delivered aphasia rehabilitation has been purported to be an effective mode of rehabilitation (Zheng et al., 2016) that is acceptable to many people with aphasia (PwA) (Kearns et al., 2021) and offers the potential for intensive rehabilitation (Brady et al., 2016; Zheng et al., 2016) particularly where services are strained. ICT programmes and applications are also often incorporated in to the everyday lives of PwA to facilitate communication and social connection as well as self-management of daily chores and activities (Kelly et al., in print). A scoping review exploring self-management of aphasia identified that technology-based treatment was the predominant intervention approach among the included studies and the authors recognise that technology could play a significant role in aphasia self-management (Nichol et al., 2019). A significant focus of research in health care-related ICT examines the design and implementation of technology suitable for use in this setting, with less focus directed on the readiness of clinicians to implement ICT in health (Holden & Karsh, 2010). It is important to understand the perspectives of Speech and Language Therapists (SLTs) in relation to ICT in order to recognise the factors that may influence their acceptance and use of ICT, whether they offer it as an option in rehabilitation, and therefore plan and provide support accordingly (Holden & Karsh, 2010).

A small number of studies have explored SLTs' perspectives of ICT use in aphasia rehabilitation, which relate to specific programmes developed by research teams (Burke et al., 2021; Hill & Breslin, 2016) and general experience of ICT in practice (Benedon, 2018; Davis & Copeland, 2006; Gunning et al., 2017; Swales et al., 2016). A range of factors have been identified that health professionals, including SLTs, take into account when making decisions regarding the introduction of novel and digital technologies into stroke rehabilitation (Chen & Bode, 2011; Davis & Copeland, 2006; Hill & Breslin, 2016). These include factors specific to the individual and their environment, such as the availability of support (Burke et al., 2021; Hill & Breslin, 2016) including family support and encouragement (Chen & Bode, 2011), budget and costs (Burke et al., 2021; Chen & Bode, 2011; Swales et al., 2016), and access to software licences (Swales et al., 2016). People with aphasia are a heterogeneous population, with each experiencing aphasia differently, and one pertinent factor in ICT is the inherent flexibility and ability to personalise material in rehabilitation software in order to achieve personalised, on-target, goals in aphasia rehabilitation (Hill & Breslin, 2016; Swales et al., 2016). Additionally, using ICT-delivered rehabilitation as an adjunct to face-to-face therapy is a noted benefit of this mode of rehabilitation (Davis & Copeland, 2006; Hill & Breslin, 2016).

Theoretical models, derived from the field of Information Systems, have been used to provide frameworks to understand the usage and non-usage of modern assistive technologies (Holden & Karsh, 2010; Peek et al., 2014). Peek et al. (2014) note that two models have dominated research regarding technology acceptance and usage: the Technology Acceptance Model (TAM; Davis, 1985) and the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003). The latter was built on eight models of technology acceptance, including the TAM, which has been empirically validated

(Venkatesh et al., 2003) and included in health technology research with patients (Cranen et al., 2012) and health professionals (Liu et al., 2015). According to the UTAUT, the *performance expectancy* of an ICT system, i.e., the perceived gains associated with using that system, is the strongest predictor of the intention to use that ICT system (Venkatesh et al., 2003). There are a number of factors that may pose challenges to this performance expectancy including the maintenance of devices (Chen & Bode, 2011) and compatibility of programmes for use on different devices and operating systems (Swales et al., 2016).

While performance expectancy may be considered to act as the strongest predictor of intention to use an ICT system, the *effort expectancy* or the perceived ease of use of the system may also be an important factor when deciding to implement such a system (Venkatesh et al., 2003). In this context, effort expectancy can be viewed from two standpoints: the SLTs' views in relation to the ease of use for the person with aphasia and secondly in relation to their own effort and ease of use. When considering PwA, SLTs recognise a number of factors that may influence the effort expectancy in relation to ICT-delivered aphasia rehabilitation including the person's cognitive ability (Burke et al., 2021; Chen & Bode, 2011; Hill & Breslin, 2016; Schröder et al., 2007), previous ICT skills (Davis & Copeland, 2006; Gunning et al., 2017; Hill & Breslin, 2016) and visual and auditory skills (Benedon, 2018; Schröder et al., 2007). With respect to their own effort expectancy, SLTs also reflect on their own knowledge and confidence in relation to their ICT skills (Burke et al., 2021; Gunning et al., 2017). In addition to these issues that are unique to each stakeholder group, there are also factors that are shared between SLTs and PwA including the ease-of-use and usability of the programme and ICT-device (Hill & Breslin, 2016).

Some external factors or *social influence* (Venkatesh et al., 2003) may also influence SLTs' decision-making when considering integrating ICT into rehabilitation. A research study that explored practices and attitudes to the use of apps in therapy reported that SLTs are likely to seek recommendations and advice from fellow colleagues when considering whether to use apps in practice (Benedon, 2018). In addition, SLTs have identified the support provided to PwA from significant others e.g., families, carers, volunteers, and the SLTs themselves, can be an important enabler for PwA to engage in ICT-delivered aphasia rehabilitation (Burke et al., 2021; Chen & Bode, 2011; Hill & Breslin, 2016). The role of social influence in the acceptance and use of technologies is controversial (Liu et al., 2015). This construct has been noted to play a significant role in technology acceptance and use where the use of technology is mandatory but not significant in settings where the use is voluntary (Venkatesh et al., 2003). Liu et al. (2015) examined the factors that influence Occupational Therapists' and Physiotherapists' decisions to use technology. They found no significant effect of social influence and decisions to implement new technologies were made independent of other professionals in the health care team.

