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Telepractice in the Communication Treatment of Individuals with Post-stroke Aphasia: Systematic Review

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Telepractice in the Communication Treatment of Individuals with Post-stroke Aphasia: Systematic Review

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by

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ABSTRACT

Telepractice, a branch of telehealth, which is the delivery of services to distant sites employing telecommunication, has been developing rapidly nowadays. Owing to the nature of the condition and treatment foci in aphasia, telepractice has been identified as a potential mode for intervention to persons with aphasia (PWA) in the field of speech-language pathology. Based on the American Speech-Language Hearing Association (2005), telepractice is considered a means to extend services to a wider context overcoming the barriers of transportation, costs, and limited availability of services. Thus, exploration of treatment accessibility to underserved populations in middle/low-income countries or rural areas via telepractice is warranted. The primary objectives of this study are to systematically review literature on telepractice of speech-language pathology services for PWA, with a focus to synthesize and analyze data that will be useful to low-income countries to consider telepractice as an alternate option and also to contribute to broaden the evidence base of aphasia practices via telepractice and include the newest available evidence.

A systematic review was conducted in this study following the guidelines of Cochrane Handbook (Higgins et al., 2020). The study utilized a systematic search based on PRISMA guidelines and included 11 articles following a thorough screen for eligibility. A pre-designed coding manual was utilized in order to extract relevant data. All the included studies evaluated the feasibility of telepractice in intervention and to investigate the effectiveness of treatment programs conducted via teletherapy. A majority of the participants (72%) included in the review are PWA secondary to strokes. The treatment areas studies targeted are word retrieval, language skills, communication skills and language and communication skills, with communication skills being the area covered in highest number of studies. The review found that telepractice in the targeted treatment programs is feasible and effective. However, the included articles lack strong

methodological designs limiting the certainty of the evidence. Participant-perceived data indicated some advantages of telepractice, such as overcoming transport/cost barriers, receival of higher intensity of treatment, and facilitations for non-verbal strategies to improve language and communication skills. In addition, the results revealed that all but one of the included studies was completed in a high-income country. Most of the findings also lack adequate details on therapy receival and delivery setting dynamics from a standpoint of replicating the studies or in order to generalize the findings.

In conclusion, the current review shows limited evidence guidelines for the use of telepractice in rural and middle/low-income countries. There is a need to explore simple affordable technology options in telepractice and evaluate their effectiveness in low/middle-income contexts. Empirical data on efficacy of telepractice for PWA drawn from strong methodological designs should also be considered to encourage evidence-based clinical practice using telepractice in those contexts.

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DEDICATION

To all the people living in underserved and developing countries. I believe my work would ultimately contribute to make a positive change in people's lives by uplifting the speech therapy practices in such countries.

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1. INTRODUCTION

Telehealth nowadays has become a significant means of connecting service-seeking people to health professionals. It covers a broader category of services that use telecommunication to provide health information and services from distance (Winters, 2002). Telehealth consists a number of subfields of which, telepractice is one (Weidner & Lowman, 2020). Based on the ASHA (2019) definition, delivery of speech-language pathology and audiology professional services by the means of telecommunication to a distance, outside the health care setting is known as telepractice. Figure 1 elaborates further, how each terminology is inter-related.

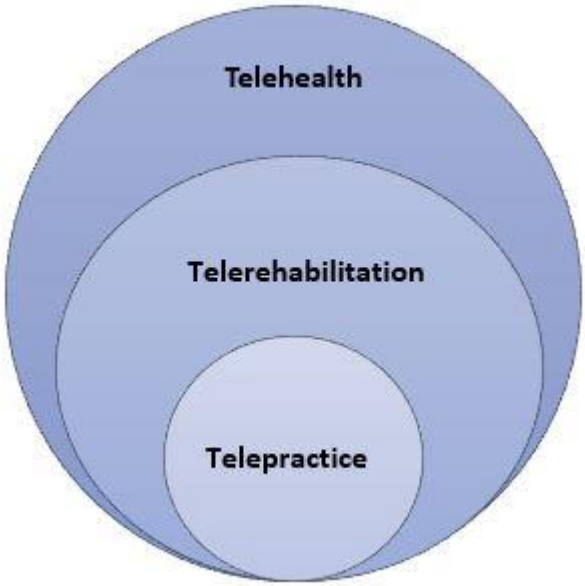


Figure 1: Inter-relation of Terminologies Related to Telepractice

Telepractice should link client to clinician or clinician to clinician via telecommunication in order to provide assessment, intervention, and/or consultation. Current use of telepractice can be categorized in to three main methods: synchronous, asynchronous, and a combined approach of both forms of telecommunication interactions. Services delivered in real time utilizing an interactive audio and video connection, resembling face-to-face therapy interaction is categorized

as synchronous practice. Asynchronous telepractice utilizes “store-and-forward” techniques to capture and transmit data for reviewing or interpretation by professionals (ASHA, n.d.).

ASHA recognizes telepractice as a potential mode of service delivery to overcome barriers such as transportation difficulties/costs, distance to facilities, and limited availability of professionals in geographic regions (ASHA, 2005). It is also considered as a means to extend speech therapy services to remote and rural locations with very limited services as well as to culturally and linguistically diverse populations (ASHA, 2005). Bridging the gap that exists due to aforementioned barriers between service seekers and service source, therefore, has been defined as a major focus of telepractice.

The advanced technology used in telerehabilitation creates greater accessibility to resources, people, and information. These advancements, on the other hand, lead to consideration on security and confidentiality of information transferred via telecommunication. ASHA (2010) has suggested data encryption, security certificates and virtual private networks in order to fulfill Health Insurance Portability and Accountability Act (HIPPA, 1996). Other security measures such as using firewall, up-to-date anti-virus software, and clinicians getting trained to use security protocols have been discussed in past literature (Boisvert et al., 2012).

The current study focused on reviewing the prevailing evidence on communication intervention practices of aphasia via telepractice, particularly with a purpose to be informative and beneficial to generalize the findings to a wider context.

2. LITERATURE REVIEW

2.1 Telehealth and Aphasia

Aphasia is an acquired, selective impairment of language modalities and function; it results in deficits in communicative and social functioning, impacting the quality of life. The manifestations are attributed to a focal brain lesion in the language dominant hemisphere (Papathanasiou, Coppens, & Potagas, 2011, as cited in Hallowell, 2016). The condition manifests in deficits in comprehending and formulating language in all modalities (i.e., spoken, written, and sign). The cause of the majority of cases has been identified as strokes (Engelter et al., 2006; Pedersen et al., 2004). Due to the nature of breakdowns, people with aphasia (PWA) encounter communication difficulties in day-to-day life to varying degrees, warranting the speech therapists to focus on functional communication as well as language restoration (Brady et al., 2016). Facilitating an individual's language and communication skills, activities, and communicative participation has been the primary focus of aphasia treatment highlighted in the past literature (see Brady et al., 2016). These targets are being achieved through a number of service delivery modes such as, conventional face-to-face therapy, computer-based treatment, and telepractice.

Despite the fact that there is no consensus about the optimum intensity, duration, and amount of therapy in aphasia intervention (Cherney, Halper, et al., 2011), a number of systematic reviews (Brady et al., 2016; Cherney, Patterson, et al., 2011) as well as the guidelines developed by Winstein et al. (2016) for aphasia therapy have suggested the favorability of intensive treatment. Moreover, evidence indicates that PWA require and benefit from long term speech therapy intervention (Brady et al., 2016; Parr et al., 1997).

Even if the empirical facts are favorable to intense and long-term services, high intensity services can pose challenges to PWA from a logistical standpoint. A number of PWA, for example,

manifest motor dysfunctions and challenges to mobilize, which can make travelling to clinics difficult. On the same note, Dew et al. (2013) have mentioned a number of challenges PWA may face, including lack of access to transportation and medical fragility, which possibly hinder accessing rehabilitation services. Theodoros (2008) supports this and affirms that motor dysfunction and fatigue can make travelling to services a challenging task. Studies done by Parr et al. (1997) and Cant (1997) on views of PWA about rehabilitation services have also described the difficulties reported about travelling, particularly from rural areas where PWA have to rely on public transport or ambulance services, which may result in longer waiting times and reduced intensity of treatment. The possible consequence of longer waiting times for services and reduced intensity of treatment is that they can diminish the potential benefits of intense treatment in aphasia.