The final predictor of technology acceptance and use in the UTAUT model is *facilitating conditions*. There are a number of factors that reflect facilitating conditions e.g., training, time constraints, sufficient caseload, access to programmes and devices, funding and costs, and ICT support (Burke et al., 2021; Chen & Bode, 2011; Hill & Breslin, 2016) that may influence acceptance and use of digital technologies in rehabilitation. When satisfactory conditions are not realised in relation to these factors, e.g., time constraints and limited IT support, they frequently represent barriers to ICT-delivered aphasia rehabilitation (Burke et al., 2021). Cost is also noted as a barrier to ICT adoption among other professional groups in the adoption of mobile health (m-health) such as electronic medical record and

remote monitoring systems (Gagnon et al., 2015). It is also reported as a factor when considering assistive technology (McGrath et al., 2017) and telehealth service delivery (Dunkley et al., 2010). Trialling technology before committing to purchase is an important factor that influences other health professionals' decision-making in relation to the adoption of, and recommendation for, new technologies (De Joode et al., 2012; McGrath et al., 2017). The training and the availability of support for SLTs are considered important by the professionals themselves (Burke et al., 2021; Chen & Bode, 2011; Hill & Breslin, 2016). Training, and lack of it, has been highlighted as both a facilitator for, and barrier to, the introduction of ICT in health (Dunkley et al., 2010; Gagnon et al., 2015; Ifinedo, 2012; De Joode et al., 2012; Liu et al., 2015). Time has also been identified as a two-sided factor for technology acceptance. The adoption of technology may well be time-consuming, especially in the initial stages of upskilling, but it can also save time for professionals in the long run (Burke et al., 2021; Gagnon et al., 2015).

In light of the small number of studies that examine SLTs' perspectives of ICT in aphasia rehabilitation, which contrasts with the growing body of evidence exploring the perspectives of PwA (Kearns et al., 2021), an in-depth investigation is indicated. As noted above, it is important to understand SLTs' acceptance and use of ICT in clinical practice and their readiness to implement technology-based interventions with PwA (Holden & Karsh, 2010). These insights can help inform future planning and provision of ICT support and training as required. This qualitative study seeks to explore SLTs' perspectives of ICT use in aphasia management within their professional practice in an Irish context, where SLTs reported that 57% of patients (n = 569) had not received sufficient treatment intensity in hospital in 2019 and 51% were referred for further speech and language therapy upon discharge (National Office of Clinical Audit, 2020). This largely constrained service delivery is also reflected in findings from a cross-sectional survey of 95 SLTs delivering services to PwA in the Republic of Ireland, where 26% reported there was a lack of readily available speech and language therapy for PwA and over half (54%) identified barriers to accessing services, including geographical, financial, and practical barriers (such as getting to the clinic) (Manning et al., 2020). As previously discussed, ICT has the potential to facilitate access to and intensity of therapy. However, it is important to note that funding of devices, programme licences, and other ICT infrastructure is generally not covered by the national Health Service Executive (HSE) in Ireland, with the burden of cost being covered by individuals with aphasia or their families.

Our study aims to identify the factors that influence SLTs' decision to introduce ICT into clinical practice and identify the barriers and facilitators to ICT usage and acceptance. The research seeks to explore perspectives related to ICT-delivered aphasia rehabilitation in its broadest sense, such as synchronous telepractice, asynchronous ICT usage, as well as ICT hardware and software.

Methods

Recruitment

The study received ethical approval from the Social Research Ethics Committee (SREC) at University College Cork. A purposive sample of SLTs were recruited via email and provided with information about the research. SLTs were considered eligible if they were working

Table 1. Participant details – speech and language therapists.

Focus Group	SLT	Time spent working as SLT (years)	Time spent working with adults with acquired communication disorders (years)	Percentage of time spent working with adults with acquired communication disorders	Work setting
1	1	10–15	6–10	61–80%	rehab & community
1	2	> 20	15–20	41–60%	community
1	3	6–10	6–10	61–80%	community
1	4	10–15	10–15	< 10%	community & long-term care
2	1	6–10	6–10	< 10%	hospital
2	2	1–5	1–5	61–80%	hospital
2	3	15–20	15–20	81–100%	hospital
3	1	1–5	1–5	11–20%	community
3	2	> 20	> 20	21–40%	community
3	3	1–5	1–5	< 10%	community
4	1	6–10	1–5	41–60%	community
4	2	6–10	1–5	21–40%	community
4	3	1–5	1–5	41–60%	community
4	4	1–5	1–5	61–80%	rehab
4	5	6–10	6–10	61–80%	rehab

with adults with acquired communication disorder for at least one session (3.5 hours) a week, there was no minimum experience required for participation in the study. SLTs were given the opportunity to ask questions about the research and provided written informed consent.

Participants

Fifteen SLTs participated in the research. The SLTs represented a broad array of work settings in the Republic of Ireland, including hospital-based, inpatient rehabilitation and community services, as well as a wide range of experience working with PwA. See, Table 1 for an overview of participants' work setting, SLT experience, experience working with acquired communication disorders and proportion of caseload. All SLTs in this study had experience using some form of ICT in the assessment or management of communication disorders.

Data collection

Four in-person focus groups were carried out in four separate health care settings located in two of the nine Community Health Organisation areas in the HSE in the Republic of Ireland. Focus groups can provide a useful method for health research, and this mode of data collection can help provide rich data on a range of views from groups of SLTs. One key advantage of focus group discussions is the ability to discover not only the content of knowledge but to explore how decisions are made, and the naturalism of the interactions between participants can facilitate a much broader discussion than individual interviews (Green, 2013). Focus group methods have also been used in research exploring SLTs' preferences for ICT features (Swales et al., 2016) and investigating SLTs' perspectives of

high-intensity clinical programmes, which included computer-delivered therapy (Gunning et al., 2017). The focus groups were facilitated by the first author, an experienced SLT, using a question guide to ensure fidelity to the research questions (Appendix A). The guide included questions on experience, access, acceptance, supports, drivers, and barriers. The focus groups were completed prior to Covid-19, and at the time synchronous telehealth sessions were rarely used. Therefore, discussions generally focused on, but were not limited to, technology-based interventions, including reference to ICT devices and programme applications, carried out with PwA during in-person speech and language therapy sessions as well as home-based ICT usage outside therapy sessions. This study was part of a larger mixed methods research project, exploring stakeholders' perspectives of ICT-delivered aphasia rehabilitation, which was carried out by the first author as part of her PhD research.

All focus groups were audio-recorded and each recording was transcribed by an individual not involved in the data collection. Each transcript was checked by the first author against the audio file for accuracy.

Data analysis

Data were analysed using inductive thematic analysis following the approach as outlined by Braun and Clarke (2006). Thematic analysis is a rigorous but flexible approach to qualitative data analysis that can be used across a range of research questions and epistemologies (Braun & Clarke, 2006). Two researchers (AK & RH) completed the first three stages of the thematic analysis and independently coded each transcript. The transcripts were uploaded to QSR International's NVivo 11 software in order to store and organise the data. Each transcript was read through for a sense of whole and then coded using six phases of thematic analysis as per Braun and Clarke (2006). During the initial reading, any patterns or points of interest were noted and the researchers became familiar with each transcript. Initial codes were produced in an inductive manner, rather than theory-driven, with the intention to capture as many themes as possible that would be refined later in the process. Each transcript was coded separately and after each coding, the two researchers discussed the codes, their meaning and definitions, and any disagreements were resolved through discussion. Once a list of codes was generated from the four transcripts, the researchers collaboratively examined potential themes. Mind maps were developed to visually represent the relationships between codes and between potential themes. Candidate themes and subthemes were identified. Following these initial steps of thematic analysis, the data was reviewed and refined by the research team (AK, RH, and HK). During this process, all the coded extracts for each theme were read through to decide whether they fit a coherent pattern. Where extracts were deemed not to fit, the researchers discussed whether the theme itself was problematic, or if the issue lay with the extracted data, and then collaboratively came to a final decision on each code and how it fit within the subtheme and theme. When all the themes were considered to represent the coded data, a second level of refinement began. This process involved the first author reviewing the themes in relation to the entire data set and required re-reading the entire data set with two purposes: to see if the themes fit the data set and to identify, and then code, any

missing data that was overlooked in earlier coding stages. A thematic map was developed and the themes were defined and further refined by identifying the "*essence*" of each theme (Braun & Clarke, 2006).

When the thematic analysis was completed, the key findings in relation to barriers, facilitators, and factors that influence SLTs' decisions to introduce ICT in their practice were summarised and mapped against the UTAUT. In order to enhance rigour and transparency, the discussions within all members of the research team and the outcomes of each discussion were noted at each point in the analysis process. In addition, a reflective journal was maintained by the first author in order to examine and reflect on her role through the research process taking into account her role within data collection and data analysis. Analytical memos were also tracked with the transcripts in NVivo 11.

Results

The findings of the thematic analysis are presented below, followed by a mapping exercise, which provides a summary of the factors that influence the SLTs' decision to introduce ICT in aphasia rehabilitation including barriers and facilitators to ICT-delivered aphasia rehabilitation mapped against the UTAUT.

Themes

Four key themes were identified in the data: i) Infrastructure, Resources, and Support, ii) SLT Beliefs, Biases, and Influencers, iii) Function and Fit, and iv) ICT and Living Successfully with Aphasia. The themes are described below and an overview of the themes, subthemes, and supporting quotes is available in Table 2.

Infrastructure, resources, and support

This theme identified many issues that are situated within the milieu of aphasia rehabilitation, including the relationships involved, the structure of services, and the resources within these services. The SLTs discussed how the rehabilitation environment, and features within it, can enable ICT introduction or act as a barrier to it. The issue of support for PwA and SLTs were discussed in each focus group. This support was needed to optimise successful integration of ICT into clinical practice and appeared to reflect circles of support around the person with aphasia and the SLT. With respect to support for PwA, the person's family was seen as a key component to this support in conjunction with the support within the therapeutic relationship between the person with aphasia and the SLT.

> So you know or the other factor I find is, you really … when you have a really highly motivated family who want to work hard with them at home FG3P2.

The SLTs discussed how this support can vary between families and also how the amount of support provided by families can change along the rehabilitation journey. One SLT described how a young man with severe expressive difficulties post-stroke was appropriately using emoji responses, but his family repeatedly looked for articulated responses despite his significant expressive difficulties and his provision of an accurate, functional response.

Table 2. Themes, subthemes, and quotes.

	Subtheme	Supporting quotes
Infrastructure, Resources and Support	**Relationships**	*"And that depends on your working environment, I suppose we can run down the corridor and find the OT and say to them, listen, I notice on task that they are consistently missing the object or the space to the right they are not scanning all the way over" FG4P4"Even that gap between us and IT or programme developers like . . . how do you meet in the middle . . . because they don't know what we want but they could do it and you know that relationship is missing" FG3P3"And you see that's another level of support . . . the IT support that we need on the job, do you know, that we could call someone and say you know look will you help me with this and we don't have that, like we have IT support for the big computers in the office if something goes wrong". FG3P2*
	Service Delivery & Professional Support	*". . . actually a specialist IT therapist would be great if we had one of those in every department that went around, not just an IT technician but a specialist SLT IT technician!" FG2P1*
	Training Needs	*"I'd like more training and more education opportunities" FG4P2"I'm hesitant to use it because you'd be spending so much time teaching them actually how to use an iPad, even though the apps are very intuitive, I think you have to have a mind for it. So like, if you were spending your time being like, 'oh no, backward, forward, here's the home button', showing the basics, I think it would be a bit of a barrier" FG1P3*
	Technological Change	*"I think technology is so ubiquitous . . . like everyone has an iPhone and then they'll know to work an iPad, someone somewhere will know how to work the iPad, so I think that's a facilitator and even basic functions it's like go away and take photos of that or go and video on your own phone . . . that's very straightforward". FG4P3*
	Time	*"It's the time taken to up-skill on it, and I suppose you can use things like the aphasia software finder website, but you don't really know. You have to go download it, test it out, you know" FG4P3"we have 45 minutes here I'm not going to spend half of the time that this person has in front of me fighting with the iPad" FG3P2*
	Cost	*"I think I'm slow enough to recommend it to somebody just because it's quite pricey" FG1P1*
	ICT Access and Availability	*"we have three iPads and we do have a lot of [named commercially available programmes] apps on them. Some of the girls use them regularly in their therapy" FG4P2we do have one or two [referencing therapeutic software programmes] unfortunately here for us they're downloaded to one particular computer, so trying to get access to the room" FG2P3*

(*Continued*)

Table 2. (Continued).