Given the chronic nature of aphasia, telepractice caters to the need of continued therapeutic services over the long term and to hinder logistical difficulties such as mobility and associated cost. A recent overview conducted by Mashima and Doarn (2008) on telepractice in speech-language pathology has detailed the ways telepractice augments the accessibility of services. The increased availability of treatment can reduce long waiting lists and potential delays for treatment allowing more opportunities to intensive treatment programs. The challenges for transportation, costs, and time associated can easily be cut down which particularly are advantageous for PWA who live in rural areas. The method also provides a unique opportunity to connect with patients in their natural, functional environments allowing the treatment to be oriented towards patients' everyday life needs with significant involvement of family and caregivers (Cason & Cohn, 2014; Mashima & Doarn, 2008). This opportunity stands to serve as a major asset in communication intervention for PWA, given the focus on functional communication within everyday life.

Bradley and Poppen (2003) point out another positive aspect of using telecommunication with people with communication disorders in general. Some specific features of telecommunication allow nonverbal and other strategies to facilitate and/or compensate for limitations in verbal communication. For example, some telecommunication technologies allow for the use of closed captioning.

Several aspects of telepractice were identified by Boisvert and colleagues (2012) as key practices in order to deliver intervention successfully. Conducting a thorough assessment prior to intervention via telepractice is one key recommendation. According to ASHA (2010) , this will guide clinicians to identify specific goals as well as limitations of the technology that may restrict planned intervention strategies. Client's needs, resources, infrastructure required, technology/equipment, documentation strategies, schedules for professional and caregiver education, and schedules for client services are a few aspects recommended by ASHA as essential components.

Based on empirical evidence, support persons are an integral part of a successful telepractice program. Caregivers/parents, general/special educators, paraprofessionals, and speech language pathology assistants (SLP-As) are all defined as support persons by Boisvert et al. (2012). They further insist the importance of identifying the role of support persons clearly and distinguishing between a SLP-A and an onsite helper. The individuals who are actively involved in intervention assisting to provide therapy are considered as SLP-As and should possess credentials to practice legally. Others who help clients to receive intervention primarily by assisting to troubleshoot are considered onsite helpers who will be referred to as e-helpers in this study.

The importance of satisfaction surveys in telepractice and utilization of surveys with clients, caregivers and clinicians have been emphasized by ASHA (2010). The literature on inclusion of such surveys indicate satisfaction in majority of studies (see Brennan et al., 2002, 2004; Molini-Avejonas et al., 2015; Simic et al., 2016; Wade et al., 2003).

Despite the fact that telecommunication supports accessibility of treatment, Kelly et al. (2016) discuss the potential that it hinders access to use technology by PWA through a phenomenon known as the 'digital divide'. In fact, Egan et al. (2004) list hemiplegia, hemiparesis and limb apraxia as some physical impairments that may cause challenges to use technological devices such as keyboards, mousepads, etc. Accessibility barriers due to communication impairments such as aphasia were taken into consideration in empirical studies, despite the fact that 'digital divide' was originally defined for physical disabilities that negatively affect accessibility to technology. Since aphasia can manifest itself in multiple forms such as reception, expression, reading and/or writing, researchers believe that it can greatly impact the use of technology (Elman, 2001).

2.2 Telehealth for Communication Services in Low- and Middle-Income Countries

Rehabilitation services such as speech, language, and communication assessment and intervention for PWA in low-income countries face many challenges. Many of the issues are related to logistics resulting from the disparity of healthcare services between urban and remote areas. In fact, O'toole & Mcconkey (1995) claim that, most of the specialist services in low-income countries are located around urban areas. The majority of the population in such countries live in the rural areas of low service coverage. For example, 78% of the population in Sri Lanka and 88% of the population in Uganda live in such rural areas (Instituto del tercer Mundo, 1997, as cited in Hartley et al., 2002).

Receiving services from urban centers, therefore, has been costly and less feasible due to long distance transportation and mobility issues. The developing world, the low- and middle-income countries as defined by the World Bank (United Nations Statistical Annex, 2018) requires solid and practical solutions to overcome these barriers for inaccessibility apart from the solutions and strategies that cater to developed countries. Given that telepractice has been defined as an alternative mode of service for individuals with limited access to services (Hill & Theodoros, 2002; Mashima & Doarn, 2008; Tindall, 2012), exploring telepractice, utilized in aphasia care specifically in terms of viable methods and supports (e.g., service delivery/receival locations, focus of intervention, etc.) is pertinent.

Thus, Weidner and Lowman's (2020) remark on the need for greater details regarding treatment settings (entailing both settings of service delivery and receival) is important in determining the generalizability of prevailing findings on telepractice. Marked differences such as underdeveloped infrastructure, lack of technical expertise, and high costs seen in developing countries should be substantially considered in attempts to explore solutions. Thus, in addition to effective methods, attempts to find simple, inexpensive and technologically appropriate telepractice options catering to the developing world are needed (Scott & Mars, 2015). Such attempts could guide the practice in low-income countries toward enhanced service provision.

Being an emerging treatment modality, telepractice is still in its infancy in terms of research support (Tucker, 2012). Nevertheless, the first documented use of telepractice in the field of speech-language pathology was with PWA; the approach utilized auditory stimuli presented via a telephone and paired printed visual stimuli (Vaughn, 1976, as cited in Hall et al., 2013).

A greater amount of literature on speech-language pathology services to adults via telepractice for the past five years is focused particularly on services for PWA, (see Choi et al.,

2016; Kurland et al., 2018) as compared to other adult communication disorders (Weidner & Lowman, 2020). Molini-Avejonas et al. (2015) point out that many of research studies on telepractice in speech-language therapy are preliminary studies rather than higher evidence-level papers such as randomized control trials or systematic reviews.

Nevertheless, a number of systematic reviews useful to clinicians for information and clinical decision-making can be found in the field of speech-language therapy for adults (see Coleman et al., 2015; Keck & Doarn, 2014; Molini-Avejonas et al., 2015). All of these reviews discuss speech-language pathology practice in a broader perspective rather than researching into disorder-specific telepractice. Consequently, systematic reviews specifically on telepractice in aphasia therapy remain an area of research paucity.

The review done by Hall et al. (2013) is one of the few systematic reviews done specifically about telepractice in aphasia. The findings support the effectiveness and viability of telepractice for PWA. A systematic review done by Morgan et al. (2018) exploring if telepractice results in positive outcomes in language expression of PWA also affirms the effectiveness of telepractice to stand alone as a separate delivery mode. Even if the effectiveness is reported in empirical studies, the current limited literature yet fails to elaborate certain important aspects that would be beneficial in generalizing the approach to a wider context, specifically the low- and middle-income country context (e.g., study settings, levels of support provided, technology utilized, facilitators, etc.). Furthermore, a number of studies focused on telepractice for PWA have likely been published since the completion of any currently published systematic reviews on the topic. Therefore, a disorder-specific systematic review on aphasia exploring aforementioned aspects meticulously is warranted.

2.3 Objectives

The primary aim of this study is to systematically review literature on telepractice of speech-language pathology services for PWA, with a focus on the synthesis and analysis of data that will likely be useful when considering telepractice as an alternate option in low-income countries. The study also aims to contribute to broaden the evidence base of aphasia practices via telepractice and include the newest available evidence.

3. METHODOLOGY

A systematic review was conducted following the guidelines mentioned by the Cochrane Handbook (Higgins & Green, 2008). The systematic search followed the guidelines defined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009).

3.1 Search Procedures

To identify relevant literature, a search utilizing five electronic, health-related databases was conducted. The databases included CINAHL, ERIC, Web of Science, PubMed, and PsycINFO. The search was carried out using the terms "aphasia," "aphasic," and "anomia" paired with "telepractice," "teletherapy," "telehealth," "telerehabilitation," "Skype," "iChat," "videoconferencing," "telemedicine," and "teleconference" (e.g., "aphasia" AND "teletherapy"). The selection procedure followed the PRISMA guidelines and steps as shown in Figure 2. The abstracts of the initially selected articles were reviewed by the researcher to determine the eligibility to the study, which is outlined below. The abstracts of the studies that did not meet the inclusion criteria were removed, and the abstracts of studies compliant with the criteria were selected for further review.

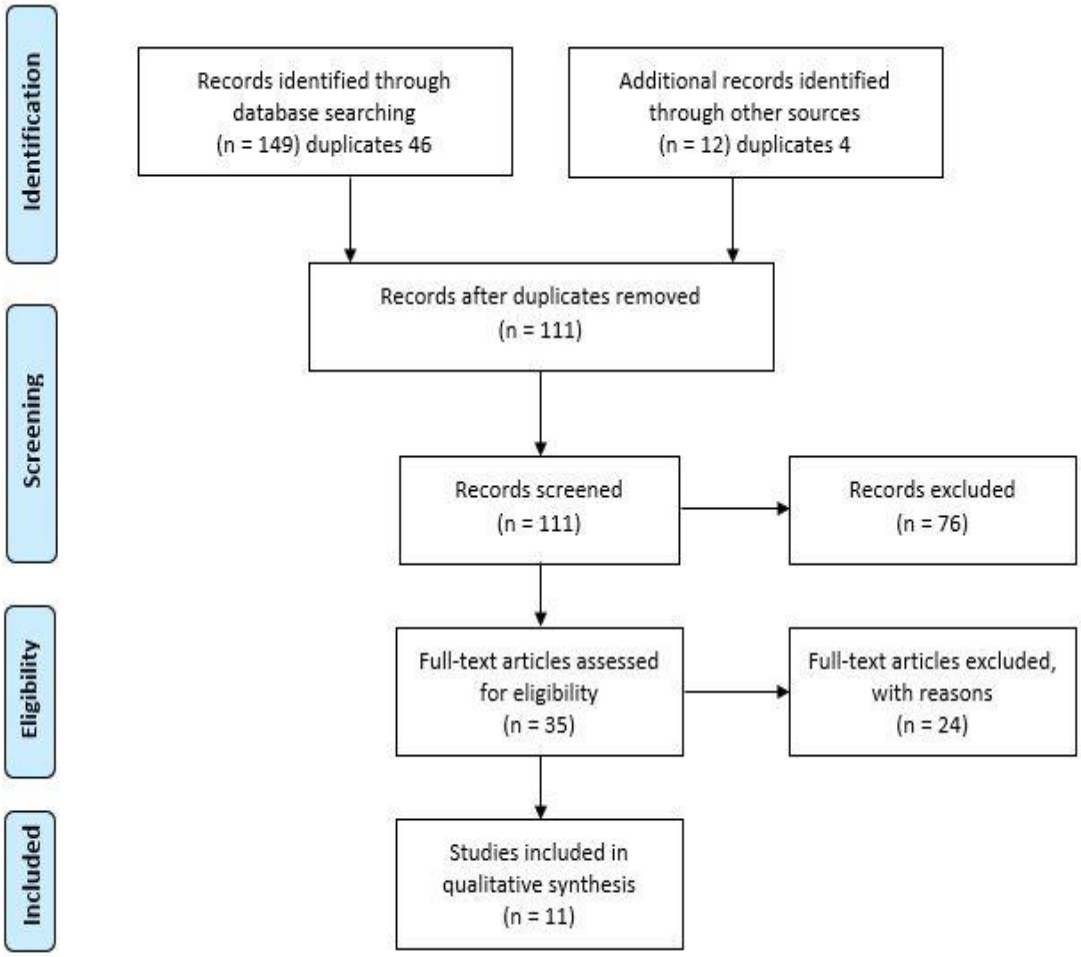
Inclusion Criteria

To be included in the planned review, the studies fulfilled the following requirements:

- Participants received teletherapy should be ≥ 18 years of age
- At least one participant with a diagnosis of aphasia
- At least one dependent variable that involved the participant/s with aphasia and results of an intervention implemented via synchronous or hybrid methods of telepractice

- Intervention delivered via telepractice should be specific to language and/or communication
- Intervention delivered via telepractice should be by a certified speech-language pathologist at one location to a participant with aphasia at a remote location
- Published in peer-reviewed journals

Studies that have explored the effectiveness, and/or efficacy of a treatment provided via telepractice were included in the review. Asynchronous telepractice often provides home programs and practice tasks through utilizing sophisticated software/computer programs (see Kurland et al., 2018; Meltzer et al., 2018). Such technology is unlikely to be available in low- and middle-income countries for use in telepractice. As approaches using such technologies are not likely to be feasible in the context of interest, this review excluded studies that utilized primarily asynchronous therapy. To provide a summary of evidence that reflects the many available methods and outcomes of telepractice that have been in practice thus far, the review did not pose a restriction to the publication years of studies or to the study designs.



Note: Adapted from Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Altman, D., Antes, G., Atkins, D., Barbour, V., Barrowman, N., Berlin, J. A., Clark, J., Clarke, M., Cook, D., D'Amico, R., Deeks, J. J., Devereaux, P. J., Dickersin, K., Egger, M., Ernst, E., … Tugwell, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. In *PLoS Medicine* (Vol. 6, Issue 7). https://doi.org/10.1371/journal.pmed.1000097

Figure 2 : PRISMA Flow Diagram of Study Identification, Screening, and Inclusion.

3.2 Data Extraction and Review Parameters

The initial review of abstracts followed by the full-article review of selected studies determined all the studies that fulfilled the pre-determined inclusion criteria of the current

systematic review. The researcher read and summarized each selected article. A pre-designed coding manual (see Appendix) was used to extract data on the following aspects of each study:

- Participant characteristics
- Telepractice methods
- Remote site dynamics
- Service delivery setting dynamics
- Training sessions for remote therapy
- Technology type
- Research design type
- Treatment aspects/skills targeted
- Measured outcomes
- Results
- Issues related to use of telepractice

The researcher coded all articles according to the prescribed manual and tabulated the data accordingly. Additionally, a second independent coder was trained to use the manual to independently code 20% of included articles to ensure interobserver reliability of the data. Identifying the 20% from the total number of recruited studies was done through random selection. Disagreements were discussed and resolved. The researcher subsequently coded each selected article. In the presence of unclear data or querying information, the researcher sought for the opinion of a senior speech-language pathologist during the coding process.

The framework by Schlosser and Koul (2015) was utilized to determine the certainty of study evidence. The classifications in fact were based on three features: design, inter-observer

agreement (IOA) of the dependent variable, and treatment integrity. The framework allowed the flexibility to use it on both single-subject experimental designs as well as experimental group designs.

4. RESULTS

4.1 Search Results

The systematic search through five databases yielded 149 articles for preliminary review of abstracts. Hand searches for keywords in Google Scholar and reference list checking resulted in 12 potential studies for further review. The researcher scanned and reviewed each title, abstract, and, subsequently, the full articles to determine the eligibility against the pre-defined inclusion criteria. A total of 35 studies were selected for preliminary inclusion and proceeded to full-article review (Figure 2). After a thorough assessment of each article by the researcher, 11 studies fulfilled the inclusion criteria and were selected for the systematic review.

From the total number of studies included for full-article review, 69% were excluded for numerous mismatches with the inclusion criteria. Table 1 provides a breakdown of rationales for article exclusion.

Table 1
Rationales for Exclusion and Percentages

Rationale for exclusion	Number of studies	Percentage
Asynchronous telepractice	8	33.33%
Not interventional	5	20.83%
Service not provided by qualified SLPS	4	16.67%
Not the population of interest	3	12.50%
Study still in progress	2	8%
Full article not written in English	2	8%

Three studies excluded for services not being provided by qualified SLPs involved student SLPs who delivered services remotely. The other study excluded for this reason utilized a virtual animated therapist throughout the intervention period. The SLP's contribution to service delivery was reported minimal and limited only for troubleshooting and for evaluating progress.

4.2 Inter-Observer Agreement (IOA)

From the total number of recruited articles, 20% was randomly selected and coded by a second independent rater. The results achieved 85% of IOA. Final data was based on the researcher's coding after resolving the disagreements with the independent coder by referring back the coding manual.