	Subtheme	Supporting quotes
SLT Beliefs, Biases and Influencers	**Ageism**	*"I suppose I do think well if . . . and it's terrible, if they are a younger client they are going to be more willing to use it and it's terrible, like, and I should automatically think about using it with older clients". FG3P1"I wonder with that client age group whether . . . who is wanting the technology?" FG4P5"And I suppose as the years go on, it's becoming more expected that we are au fait with it [ICT], it's kind of nearly at this stage you can't really say oh gosh, I actually don't know anything about it, I feel I should know something about it, that's what they are looking for. And as the next generation comes up . . . they are going to be more demanding of skills and support and knowledge in that area. So I think it's really, really essential that we get it, that we up skill on it and have the support" FG3P2*
	Harmonising Patients with ICT	*". . . establishing a patient's baseline IT skills is probably the initial thing that you do and then develop your programme or your advice around that". FG4P5"So I think it's interest and it's often they ask for it before I produce it or a family will ask for it" FG3P2"I think it's that difficulty that they think that this magic slate is going to give communication back". FG3P2*
	Questioning Traditional Mind-Sets	*"I guess sometimes the IT ones might cue better than you might imagine some family members, you know, unless you've done a lot of training with them about cueing and if you imagine them doing a paper-based task at home together, you might wonder how that other person supports them in a task, whereas at least on the iPad you know that they're going to do appropriate . . . cueing" FG1P3"But technology is interactive and there is an element of fun about it too, whereas the paper-based stuff is not so fun". FG3P3"I wouldn't see any difference between giving paper-based activities or IT-based activities in terms of, kind of, cueing" FG1P2"I struggle with that one [referring to training ICT skills for PwA] because I don't think that the role is defined for us" FG4P5 // "Yes, if we don't do it, who will?" FG4P3*
	Digital Discomfort	*"I think if I were more familiar with them and had more accessibility to them and if I were bringing them very naturally into therapy sessions, I think I would see much quicker" FG3P2"we bought one app and I can't even remember what it was and then no clients came through for us to use it! And then we forgot about it and we never used it". FG3 P1"I had a phone call this week from . . . an outpatients' son who had downloaded an app that I've never heard of and wanted to know my opinion on it. So I just had to say I've never heard of it, but I'll have a look at it . . . and, I did and then he asked what other apps I'd recommend and I kind of felt slightly panicked" FG1P1*
Function and Fit	**Therapeutic Practice and Benefits**	*"And I suppose some clients going home, I suppose if there was going to be a wait for community, they would use the [named commercially available app] app as well" FG3P1"you know the way being dependant on someone else to do the homework with you, they can go away and do it independently and they don't feel that someone is correcting them whereas they'll get that feedback from the likes of the [named commercially available] apps and those ones" FG4P3" . . . it's fantastic but I think more often than not they are not doing it themselves [working independently on ICT-delivered homework activities], you are trying to get them to do it or the family". FG3P2"they [reference to the PwA] still need the face to face support" FG2P1 "I wouldn't actually completely replace with IT" FG3P2*
	Fit for Purpose?	*"There's no quality control, it doesn't have to reach a certain standard to have 'Aphasia app' on it" FG1P2"And some of those low-quality ones offer a free trial, but there's no way of actually using the free trial. I downloaded a couple of them" FG1P1"Because there is apps there but they don't have everything that you'd want and how do you move onto the next step or if there was another folder within it, where you know to edit it, you can't" FG3P3"so like both the Android and the Apple devices now, I find retrofit a lot of accessibility features so not just physical stuff but also things that is really beneficial for our patients with aphasia so using the readability feature just simplifies and declutters like an Irish Independent article so somebody who is milder on the spectrum that would just declutter the whole thing, makes it much easier for them there is no junk on the page for them to have to process" FG4P4*

(*Continued*)

Table 2. (Continued).

	Subtheme	Supporting quotes
ICT and Living Well with Aphasia	**Emotional Effects of ICT**	*"... and then they've had a stroke and all of a sudden you're putting this iPad in front of them and they can kind of, with lots of help, get through like, the [named commercially available application] ... or something, and there's great sense of like "I've achieved something"" FG1P2"I guess there's the risk as well that, when they go home, even if you've given them clear instructions about what they're going to do, when, if they go into the wrong or, you know an ad- area that's not suitable for them and it's too challenging, they could easily have a negative experience of it, you know" FG1P3"And often the higher functioning clients, they're educating us rather than us educating them". FG1P2*
	Levelling the Playing Field	*"And I wonder will that [stronger focus on speech output in therapy over total communication] change over time because WhatsApp you know, it's all more frequently used". FG4P3"So yea, some of the communication apps, the communication aid apps, are quite nice and I think they are really nice for an iPhone or smart phone, that some people in my experience, some people who wouldn't bring around a communication book in their pocket will take out an iPhone and communicate with you through an iPhone because it's much more normal". FG3P2*
	Redefining Independence and Social Affiliation	*"And it kept her role pivotal in the family which is so important for mum" FG4P2"I had a lady who did that as well, we developed her strategies over a session or two, I typed them up and then she was, right, took a picture and posted it up to Facebook there and then, and she was like when I'm home at the weekend this is what I want everyone to know how they can support me, how I'm helping myself as well. So, it was just really empowering for her to just take charge. Again, someone who was very cognitively able". FG4P3*

The SLTs reported they also require support from the service they work within. They identified support from the multidisciplinary team and IT support as important components to successful ICT integration in rehabilitation. SLTs considered the benefits of a specialist clinical service to support ICT in SLT practice. Additionally, support in relation to training for both SLTs and also PwA who wish to engage in ICT-delivered aphasia rehabilitation was discussed.

> I'd like more training and more education opportunities FG4P2

This training need was debated and largely considered unmet as the SLTs reported what they would like to see provided. The SLTs discussed the issue of time, in particular, the time required for their own upskilling as well as the time required to set up ICT within aphasia rehabilitation. This was seen as a potential constraint to the implementation of ICT-delivered aphasia rehabilitation.