4.3 Participant Characteristics

The final set of 11 included studies involved a total of 82 participants with aphasia. A majority (73%) of participants had aphasia secondary to cerebrovascular accidents (CVA). One study included a single participant with aphasia following a gun-shot injury (Goldberg et al., 2012). The cause for aphasia of the remainder of 21 participants was not reported. The severity of the condition varied across studies. In addition to the diagnosis of aphasia, three studies included word finding difficulty as an inclusion factor (Agostini et al., 2014; Macoir et al., 2017; Walker et al., 2018; Woolf et al., 2016). Phonologic alexia was also an inclusion factor in one study as a part of aphasia (Getz et al., 2016).

Of the 11 studies, four consisted of participants with varied severity levels of apraxia of speech (AOS) in addition to the primary diagnosis of aphasia (Furnas & Edmonds, 2014; Goldberg et al., 2012; Pitt et al., 2017; Rhodes & Isaki, 2018). The sample size of each individual study ranged from one to 21 participants which is outlined in detail in Table 2 below.

Table 2
Sample Sizes of Included Studies

Study	Sample size
Goswami et al. (2012)	1
Furnas and Edmonds (2014)	2
Goldberg et al. (2012)	2
Pitt et al. (2017)	2
Getz et al. (2016)	2
Rhodes and Isaki (2018)	2
Agostini et al. (2014)	5
Walker et al. (2018)	6
Pitt et al. (2019)	19
Macoir et al. (2017)	20
Woolf et al. (2016)	21

4.4 Service delivery Setting Dynamics and Remote Site Dynamics

4.4.1 Countries where the Studies Conducted.

All 11 studies recruited participants only from local areas and, therefore, the service provision through telepractice occurred only to local remote sites. Only one study reported distributing information about the study to registry members within a 300 km radius of three Australian capital cities and recruitment was done through the University of Queensland Communication Research Registry (Pitt et al., 2019). Given these facts, no cross-country administration of teletherapy was reported in any of the 11 studies.

The country where the studies were conducted was revealed in all the articles except for one study done by Goldberg et al. (2012). Of the 11 studies, four of the interventions were conducted in the USA, representing the country in which the majority of included interventions were conducted. No records of studies done in low-income countries were found except the work done by Goswami and colleagues (2012) which was completed in India. Figure 3 depicts the number of studies conducted by country.

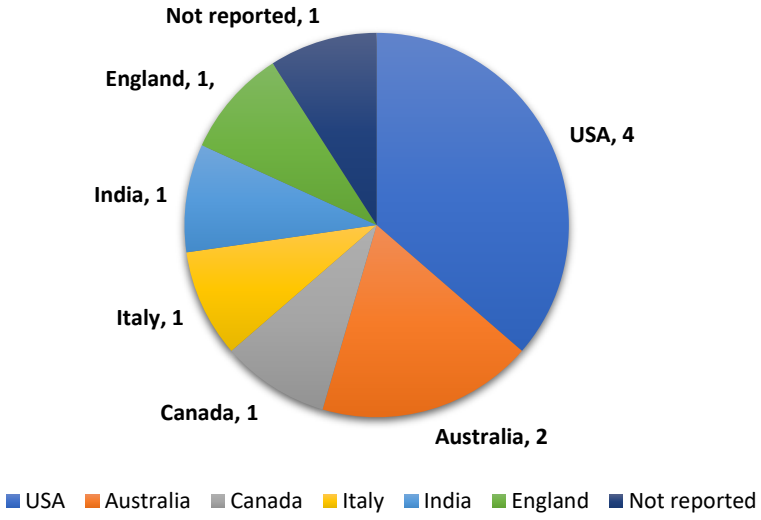


Figure 3 : Proportion of Countries Studies Conducted

4.4.2 Service Delivery Setting/Hub-site Characteristics

Information regarding the settings on the clinician's end and the participant's end indicates lacking detail in general. A majority of studies (55%) did not report any information about the settings utilized to provide services via telepractice. From five of the studies that can be categorized as telepractice provided from a university lab setting (Getz et al., 2016; Goswami et al., 2012; Pitt et al., 2017; Walker et al., 2018; Woolf et al., 2016), only four specifically mentioned the study setting. Information outlined in the methodology of the other study by Pitt et al. (2017) provide

the reader with inexplicit clues to deduce that the study was conducted in a university lab. Of these five studies, one involved two types of remote groups, one of which received therapy from the university lab, while the other group received services remotely from a clinical site (Woolf et al., 2016).

Reporting on hardware used at the hub-sites shows an inconsistency in terms of details included (see Table 3). Some researchers comprehensively reported on the details of devices; for example, "[t]he 'clinician' system consisted of a Dell 790 OptiPlex desktop computer loaded with the treatment software and Vidyo; an add-on video camera; and a hands-free noise cancellation microphone" (Getz et al., 2016, p.8). Meanwhile, in other studies, information on hardware was not included (Furnas & Edmonds, 2014; Goldberg et al., 2012; Pitt et al., 2017, 2019). Reporting on only key hardware devices were also evident in some studies (Rhodes & Isaki, 2018; Woolf et al., 2016). Use of laptop computers (Agostini et al., 2014; Goswami et al., 2012; Rhodes & Isaki, 2018), desktop computers (Getz et al., 2016; Macoir et al., 2017) and iPads/Mac books (Woolf et al., 2016) were reported. Description of the technology utilized consisted of the availability of peripheral devices such as microphones, video cameras in five studies (Agostini et al., 2014; Getz et al., 2016; Goswami et al., 2012; Macoir et al., 2017; Walker et al., 2018). Use of teletherapy software with required features specifically developed for treatment programs of several studies (Furnas & Edmonds, 2014; Getz et al., 2016; Macoir et al., 2017; Pitt et al., 2017) were also noted. Further, one study used a prevailing teletherapy software known as TeleGain (Pitt et al., 2019). In addition, one study used the LogMeIn application to facilitate participants in troubleshooting as well as to have control over participants' technological barriers (Getz et al., 2016).

4.4.3 Remote Site Characteristics

The focus given on describing the remote sites is limited in nearly half (45%) of included studies (Agostini et al., 2014; Goldberg et al., 2012; Goswami et al., 2012; Macoir et al., 2017; Rhodes & Isaki, 2018). In these studies, the locations in which participants received services were not reported. Remaining studies stated that services were provided via telepractice to participants' homes (Furnas & Edmonds, 2014; Getz et al., 2016; Pitt et al., 2017, 2019; Walker et al., 2018; Woolf et al., 2016). In general, reporting characteristics of remote sites indicates a greatly varied range in the amount of details (see Table 3). As an example, the description given by Pitt et al. (2019) on the remote setting included the location, hardware, software participant used, while in Goldberg et al. (2012) none of the information in terms of the setting were delineated.

From the studies that revealed details about the hardware used, three utilized laptop computers (Agostini et al., 2014; Getz et al., 2016; Pitt et al., 2019). Two studies used both desktop computers and iPads (Rhodes & Isaki, 2018; Woolf et al., 2016), where Woolf et al. (2016) allowed participants to choose their preference. Walker et al. (2018) reported that the participants used home computers, which does not precisely state the type of device used at the remote site. The type of device used was not reported in other remaining studies (Furnas & Edmonds, 2014; Goldberg et al., 2012; Goswami et al., 2012; Macoir et al., 2017).

Information about the internet connection used by participants at remote sites was not clearly outlined in all studies except for three, which reported utilizing Wi-Fi connections, a mobile Wi-Fi connection in two studies (Getz et al., 2016; Pitt et al., 2019), and an ADSL Wi-Fi connection in the other (Pitt et al., 2017). Getz and collegues (2016) provided descriptive information about the upload and download speeds of internet connections participants used. It was noted that some researchers provided required devices such as iPads and laptops to all

participants (Getz et al., 2016; Woolf et al., 2016), whereas, in one study, the devices were provided only if the participant's devices were not adequate to receive services (Pitt et al., 2019). Mobile internet connections were also provided by some researchers if home internet performances were not adequate. As examples, Woolf et al. (2016) provided mobile data allowances, and similarly, mobile hotspot connections were provided in (Pitt et al., 2019) if necessary. Two researchers supplemented other audio and visual devices required to all their participants (Getz et al., 2016; Pitt et al., 2017), or in some depending on the necessity they were provided; such as, microphones, headsets, cameras and speakers (Pitt et al., 2019).