> It's the time taken to up-skill on it, and I suppose you can use things like the aphasia software finder website, but you don't really know. You have to go download it, test it out, you know FG4P3

Other constraints included the cost and access to funding for ICT hardware and software as well as the cost of licences for rehabilitation software. The access to and availability of ICT devices and software as well as infrastructure, such as Wi-Fi, were seen as challenges to the implementation of ICT delivered aphasia rehabilitation. The SLTs identified that the availability of funding is restricted in some cases due to health conditions. They reported how it is easier to access AAC devices for individuals with MND as this comes from a specific budget but ICT-devices for PwA are not funded as easily. Technology was seen as fast changing and a challenge to keep up with. These changes bring new benefits. The use of touch screen technologies and accessibility features of tablet and smartphone devices were seen as important facilitators for ICT implementation. However, technological advances also bring new challenges for SLTs. They highlighted that they now need to consider emerging issues with Data Management and Protection. These technological innovations created new opportunities, but some felt that the supports and infrastructure in the health service was lagging behind.

SLT beliefs, biases, and influencers

This theme explored SLTs' perceptions of the factors that influence their own ICT usage in clinical practice. It explored their sense of competency and confidence when integrating ICT into aphasia rehabilitation and considered the traditional mode of therapy activities in aphasia rehabilitation. In general, the SLTs debated their own skills and knowledge of ICT with a sense of perceived limitations. This seemed to reflect a vicious circle where SLTs felt that familiarity and repeated use of ICT would enhance their skills and increase confidence but this repeated use was not happening due to their lack of confidence, access, and opportunity. So, a cycle continued where SLTs were feeling they could not keep up to date.

> I think if I were more familiar with them and had more accessibility to them and if I were bringing them very naturally into therapy sessions, I think I would see much quicker FG3P2

A sense of unease and discomfort about this new mode of rehabilitation emerged in some of the discussions. Some SLTs reported feeling out of their comfort zone, especially when asked for recommendations or opinions from families of PwA. The SLTs discussed some of their concerns regarding the changing technological environment and the impact this has on their day-to-day clinical practice. They questioned some of the traditional roles they hold in aphasia rehabilitation and the role that ICT brings to rehabilitation. The traditional pen and paper activities compared to ICT-delivered rehabilitation were viewed from a variety of different perspectives. The paper was viewed as a dependable resource that is easily accessible and not breakable. Meanwhile, rehabilitation software was considered a means of ensuring consistent therapeutic cueing and adding gamification to rehabilitation. Others asserted that the two modes had no significant differences between them in terms of achieving the objectives for therapy. The SLTs questioned their role in teaching IT skills to PwA who do not have basic ICT skills. This role was considered unclear, although there was an identification that SLT had specific skills that would be beneficial for supporting PwA learning ICT skills.

This theme also examined the SLTs' views on the suitability of some PwA engaging in ICT-delivered aphasia rehabilitation and in particular a potential bias with respect to age. The SLTs identified that this conscious bias should be challenged, but clinical experience led them to consider younger adults with post-stroke aphasia as having a greater potential for successful implementation of ICT-delivered aphasia rehabilitation.

> I suppose I do think well if . . . and it's terrible, if they are a younger client they are going to be more willing to use it and it's terrible, like, and I should automatically think about using it with older clients. FG3P1

Other factors that influence decision-making in practice were explored including post-stroke deficits such as visual impairment, the person's pre-stroke ICT skills and their openness to ICT-delivered aphasia rehabilitation. The SLTs discussed how a discrepancy between family and SLT expectations regarding the benefits of ICT for PwA can be challenging. Devices such as iPads may be viewed as a magical solution to the problem of post-stroke aphasia; however, this was rarely in keeping with the SLTs evaluation of the situation. This mismatch of expectations and the challenge of balancing the needs of the person with aphasia, with the available ICT, were identified as an ongoing challenge.

Function and fit

This theme reflected SLTs' discussion of their experience of clinical practice and the application of ICT in aphasia rehabilitation. The SLTs discussed the potential of ICT as a mode of providing increased intensity and flexible delivery of aphasia rehabilitation, at a time and place convenient for PwA. This was seen as positive for service delivery while awaiting face-to-face therapy and as a means of working through rehabilitation activities at home between SLT sessions. They identified that available software may indeed improve treatment fidelity outside of the clinic by providing standardised prompts and cues when compared to pen and paper activities delivered by family members.

> you know the way being dependant on someone else to do the homework with you, they can go away and do it independently and they don't feel that someone is correcting them whereas they'll get that feedback from the likes of the [named commercially available] apps and those ones FG4P3

This was highlighted as an important factor for home-delivered aphasia rehabilitation where an individual can independently work on their rehabilitation. However, this was considered to be less common in practice and more likely that PwA are assisted by family members at home.

The SLTs discussed some of their commonly used software applications for aphasia and also for post-stroke motor speech disorders. They identified that ICT can also provide options for augmentative and alternative communication (AAC) and this was discussed at length in one group who reported that their service delivery, i.e., acute hospital setting, tended to focus more on ICT for AAC use than rehabilitation. The potential for personalising the material within the therapy sessions delivered by ICT software was seen as a positive feature. However, they considered that such functions may be tedious to implement and some available software were perceived as low quality or not culturally appropriate.

> Because there is apps there but they don't have everything that you'd want and how do you move onto the next step or if there was another folder within it, where you know to edit it, you can't FG3P3

Two of the groups discussed how devices can be made more accessible and be customised to each individual. This was considered to provide improved and personalised ease-of-use of activities. Refusal and lack of acceptance of ICT by PwA was also discussed. It prompted the question about putting significant resources into such management if the uptake of ICT by the person with aphasia was not guaranteed. The SLTs considered that using ICT to deliver aphasia rehabilitation could be ideal as an adjunct to face-to-face therapy. They discussed that face-to-face rehabilitation should not be replaced by ICT-delivered rehabilitation as PwA need the face-to-face contact provided in SLT sessions.

> they [reference to PwA] still need the face to face support FG2P1

ICT and living successfully with aphasia

This theme explored the impact that ICT can have on a persons' recovery and everyday life following a stroke. All groups recognised the potential impact of ICT as being both positive and negative for a person with aphasia. There were discussions about examples of ICT aiding people's return to work, facilitating their resumption of roles coordinating activities within a family, and increasing independence by reducing dependence on others.

> So we set her up with that again she was really tech savvy, so we just downloaded the things for her in my office one day, got her set up and into the doctor the next day before I even saw her and he was like, "you'll have to tell me the name of that app, she is absolutely on a high up there!", that she can now communicate and keep up and tell her husband and say, don't forget to pick up the kids from swimming I know they have whatever on today. So, she was able to use all those things to keep in contact with family. FG4P4

The SLTs considered the potential of ICT to promote such activities could promote independence, and there was a recognition of the potential for improving psychological well-being. In some cases, SLTs were learning about ICT from PwA, providing an opportunity to reverse roles and provide positive experiences engaging in ICT.

> And often the higher functioning clients, they're educating us rather than us educating them. FG1P2

Some SLTs discussed how ICT can also provide opportunities to circumnavigate the communication impairment and facilitate an alternative mode of communication. This was seen as an opportunity for PwA to engage in a new mode of communication and thus potentially level the playing field for PwA in some contexts. However, it was also noted that social media applications may be inaccessible to some PwA, which may further impact their ability to engage in communication activities. Also, the possibilities of failing to achieve goals in ICT-delivered therapy activities, becoming frustrated with ICT usability and being overwhelmed by the introduction of new technology and programmes were discussed as potential negative aspects of ICT usage.

At a general level, the SLTs described how ICT is becoming ubiquitous and permeating many daily activities. This was seen as a potential for reducing stigma and improving uptake of ICT in post-stroke rehabilitation while also noting the new modes of electronic communication that are becoming part of everyday life and the potential access challenges for PwA with some of these new applications.

> So yeah, some of the communication apps, the communication aid apps, are quite nice and I think they are really nice for an iPhone or Smartphone, that some people in my experience, some people who wouldn't bring around a communication book in their pocket will take out an iPhone and communicate with you through an iPhone because it's much more normal. FG3P2

Influencing decision-making factors and the UTAUT

Within the themes above, a number of key factors were reported by the SLTs that appeared to influence their decisions to introduce ICT-delivered aphasia rehabilitation, which are mapped against the UTAUT in Table 3 and considered further with reference to the literature in the Discussion. Factors were primarily situated at four levels: the abilities and skills of the *person with aphasia*, the confidence and knowledge of the *speech and language therapist*, the availability of support and ICT access in the *rehabilitation environment* and *ICT and programme features*. Within these four levels, a number of key barriers and facilitators were identified by the SLTs. They reflect a variety of factors that SLTs consider when deciding to introduce ICT into clinical practice. The most prominent barriers are those related to access to ICT software and hardware. The cost of licences and the availability of programmes and devices were identified as obstacles to the introduction of ICT in aphasia rehabilitation. The SLTs reported that keeping up to date with ICT advancements in clinical practice was a barrier to implementation. A mechanism for sharing knowledge was proposed by one group member as a potential method to improve access to up to date information. Their own perceived skills and training needs may also act as barriers to implementation. Additionally, when considering the person with aphasia, the presence of co-occurring cognitive and visual impairments was seen to act as a potential barrier to the successful use of ICT-delivered aphasia rehabilitation. Although the discussions within the four focus groups appear to concentrate on barriers, a number of key facilitators are also identified. The ubiquitous nature of digital technologies in everyday life was seen as a potential facilitator

Table 3. Mapping factors identified by speech and language therapists against the unified theory of acceptance and use of technology (Venkatesh et al., 2003).

	Performance Expectancy	Effort Expectancy	Facilitating Conditions	Social Influence	Other factors
Person with Aphasia	Motivation and interest	Visual and cognitive skills	Prior ICT skills Family support with ICT	Family support and encouragement	Age of PwA
Speech and Language Therapists	Provides additional opportunities for practice	ICT skills and competency Paper is dependable	Training IT Support Time (upskilling & setting up) Specialist SLT support		Questioning role of SLT teaching ICT skills
Rehabilitation environment	ICT provides convenient options for augmenting and increasing intensity of therapy		Access to ICT devices and programmes Access to funds WiFi and internet access IT support Technology now part of everyday life		Data protection issues
ICT and programme features	Personalisation and flexibility Quality of programme and apps Feedback and cueing Remote monitoring of progress	Accessibility and ease of use features Touch screen interface	Outdated ICT Remote monitoring of progress Cost of licences	Technology now part of everyday life	Data protection issues

Some factors are mapped more than once as they may be present in more than one level

for the use of ICT in rehabilitation. This pervasive presence of ICT has resulted in greater access and social acceptance in general. Finally, the presence of family support, prior ICT skills, and individual motivation were noted as important facilitators for PwA.

Discussion

This study sought to explore SLTs' perspectives of ICT use with PwA, to examine the factors that influence their decision to introduce ICT into clinical practice and identify the barriers and facilitators to ICT usage and acceptance. Four themes were identified: *Infrastructure, Resources, and Support, SLT Beliefs, Biases and Influencers, Function and Fit*, and *ICT and Living Successfully with Aphasia*. The SLTs in this study were identifying, and advocating for, the potential that ICT can provide in aphasia rehabilitation in terms of supporting communication, regaining lost communication roles and broadening networks. However, they also highlighted numerous barriers to ICT introduction and implementation in aphasia rehabilitation. There are a large number of varied factors that influence their decision to introduce ICT into aphasia rehabilitation. These reflect many of the factors that emerge in the limited available research on the use of ICT-delivered aphasia rehabilitation among SLTs and are consistent with findings of ICT acceptance and use among other health professional groups.