Table 3:
Hardware and Software Utilized in Hub-sites and Remote Sites

Study	Hardware/Software Used at Hub-site	Hardware Used at Remote Site
Woolf et al. (2016)	Hardware - iPad/ desktop computers Software – NU	iPad/ desktop computers
Macoir et al. (2017)	Hardware – 25.5" Touchsmart embedded computer, h.264 video codec ,pan-tilt-zoom (PTZ) wide-angle camera , omnidirectional microphone Software – TeleTherapy (Oralys Inc.)	NR
Goswami et al. (2012)	Hardware - laptop computer with microphone Software – NU	NR
Getz et al. (2016)	Hardware - Dell 790 OptiPlex desktop computer, add-on video camera, hands-free noise cancellation microphone Software – Homepractice, LogMeIn	IBM Thinkpad,hands-free noise cancellation microphone, built-in video camera
Pitt et al. (2017)	Hardware – NR Software – iCILT	Desktop with webcam, speaker,headset
Rhodes and Isaki (2018)	Hardware – laptop computer Software - NU	iPad /desktop computers

Table 3 (Cont)

Study	Hardware/Software Used at Hub-site	Hardware Used at Remote Site
Pitt et al. (2019)	Hardware – NR Software - TeleGAIN	Lenovo ThinkPad Edge E431 Touch, Logitech C270 web camera, Sennheiser Headset PC 7/ Plantronics Audio 478 headset microphone
Furnas & Edmonds (2014)	Hardware – NR Software – VneST-C	NR
Agostini et al. (2014)	Hardware - Intel based 17" laptops connected to the Internet, equipped with internal video cameras, external headphones. Software – NU	Intel based 17" laptops connected to the Internet, equipped with internal video cameras, external headphones
Goldberg et al. (2012)	Hardware – NR Software – NU	NR
Walker et al. (2018)	Hardware – NR Software – NR	Home computers (unspecified)

Note: NR = Not reported, NU = Not utilized any special software designed for treatment

The involvement of facilitators/e-helpers was evident in 72% of the studies with their scope of work and the amount of involvement varied across studies. Excluding one study from the above group, in all the other studies, a caregiver or a family member was reported as the facilitator (Macoir et al., 2017; Pitt et al., 2017, 2019; Rhodes & Isaki, 2018; Walker et al., 2018; Woolf et al., 2016). A researcher from the team facilitated the participants only during the first session in Getz et al. (2016). In few studies a facilitator's input was present only if the participant required support (Pitt et al., 2019; Walker et al., 2018; Woolf et al., 2016), while in Rhodes and Isaki (2018), Pitt et al. (2017) and Macoir et al. (2016), a caregiver had to present during the sessions regardless of participant requirement. In all the studies mentioned above, the facilitator's role was to troubleshoot and help with technological issues mainly except in the work done by Rhodes and Isaki (2018) and Walker et al. (2018) in which the facilitators helped in communication as well. In fact, two authors reported the contribution of family members as being e-helpers and the familiar

everyday environment that facilitated the improvement in functional communication skills (Getz et al., 2016; Rhodes & Isaki, 2018).

Completion of a preliminary assessment of remote site in order to verify if internet connection, equipment, facilitator, and participant's skills needed to attend teletherapy was reported in two studies (Goswami et al., 2012; Walker et al., 2018). Walker and colleagues (2018) utilized Telepractice Technology Checklist (Walker, 2015) and Goswami et al. (2012) developed a pre-requisite protocol which they employed to determine the aforementioned aspects to determine the adequacy of the remote site. Prior to start intervention, the internet connection speed of remote sites was checked in Getz et al. (2016) for adequacy to receive required audio and video signals.

4.4.4 Characteristics of Telepractice Used

All but one study (Goldberg et al., 2012) used only telepractice for synchronous methods of service delivery which allowed remote, live interaction in real-time with participants. Goldberg et al. (2012) employed a hybrid approach that involved primarily synchronous telepractice services in real-time and few sessions of in-person, traditional treatments. The studies used different telecommunication and video conferencing software to connect with participants in real time. One study employed Facetime videotelephony technology as the telepractice platform (Woolf et al., 2016). Remaining studies used videoconferencing software. A freely available software (i.e. Skype) was used only in three studies (Agostini et al., 2014; Goldberg et al., 2012; Goswami et al., 2012). Others utilized commercially produced software such as, Adobe Connect (Furnas & Edmonds, 2014; Pitt et al., 2017, 2019) , Vidyo (Getz et al., 2016) and Cisco WebEx (Walker et al., 2018). Cisco WebEx allowed multiple simultaneous webcam feeds, a large screen, and

thumbnail video presentations of each participant providing a virtual environment to encourage communication exchanges as required in the treatment program.

Several authors indicated additional benefits gained from using telecommunication platforms in therapy. The features of these platforms provided accessibility to use multimodal cues such as, graphic, auditory, visual, and typed modality that facilitated target skills (Furnas & Edmonds, 2014; Goldberg et al., 2012; Goswami et al., 2012; Pitt et al., 2017; Walker et al., 2018). Using additional cues on participant's request or initiation, which were not included in the planned protocol, was evident in two studies. These were self-cueing in script training and orthographic cuing in iCILT. Interestingly, the authors found these cues beneficial for treatment outcomes (Goldberg et al., 2012; Pitt et al., 2017).

4.5 Issues Related to Use of Telepractice

Technical difficulties encountered in service delivery were reported in several studies. Limitations to providing language and/or communication stimulative cues required in the intervention protocol were reported in Goldberg et al. (2012) and Walker et al. (2018). Time lags occurred in Walker et al. (2018) when switching voice activation between speakers, and audio and video glitches disrupted some cues that could help convey meaning (i.e., facial expressions, prosodic patterns). Using choral reading as a cue could not be possible in Goldberg et al. (2012) due to improper timing between audio and visual signals. Cueing hierarchy for participants receiving telepractice, therefore, had to be modified to only two levels of cueing excluding choral reading. Drop-out of one participant and incomplete data of the post assessment stage due to issues associated with technology were reported in Pitt et al. (2019). Further, inadequate technology support at home resulted in one participant being unable to complete the post assessment.

Disruption of an electronic recording done via teletherapy caused one occurrence of missing data. Similarly, one occurrence of missing data was reported in Goldberg et al. (2012) due to technical difficulties. Increased time to resolve technological issues in several instances was also a drawback reported in Pitt et al. (2019). The impact caused by a lack of synchrony between audio and visual signals was stated in Pitt et al. (2017, 2019) and Rhodes and Isaki (2018) as breakdowns in communication between clinicians and participants. Nevertheless, Pitt et al. (2017) and Rhodes and Isaki (2018) reported that these breakdowns could easily be resolved and did not pose a threat to the treatment protocol and to the flow of conversation.

Woolf et al. (2016) encountered a problem regarding safety and possible unauthorized access to mainstream internet technology. Thus, the technology department of the hospital raised the need of using the custom-made platform in order to ensure safety and confidentiality. However, Facetime was employed (with approval from the hospital) due to lack of accessibility of a bespoke platform option.

4.6 Intervention

The 11 studies recruited for this review indicated a variety of treatment approaches that are commonly used in aphasia intervention. Similarly, a variety was noted in intervention targets as well. Communication skills were targeted in 37% of the studies (4/11). These studies in fact, provided teletherapy to improve different aspects of communication or used differed approaches to improve communication skills.

Group therapy intervention via telepractice was evident in two studies focusing on communication skills (Pitt et al., 2019; Walker et al., 2018). Duration of treatment in Pitt et al. (2019) indicated double the number of hours (48 hours) when compared to treatment duration of

Walker et al. (2018), which was 24 hours. Both studies indicated promising findings for improvement in communication skills by the group therapy approaches used. Walker et al. (2018) used a socially oriented, less structured aphasia group therapy program, while Pitt et al. (2019) used TeleGAIN, a specialized software to provide group therapy virtually. In fact, Walker et al. (2018) claimed that the online treatment program helped to significantly reduce social isolation of PWA and Pitt et al. (2019) claimed multi-purpose group intervention for PWA can also result in communicative participation and quality of life, and outlined the potential to use telepractice as an alternative to face-to-face services.

Macoir et al. (2017) targeted functional communication skills by providing treatment based on Promoting Aphasic Communication Effectiveness (PACE) approach and investigated the effectiveness of telepractice on communication skills. Duration of treatment program was reported as total of nine sessions over a period of three weeks. Study results suggested that synchronous telerehabilitation of multi-modal language therapy based on PACE approach improved functional communication of PWA.

Script training was utilized in two studies, one of which, employed a combination of synchronous telepractice and in-person services (Goldberg et al., 2012). The study examined the effects of script training on language and communication abilities following 11-13 of 30 minute sessions (number of sessions varied across participants). Rhodes and Isaki (2018) used videoconferencing to provide script training in order to determine the effectiveness on functional communication. Treatment duration was a total of 13 sessions with each session of 45 minutes. Both studies showed positive findings, with Goldberg et al. (2012) indicating improved language skills in generalization samples as well.

Feasibility of constraint-induced language therapy delivered via telerehabilitation was studied in one study (Pitt et al., 2017). The study used a web-based card game, Internet constraint-induced language therapy (iCILT), which is a transformed version of the dual card game used in face-to-face constraint-induced language therapy. Intervention was provided over two weeks for a total of 10 sessions with each session lasted for three hours. Post treatment findings on language skills and communication-based quality of life differed across each participant. Nevertheless, improvements in naming were evident. Further, the study suggested the potential to use of iCILT as a feasible alternative to traditional face-to-face intervention.

Treatment on word retrieval was the primary focus of 27% of studies (3/11). A quasi-randomized controlled feasibility study was conducted by Woolf et al. (2016) to compare the effects of remote therapy to face-to-face therapy on word retrieval. The study consisted of two remote groups, university lab and clinical site, allowing the researcher to explore feasibility of mainstream remote technologies from different settings. Comparison between naming treatment via teletherapy and face-to-face was studied in Agostini et al. (2014) as well. In both studies on word retrieval treatment, the treatment period lasted for eight sessions, which in detail provided in Woolf et al. (2016) as eight one-hour sessions. The duration of each session was not reported in Agostini et al. (2014). Results of Woolf et al. (2016) indicated improved naming in confrontational naming, though the improvements were not evident in conversational level. However, findings from the two studies suggested that lexical retrieval therapy delivery is feasible via videoconferencing. Computerized Verb Network Strengthening Treatment (VNest-C) was used to provide lexical retrieval therapy via telerehabilitation in Furnas and Edmonds (2014). The study investigated how spoken and typed lexical retrieval gets effected by computerized VNeST-C, delivered in real time. Two hours of each session with 24 sessions completed the intervention

block. The results of the study revealed improvements on lexical retrieval, and improvements in both spoken and typed modalities on single-word naming. This suggested VNeST-C protocol as an effective treatment for PWA. Generalization of skills was also observed in discourse, although effects were limited.

In the study by Getz et al. (2016), telerehabilitation was provided to treat phonologic alexia, an acquired reading disorder, which was a part of aphasia of two individuals. The study evaluated the effectiveness and feasibility of treatment of phonologic alexia when services delivered remotely through teletherapy. Treatment was given three times per week, and total duration of treatment was variable between the two participants; in addition, each session ranged from 45-60 minutes. The study compared duration to reach criterion or plateau on the treatment sets with face-to-face semantic remediation treatment studies (Friedman & Lott, 2000; Kurland et al., 2008; Lott et al., 2008), which revealed similar findings to Getz and colleagues (2016). Further, the researchers stated that teletherapy for alexia treatment for PWA was feasible as well as equally effective to in-person treatments and in addition saves important resources to both participants and clinicians.

Goswami et al. (2012) did a single case study on a treatment program offered to a person with Broca's aphasia. Treatment was aimed on language skills based on Manual for Adults Aphasia Therapy in Kannada (MAAT-K) which was delivered via teletherapy. Each treatment session lasted 45 minutes, and the intervention block consisted of a total of 25 sessions over a five-week period. All targeted language domains indicated a consistent improvement. Moreover, a significant improvement was observed in the language domains of expression, repetition, and naming. The researcher suggested that the findings provide evidence for the feasibility and

effectiveness of the treatment provided via teletherapy and highlighted the need to study the efficacy across age groups in the Indian context. Figure 4 elaborates the proportion of main areas of intervention in the 11 studies. Table 4 provides a summary of findings, level of evidence and the limitations of the study methods utilized.

Training the participants and/or their caregivers prior to intervention was reported as an important step in the methodology of few studies. The particular training was mainly focused on how to use technology and to troubleshoot telepractice platforms and other utilized software. The training took place through virtual mode in only one study (Walker et al., 2018) . The study by Pitt et al. (2019) provided in-person training mainly and supplemented with ongoing training as required over telephone communication. Both Getz et al. (2016) and Pitt et al. (2017) met their participants in person at the clinical setting to provide the prior training. In addition, researchers of Getz et al. (2016) met participants at their homes to further train them. Woolf et al. (2016) did not specify the method of training, even though the participants received a training. Rest of the studies, which is the majority (55%), did not offer a prior training on the use of technology. Incorporating aphasia-friendly instructions by utilizing more pictures and less complex language was noted during the aforementioned training in all five studies.

Participant-perceived information and further review on intervention revealed an important finding. More than half of the studies (55%) reported that participants received intervention in a higher intensity than if received in-person treatments, which the latter will potentially become restricted due to barriers associated with transportation (Agostini et al., 2014; Getz et al., 2016; Goldberg et al., 2012; Goswami et al., 2012; Pitt et al., 2017; Rhodes & Isaki, 2018).

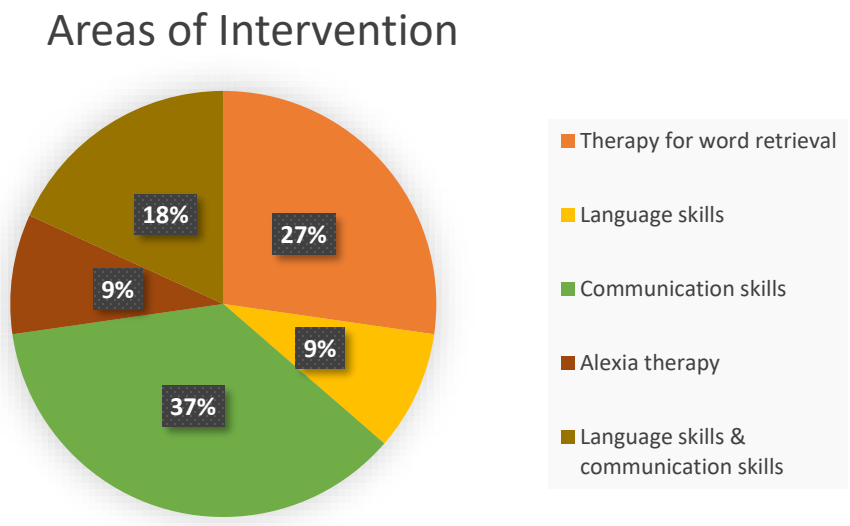


Figure 4 : Proportion of Intervention Areas

Table 4

Findings, Levels of Evidence and Appraisal of Studies

Study	Area of Intervention	Findings	Level of Evidence	Limitations in Study Quality
Pitt et al. (2019)	Communication skills	TeleGain group therapy resulted significant improvements in communication related quality of life, and decreased aphasia severity measured by CAT	Inconclusive	No functional relationship between intervention and measures established
Walker et al. (2018)	Communication skills	Telepractice in communication group therapy benefitted in improved social connectedness and language abilities.	Inconclusive	No functional relationship between intervention and measures established
Macoir et al. (2017)	Language and communication skills	Teletreatment with the PACE pragmatic rehabilitation approach is feasible and effective. Resulted significant improvement in functional communication.	Inconclusive	No functional relationship between intervention and measures established
Goldberg et al. (2012)	Communication skills	Script training using video conferencing, supported with in-person treatment is feasible and results positive outcomes of communication skills.	Inconclusive	No functional relationship between intervention and measures established
Rhodes and Isaki (2018)	Communication skills	Script training using videoconferencing indicated gains in communication measured by CETI. All participants indicated decreased negative attitudes about communication ability.	Inconclusive	No functional relationship between intervention and measures established
Woolf et al. (2016)	Word retrieval	Remote word finding therapy for PWA is feasible. Both remote and face-to-face therapy indicates improvement in picture naming similarly.	Preponderant	Minor design flaws, with adequate interobserver agreement and treatment integrity.
Agostini et al. (2014)	Word retrieval	Word retrieval therapy via telepractice is feasible, and improvements are equal to face-to-face treatment.	Suggestive	Minor design flaws, with missing interobserver agreement and treatment integrity.