Perceived benefits and gains

The proliferation of ICT devices and available software presents an opportunity within speech and language therapy. One key perceived benefit of introducing ICT into aphasia rehabilitation is the potential to increase the intensity of rehabilitation by providing an adjunct to clinical sessions. ICT was also identified as a potential mechanism for providing a mode of rehabilitation when a person is waiting to access a service. The perceived gains that can be achieved by using an ICT system are the strongest predictors of use of that system (Venkatesh et al., 2003). Our findings suggest that SLTs consider that ICT can provide increased intensity and act as an adjunct to therapy. This *performance expectancy* (Venkatesh et al., 2003) reflects the perceived benefits of this mode of rehabilitation as reported in other studies of SLTs' views of ICT-delivered aphasia rehabilitation (Davis & Copeland, 2006; Hill & Breslin, 2016). Performance expectancy was also noted to be the most important factor in determining occupational therapists' and physiotherapists' acceptance and use of new technologies, such as computer-based tools, tablets, and game consoles, in a variety of clinical services, including stroke and brain injury, where use is not mandatory (Liu et al., 2015). ICT can provide a system of cueing and prompting that was considered more consistent than what may be provided by the family. The provision of ICT-generated feedback is also considered beneficial as it provides concrete results to the PwA, which is considered a potential source of motivation for some in rehabilitation (Burke et al., 2021; Gunning et al., 2017).

ICT-delivered aphasia rehabilitation in the home can provide an option for self-administration of rehabilitation for some PwA (Palmer et al., 2012) and technology has been proposed as having the potential to play a significant role in aphasia self-management (Nichol et al., 2019). The SLTs in our study identified the potential for independent practice at home by PwA as an important, empowering aspect of using

ICT in aphasia rehabilitation. However, some questioned if rehabilitation is truly self-managed at home and considered the role of the family to be important for supporting the individual. Family support has been rated by SLTs to be an important factor when deciding to introduce technology in stroke rehabilitation (Chen & Bode, 2011).

Suitability and effort

The suitability of the available programmes with respect to targeting the specific level of breakdown in the language processing system and at an appropriate level of task complexity is highlighted as an issue when attempting to fit the programme to the needs of the individual (Hill & Breslin, 2016; Swales et al., 2016). Similarly, matching the individual's abilities and skills to the available ICT devices and software programmes were seen as a challenge.

Age was referenced in each of the focus groups as a factor that influences SLTs' decisions to introduce ICT in rehabilitation. This may indeed reflect the nature of clinical practice in which the proportion of rehabilitation goals in therapy decreases with increasing age when compared to assessment, enabling, or supportive goals (Palmer et al., 2018). Alternatively, it may reflect the findings from Menger et al. (2020) who studied post-stroke internet use among a group of participants with and without aphasia and found age, but not presence of aphasia, was a significant predictor of internet use. Additionally, participants' perception of age was noted to be a barrier to acquiring or improving internet skills (Menger et al., 2020). Contrarily, it is worth nothing that age was not a barrier for PwA learning/relearning to use ICT among participants aged between 40 and 82 years old in a study evaluating a bespoke computer training course for PwA (Kelly et al., 2016). Within our study, the SLTs also considered the ICT skills of a person with aphasia to be an important factor when deciding on ICT in rehabilitation. Prior ICT skills are considered more favourable when introducing ICT in aphasia rehabilitation (Gunning et al., 2017; Hill & Breslin, 2016). This may be because the person with aphasia is more readily equipped to start using ICT in rehabilitation and therefore better able to engage in the process. People with aphasia who have higher levels of prior computer experience have been noted to spend more time working with an ICT-delivered rehabilitation programme compared to those with lower experience (Marshall et al., 2016). Those with limited experience of ICT may be more likely to question their ability to engage in ICT-delivered aphasia rehabilitation (Hill & Breslin, 2016).

The production of ICT devices with touch screen interface and integrated accessibility features has led to improved ease of use and accessibility for devices. Smartphone and tablet technology use has increased among the general Irish population (CSO, 2018). The challenge of keeping ICT knowledge and skills up to date in an ever-changing technological environment adds additional stresses to the SLTs' already busy workloads. This can have a negative impact on SLT confidence (Gunning et al., 2017) and perceived limited knowledge within the area (Benedon, 2018). In addition, the presence of post-stroke visual and cognitive impairments may negatively impact on the PwA's ability to engage successfully with ICT devices and programmes (Chen & Bode, 2011; Hill & Breslin, 2016; Schröder et al., 2007). These issues may reflect the UTAUT construct of *effort expectancy* (Venkatesh et al., 2003). The dichotomy of this construct is highlighted in the perception that some factors will enable ease of use of ICT-delivered aphasia rehabilitation, for

example, accessibility features on ICT devices. However, other aspects may increase efforts for both PwA and SLTs, such as remembering how to log in and use the programme and keeping up to date with an ever-expanding repertoire of rehabilitation software and applications.

Social influence

ICT offers new options for modes of communication that can be exploited by PwA in order to regain and renew their communication networks. The ubiquitous nature of ICT, social media, and messenger platforms means new forms of acceptable and possibly accessible communication. For example, picture messaging and emojis have become a normal aspect of everyday life. Using these applications is not associated with social stigma and normalises a variety of modes of communication, not just text and speech. The acceptance of these alternative forms of communication can be considered positive in the context of PwA who may have difficulty accessing traditional messaging modes through text and speech. However, this must be balanced against the context of others' acceptance or others' *social influence* (Venkatesh et al., 2003). The SLTs highlighted that the aspiration to return to pre-stroke communication skills may be stronger than the acceptance of modified, functional communication. This can be an issue with respect to family acceptance of modified communication in an ICT medium and may impact on the adoption and acceptance of ICT in rehabilitation. Equally, unrealistic expectations that families and PwA may have with respect to the potential of ICT may lead to disappointment if not realised. Family support and encouragement are important factors in the introduction of ICT devices in rehabilitation (Chen & Bode, 2011).