Table 4 (Cont)

Study	Area of Intervention	Findings	Level of Evidence	Limitations in Study Quality
Getz et al. (2016)	Alexia therapy	Therapy for alexia for PWA can be delivered feasibly, effectively, and efficiently. Significant improvement of oral reading was resulted.	Inconclusive	No functional relationship between intervention and measures established
Goswami et al. (2012)	Language skills	Providing speech and language therapy based on MAAT-K via skype is feasible in the Indian context. Improved performance in expressive skills and reduced communication difficulty following therapy.	Inconclusive	No functional relationship between intervention and measures established
Furnas and Edmonds (2014)	Word retrieval	VNeST-C improved lexical retrieval in sentence production, single-word naming and standardized aphasia measures. VNeST-C results positive outcomes in word retrieval.	Inconclusive	No functional relationship between intervention and measures established
Pitt et al. (2017)	Language and communication skills	Delivery of iCILT via online was technically feasible. Results showed some improvements in language skills. Did not indicate improvements in communication related quality of life.	Inconclusive	No functional relationship between intervention and measures established

4.7 Outcome Measures

Use of a combination of standard measurements and researcher-developed measurements such as satisfaction questionnaires and rating scales was found in the studies (see Table 5). The commonly used standard measures are mentioned in the Table 5 below. Of the 11 studies, only four used social validity measures such as participant satisfaction and familiarity of the delivered telepractice (Getz et al., 2016; Pitt et al., 2017; Rhodes & Isaki, 2018; Woolf et al., 2016). Caregiver or family member satisfaction on telepractice received was also measured in Pitt et al. (2017). All the studies reported positive results for social validity measures with one participant in the Woolf et al. (2016) study indicating "neutral" on overall satisfaction of intervention. In addition, feasibility measurements were collected in three studies by interviewing, observing and keeping a log on attendance, attrition, network connection, audio/visual quality and performance for intervention (Pitt et al., 2017; Walker et al., 2018; Woolf et al., 2016). Further, reflective notes on providing therapy were considered in feasibility measuring in the work of Pitt et al. (2017).

Table 5
Areas of Intervention and Outcome Measures

Study	Area of Intervention	Outcome Measures
Woolf et al. (2016)	Lexical retrieval	Various naming accuracy measures (Test of picture naming, POWERS) Feasibility measures
Walker et al. (2018)	Communication skills	Language measures (WAB-R) Social connection (Friendship Scale) Feasibility measures
Goldberg et al. (2012)	Language & communication	Various language and speech measures (Script related word %, words with grammatical morphemes %, rate of speech, disfluencies per word)
Goswami et al. (2012)	Language skills	Various language measures (Average repetition score, average naming score at different linguistic levels, average error at discourse) Communication difficulty (BOSS Scale)
Agostini et al. (2014)	Lexical retrieval	Naming accuracy (Naming accuracy %)
Furnas and Edmonds, (2014)	Lexical retrieval	Various lexical retrieval measures (WAB-R, PPT, Kissing and Dancing, CIU%, CUTT %)
Pitt et al. (2019)	Communication skills	Communication & aphasia related functionality measures (ALA, QCL, COMACT,CAT)
Rhodes and Isaki (2018)	Communication skills	Communication effectiveness (CETI)
Macoir et al. (2017)	Communication skills	Functional communication (PACE Communication Effectiveness Score)
Pitt et al. (2017)	Language & communication skills	Language measures, aphasia related functionality measures (ALA, CAT) Technical feasibility measures
Getz et al. (2016)	Alexia therapy	Oral reading (Oral reading accuracy per word)

Note: POWERS = Profile of Word Errors and Retrieval in Speech (Herbert et al., 2012);WAB-R=Western Aphasia Battery-Revised (Kertesz, 2006); Friendship Scale (Hawthorne, 2006); BOSS=Burden Of Stroke Scale (Doyle et al., 2003); PPT=Pyramids and Palm Trees (Howard & Patterson, 1992); Kissing and Dancing (Bak & Hodges, 2003); CIU=Correct information Units (Nicholas & Brookshire, 1993); CUTT= Complete Utterances (Edmonds et al., 2009); ALA= Assessment for Living with Aphasia (Kagan et al., 2007); QCL= Quality of Communication Life Scale (Paul et al., 2004); COMACT= Communicative Activities Checklist (Cruice, 2013); CAT= Comprehensive Aphasia Test (Swinburn et al., 2004); CETI= Communicative Effectiveness Index (Lomas et al., 1989); PACE= Promoting Aphasics' Communicative Effectiveness (Davis, 1985)

5. DISCUSSION AND CONCLUSION

5.1 Overview

The current review of 11 articles yielded evidence that suggested the feasibility and effectiveness of communication via telepractice. Some of the gathered evidence also suggested that treatment outcomes through telepractice are equal to in-person treatment outcomes (Agostini et al., 2014; Getz et al., 2016; Pitt et al., 2019; Walker et al., 2018). However, the decision about the effectiveness of the treatment programs leaves a query due to lack of strong research designs and lack of utilization of control groups.

The majority (55%) of reviewed studies were single subject designs. A controlled group was evident only in a single study (Woolf et al., 2016). This is the only piece of evidence that approximates a randomized control trial (RCT) but entails a quasi-randomization of participants. Existence of a control group is crucial in making conclusions about treatment effectiveness since the control groups can eliminate the effect of possible confounding variables ensuring the internal validity of findings. Meline (2010) emphasizes using RCT as it is the highest quality evidence that establishes internal validity. Having mentioned that, Lemoncello and Ness (2013) state the potential of utilizing rigorously designed single-case experimental designs (SCED) such as multiple baseline designs (MBD) to elaborate treatment efficacy. However, the quality appraisal of studies in the review indicated limitations in the utilized methodologies suggesting low certainty of evidence on treatment effectiveness in majority of studies. In addition, based on Horner et al. (2005), the rigor of the included MBD studies was limited and the generalizability of evidence limits to individuals with similar clinical profiles.

Moreover, the above referenced point by Horner et al. (2005) directs the attention to the importance of descriptive clinical profiles of study participants. In fact, only five of the reviewed studies reported the types of aphasia of participants. Owing to the varied, but distinctive nature of linguistic behaviors in each type of aphasia, reporting the predominant types or descriptive information on linguistic profiles should also be considered. The information can particularly be beneficial to clinicians to make better client-oriented intervention decisions.

Further review of the studies found several factors that are advantageous to treatment outcomes and to participants of studies. Participant-perceived satisfaction on overcoming barriers associated with travel (Getz et al., 2016; Goldberg et al., 2012; Goswami et al., 2012; Pitt et al., 2017; Rhodes & Isaki, 2018; Woolf et al., 2016) is a key advantage discussed by authors, which is in line with the findings of Hall et al. (2013). Another positive fact is receiving intervention with higher intensity than in-person treatment with possibilities of reduced intensity due to logistic barriers as described in Parr et al. (1997) and Cant (1997). This supports the recommendation of Brady et al. (2016), Cherney et al. (2011), and Winstein et al. (2016) on the need of intensive treatment for better success in PWA, suggesting the potential of telepractice for successful outcomes.

Availability of multimodal cues such as graphic, auditory, visual, orthographic, in order to facilitate targeted skills is another benefit found in the delivery mode of telepractice. Utilization of some cues on participant's request, which in fact were not included in the protocol, was interestingly found beneficial. Such cues are self-cuing in script training and orthographic cueing in iCILT. These considerations support the conclusion of Bradley and Poppen (2003) on the positive features of telecommunication that are capable to facilitate nonverbal and other strategies to improve verbal communication. Moreover, positive gains from the involvement of caregivers

and their role as e-helpers and from the contribution of participants' familiar everyday environment to functional communication skills is also noteworthy. These findings reiterate what Cason and Cohn (2014) and Mashima and Doarn (2008) pointed out regarding the unique opportunity teletherapy provides to get connected in natural, everyday environments of PWA.