Resources and support

The supporting conditions around PwA and SLTs were highlighted as substantial issues in the focus groups with respect to usage and acceptance of ICT-delivered aphasia rehabilitation. An optimum level of support within the environments in which both parties are situated, e.g., the home and the clinic, was emphasised as a requirement for the implementation of ICT-delivered aphasia rehabilitation. The SLTs envisioned an optimum service with support from IT departments, specialised SLTs and SLT assistants that could provide them with the confidence and assistance to ensure quality ICT-delivered aphasia rehabilitation (Chen & Bode, 2011). This support would ensure that they would receive adequate training, and they could remain up to date and confident about their knowledge and skills (Burke et al., 2021; Chen & Bode, 2011; Hill & Breslin, 2016). Having resources available to them, including reliable internet access (Davis & Copeland, 2006) and access to support from IT departments within the service (Burke et al., 2021). Similarly, having ICT devices and licensed programmes at their disposal, in order to test these out and understand their functions, and to trial these with PwA before making a clinical decision to implement them, was seen as important (Benedon, 2018; Swales et al., 2016). This would inevitably involve a change in resource allocations and a review of working practice so that time could be prioritised for these activities

within an already constrained work environment; something that the SLTs felt was not currently possible in most cases. Time spent on ICT activities has been highlighted as challenging in other studies (Hill & Breslin, 2016) in particular in the early set-up stages (Burke et al., 2021).

All of the issues highlighted above fall within a dilemma of technological change and the challenge of keeping in pace with this change. This requires a shift from traditional roles to a new understanding of the role of ICT in rehabilitation. The SLTs in this study identified the potential for ICT as an adjunct to face-to-face therapy but strongly valued the face-to-face contact from traditional therapeutic sessions. Face-to-face contact was considered an important factor in other studies (Burke et al., 2021) especially before beginning ICT-delivered aphasia rehabilitation (Hill & Breslin, 2016). Also, Swales et al. (2016) reported that SLTs in their study identified the need for a larger variety of prompts and cueing within therapeutic software programmes to reflect what happens in face-to-face therapy sessions.

Support for PwA and SLTs is a shared key facilitator for the adoption of ICT-delivered aphasia rehabilitation (Chen & Bode, 2011). This support is situated in the surrounding environment for each partner in the therapeutic relationship e.g., the family home and the health care setting. These types of support, or *facilitating conditions* (Venkatesh et al., 2003) differ for SLTs and PwA, but are seen as important factors for both stakeholder groups in ICT-delivered aphasia rehabilitation. This is reflected in research findings from Liu et al. (2015) who reported that *facilitating conditions*, in the form of institutional support, were positively correlated with the use of new technologies by occupational therapists and physiotherapists. Also, Cranen et al. (2012) suggested that the UTAUT constructs of *facilitating conditions* and *performance expectancy* can offer researchers a good starting point to structure and understand patients' perspectives of telerehabilitation services. The most pertinent factors that were reported to influence the use of ICT in aphasia rehabilitation among the SLTs in our study relate to these two UTAUT constructs (*facilitating conditions* and *performance expectancy*). This echoes the findings from research applying the UTAUT to technology acceptance and usage among health professionals (Ifinedo, 2012; Liu et al., 2015) and patients with chronic conditions (Cranen et al., 2012).

Limitations

The focus groups in this study were carried out in four urban areas in the Republic of Ireland and all the participants were employed by the Health Service Executive, the national provider of health services. The transferability of the findings may be limited due to the number of participants and the diversity of workplace environments in which they were employed. However, the SLTs in this study represent a broad spectrum of clinical experience and practice in a variety of settings. In addition, a number of participants in Focus Groups 1 and 3 worked in posts split between two services and provided services to both urban and rural communities.

The focus groups were carried out prior to the Covid Pandemic. The public health guidance resulting from the Covid-19 crisis necessitated changes in SLT practice. However, such changes may vary across individual practices, clinical settings, and regions (Kong, 2021). The findings in this qualitative study are based on the

experiences of SLTs in a specific region at a specific period of time and therefore may not be easily generalisable. Nevertheless, the themes identified in this research give insight to the experiences of these SLTs in relation to ICT in aphasia rehabilitation in its broadest sense. Future research exploring this phenomenon will likely have a greater focus on synchronous telepractice alongside asynchronous use of ICT in the context of post-Covid 19 service delivery and the continued expansion of ICT in health and rehabilitation.

The concept of data saturation as a measure of quality is noted as a contentious issue in qualitative research (O'Reilly & Parker, 2013). It has been promoted as a practice to determine sample size (Marshall, 1996) in which recruitment is ceased once new categories or themes stop emerging in the data. However, the concept of saturation was originally linked to grounded theory (Bowen, 2008; O'Reilly & Parker, 2013) and its use in other qualitative research methods, such as thematic analysis, is less transparent. It is not possible to state that saturation was achieved in this study as new codes were identified in the final focus group. However, it is important to note that the four key themes were identified within the data of the first and second focus groups, and no new themes emerged after this, but rather existing themes and subthemes were further defined and refined.

The application of the UTAUT model in this study has provided a structure for presenting SLTs' perspectives of ICT use in the management of aphasia. The model is not without limitations including its low level of parsimony due to complex interactions among attributes within the model and a lack of meso-level formulation, instead focusing on the individual or micro level without consideration of the organisational or group-level construction (Venkatesh et al., 2016). However, the UTAUT has been applied to acceptance and usage of technologies in a number of settings including education and health care is considered a high-quality theory overall (Venkatesh et al., 2016).

Conclusions

The past decade has seen a significant increase in both the availability and affordability of ICT devices for personal use. This has been accompanied by an increase in the availability of programmes and apps for use in aphasia rehabilitation. It is important to explore and understand SLTs' perspectives on the use of ICT in aphasia management as this will influence integration and options offered to PwA within clinical practice. This research highlights some of the issues experienced by SLTs in relation to the adoption and use of ICT in rehabilitation. It provides an overview of the factors that influence their decision to use ICT in aphasia management. These factors relate to the person with aphasia and their support network and environment, the SLT attitude and skills, and the service delivery environment. The strongest influencers appear to reflect two constructs of the UTAUT (Venkatesh et al., 2003). First, the perceived gains of using appropriately targeted software programmes as an adjunct to face-to-face therapy, thus increasing therapy intensity, reflects the *performance expectancy* construct that is the strongest predictor of use. Second, the access to suitable hardware and software, training and support, reflects *facilitating conditions* that must be met to enable adoption of ICT-delivered aphasia rehabilitation. There are

a number of barriers that may prevent easy implementation of ICT in aphasia rehabilitation; however, there is a positive perception of the potential benefits of using ICT in rehabilitation and in everyday communication for people with aphasia.

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