Employing remote-control software, such as LogMeIn software, indicated helpful with acquired reading deficits in PWA in the study by Getz and colleagues (2016). Since the software allows to take control over the devices of participants, utilization of such software opens opportunity for people with poor literacy skills as well as illiterate in technology use. Considerations on this fact can be beneficial particularly for service delivery in under-privileged areas and in middle and low-income countries.

In addition to the positive findings, majority of the authors (Goldberg et al., 2012; Pitt et al., 2017, 2019; Rhodes & Isaki, 2018; Walker et al., 2018) have emphasized connectivity and technical problems as limitations encountered. Even though these problems were resolved easily by reconnecting, several adaptations had to be made in the treatment protocol in some studies (Goldberg et al., 2012; Pitt et al., 2017, 2019). Considerations on technological barriers encourages inclusion of advanced technological methods. However, the availability and feasibility of advanced technology should also be taken into consideration, prior to implementing the treatment approaches in middle and low-income countries.

Further review of studies revealed that details about therapy delivery and receival sites were lacking. Details about the settings play a crucial role when generalizing the study findings in clinical practice as well as in replicating the studies. Particularly from a generalizability in low-income countries standpoint, greater details in literature are essential to see if specifications match the context.

Except for one study, all studies collated in the review were conducted in countries defined as high income countries in the world bank classification of countries by income (see Fantom & Serajuddin, 2016). The one study that was referred above was conducted in India, which is a lower middle- income country. Given the fact that middle and low-income countries lack technical expertise, costs associated for sophisticated technology, and infrastructure, the preponderance of studies done in high income countries raises attention to an important aspect. On the same note, it is also important to mention that majority of telepractice platforms used in the studies are commercially developed software which are not free. In addition, a number of treatment approaches have employed specially designed software as the treatment protocol. These concerns lead to think how feasible the reviewed treatment programs would be in middle and low income countries and the substantial need to explore the feasibility of simple, affordable and technologically appropriate alternatives as described by Scott & Mars (2015).

The absence of data on telepractice conducted between countries or across states is another significant factor. Telepractice has been identified by ASHA (2005) as a potential service delivery mode to overcome logistic barriers such as transportation, and limited availability of services in rural areas. On that note, the fact that no studies have done on the above-mentioned population is interesting from the focuses of telepractice standpoint. The findings, therefore, warrants the need of studies on investigating the effectiveness and feasibility of treatment to under-privileged rural areas via teletherapy.

However, the favorability of current policies to provide telepractice across states and countries, and adequate skills/ training of speech-language pathologists (SLPs) also should be taken into consideration prior to implementation. Based on Grillo (2019), SLPs should possess licensure from both geographical areas of hub-site and the remote site in order to deliver services.

Thus, exploring the practicability, guidelines, and accessibility to necessary steps to fulfill the policy requirements is essential. This may encourage more clinicians to utilize telepractice across geographical boundaries which ultimately accomplish main focus of telepractice. Moreover, exploring the availability of relevant training for SLPs on telepractice can be a useful resource to for future telepractice users to implement effective treatment programs.

Exploring the extent to which the prevailing policies financially facilitate telepractice services is crucial to generalize the intervention mode in everyday clinical context. Considering the current practices in the United States, options for telepractice reimbursement require improvements. Health insurance policies such as Medicare does not reimburse for telepractice as it does for some telemedicine and telehealth services (Grillo, 2019). Advocating and initiating discussions to explore potential solutions for improved reimbursement options will direct both service seekers and service providers towards utilizing telepractice.

5.2 Future Directions

Telepractice is gaining more attention and becoming a developing mode of service delivery. The rapid increase in the field can be attributed to the many advantages the approach provides. Multiple studies including this review showcase the effectiveness and feasibility of telepractice for PWA. However, empirical data drawn from robust study designs, such as RCTs with larger samples and greater details of treatment and receival settings, are recommended to affirm the efficacy and to generalize the approach to a wider context.

Telepractice is recognized as a mode that enables service seekers of remote, rural, and under-served areas to access speech therapy services. Still, the current review showed a marked paucity of data on the feasibility and effectiveness of the approach in aforementioned population.

Given that the current available literature on technology, software and hardware are less likely to be beneficial in this context, studies in rural, middle, and low-income countries are warranted. To explore simple and affordable technology that is feasible to the context should be a main focus of such studies. In addition, exploring the possibility of using public or organizational centers as remote sites can also be considered as a future step to implement. This will allow more PWA in underserved geographical areas to access teletherapy, regardless of possession of personal computers, mobile phones, other required devices, and internet connections.

5.3 Conclusion

The results from this review suggest telepractice may be a feasible and effective treatment approach with the potential to overcome logistic barriers to treatment access. Consistent with previous literature in Hall et al. (2013), this review emphasizes the need for strong evidence on effectiveness and generalizability resulted from robust study methods such as randomized control trials or highly rigorous single-subject and quasi-experimental designs. Findings of the current review queries conclusions made by Hall et al. (2013) on telepractice being a feasible mode of service delivery for individuals living in rural areas. The disagreement pertains to the fundamental differences seen between high-income and middle/low-income countries. Thus, the current study emphasizes the necessity for research on delivery of telepractice to middle/low-income countries.

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7. APPENDIX

Coding Manual

Section 1: Participant Identification

This section explores the details regarding the participants who received speech-language therapy services via telepractice and control groups if any.

1.1 A Communication diagnosis or diagnoses

List the communication diagnosis/diagnoses the participants present with.

1.1 B Secondary communication diagnosis/diagnoses

Mention if any secondary communication diagnoses exist.

1.2 Number of Participants

List the number of participants reported to have taken part in the study.

1.3 Age mean and range of participants

Mention the mean age and the range reported in the study. If mean and range are not reported calculate the mean as specified below.

Mean = (Total sum of ages of all participants)/ Number of participants

Indicate the range by indicating the lowest and the highest ages of the participants.

Section 2: Telepractice Methods

Code the types of tele practice that were used in intervention. These descriptions were adapted from ASHA (n.d) .

1 – Synchronous -The mode of services conducted using application of telecommunications technology to the delivery of speech language pathology at a distance by linking clinician to client/client group or clinician to clinician for intervention by utilizing interactive audio and/or video connection in real time.

2 – Hybrid - Application of tele practice to the delivery of speech and language pathology by using synchronous delivery primarily and asynchronous speech therapy services (utilizing images or data that are captured and transmitted) and/or in-person services to supplement the primary service delivery.

Section 3: Remote Site Dynamics and Service delivery setting dynamics

3.1 – The country where the study conducted

Mention the name of the country, study was conducted.

3.2- Types of facilitators at the remote site-

Code the type of stakeholders who provided assistance. Both the situations of the presence of a facilitator throughout the treatment period, and a facilitator's presence only if required will be coded equally, regardless of their period of presence.

The criteria for coding were adapted from Asha (2010) and Rushbrooke and Houston (2015).

1. Synchronous tele practice to a remote site, which includes a clinician, client/s and a facilitator who is either another clinician or a health care worker from a related discipline.
2. Synchronous tele practice to a remote site, which includes a clinician, client and a facilitator who is a family member or a care giver.
3. Participants at the remote site/s are not specified.

3.3 – Service Delivery Setting

1. University lab
2. Other Clinical sites
3. Not specified

Section 4: Training sessions for remote therapy

1- In-person training provided

2- Training provided virtually

3- Training was provided. Method is not specified.

4- Not reported about a training stage

Section 5: Devices and technology

5.1 - Technology type

Indicate the technology type used to deliver the services virtually.

5.2 – Devices researcher used.

Mention the device/s the research team used to deliver virtual services.

5.3 – devices participants used.

Mention the device/s the participants used to receive virtual services.

Section 6: Research design type

Specify the research design used in the study.

Section 7: Treatment Information

7.1 – Treatment aspects/skills targeted.

List down the treatment aspects or the skills targeted to address in the study.

7.2 – Treatment duration

Mention the duration of treatment offered via telepractice.

Section 8: Information about outcome measures

8.1 - Measured outcome

Mention the measured outcome/s of the study.

8.2 – Social validity measures

Indicate if any social validity measures are included or not.

Section 9: Results

Indicate the results.

Section 10: Issues related to use of telepractice

List down the reported issues/ short comings faced in terms of technology when delivering intervention via telepractice