Critical Review:
Effectiveness of delivering speech and language services via telehealth

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The following critical review examines the effectiveness of delivering speech and language services via telehealth. Studies included in this review investigated the effectiveness of telehealth delivery of: the Camperdown Program, the Lidcombe Program, the ISTAR program, voice assessment/therapy, assessment of childhood language disorders, story-retelling tasks, and motor speech disorder assessments. Overall, research suggests that delivery of speech and language services via telehealth is as effective as the traditional face-to-face model. Recommendations for future research and clinical practice are provided.

Introduction

Given the large size of Canada, and the spread of our population, many individuals requiring speech and language services are forced to travel great distances to the closest city or large town to receive these services. This current situation is in direct conflict with what was set out in the World Health Organization's (1998) *Health for All in the 21st Century* strategy, whose objective aims to provide equal health care opportunities in quality and availability of health care for all individuals (Lewis, Packman, Onslow, Simpson, & Jones, 2008). This current gap has the potential to be bridged with the application of telehealth initiatives in the field of speech-language pathology. "Telehealth or telemedicine is the use of information technology and telecommunications to support or deliver health services", (Project for Rural Health Communications and Information Technology, 1996). The feasibility of telehealth has been demonstrated in many other areas of health care since 1997 when the *Comprehensive Telehealth Act* was passed (Mashima, Birkmire-Peters, Syms, Holtel, Burgess, & Peters). This act enabled health care professionals other than physicians to provide services via telehealth. The effectiveness of telehealth in speech-language pathology is currently being explored by comparing traditional face-to-face therapy with telehealth therapy. The effectiveness of delivering speech therapy via telehealth is currently an important area of research because if it is proven to be as effective as traditional therapy, countless hours of travel time would be spared, and more importantly, individuals in remote areas would have greater access to therapy services in comparison to what they would have traditionally received.

Objectives

The primary objective of this paper is to critically evaluate existing literature regarding the effectiveness of delivering speech and language services through telehealth. The secondary objective is to propose evidence-based recommendations for speech-language pathologists who may benefit from telehealth delivery of services.

Methods

Search Strategy
Computerized databases including SCOPUS and CINAHL were searched using various combinations of the following terms: (speech therapy), (telehealth), (effectiveness). Further articles were also located by using references of reputable articles found in the initial search.

Selection Criteria
Studies selected for inclusion in this critical review investigated the effectiveness of delivering speech and language services through telehealth. No limits were set on the demographics of the research participants or the outcome measures.

Data Collection
Results of the literature search yielded seven studies that met the criteria outlined above. Three studies used a non-blinded, between groups randomized clinical trial, two studies used a within groups crossover design, one study used a cohort design, and one study was a single case study.

Results

Study 1 Summary
A study by Carey, O'Brian, Onslow, Block, Jones, & Packman (2010) explored whether telehealth delivery of the Camperdown Program provides a non-inferior alternative to face-to-face treatment for adults who stutter. Participants included forty participants who were randomized into two groups of twenty. Twenty participants were to receive telehealth therapy services, and twenty were to receive face-to-face. Using the primary measure of % syllables stuttered (%SS) to measure change at 1 week pre-treatment, 9 months post-randomization, as well as 1 day, 6 and 12 months post-treatment, data was gathered, and the researchers then determined if telehealth therapy was as effective as face-to-face therapy. The results revealed that there were no statistically significant differences in treatment outcomes between face-to-face and telehealth therapy groups, and therefore telehealth is an effective way to deliver the Camperdown Program.

Study 2 Summary
A study by Lewis, Packman, Onslow, Simpson, & Jones (2008) set out to determine the effectiveness of delivering the Lidcombe Program through telehealth. There were twenty-two participants in this study, who were assigned into two groups; treatment (n=9) or control (n=13). The primary outcome measure was % syllables stuttered (%SS) which was obtained by listening to audiotape recordings of the children engaged in conversation in everyday situations, and was measured at 1 week before randomization, as well as 9-months post-randomization. Results indicate that there were no statistically significant differences between treatment settings, and the authors therefore conclude that they will move towards

conducting a phase III trial of telehealth delivery of the Lidcombe Program.

Study 3 Summary
A study written by Mashima, Birkmire-Peters, Syms, Holtel, Burgess, & Peters (2003), explored if the delivery of voice therapy via telehealth is as effective as traditional face-to-face delivery. Seventy-two (34 male, 38 female) individuals participated in this study and were randomly assigned to either the telehealth setting or the face-to-face setting, and then matched according to their diagnostic category. For each group, baseline measures were obtained, and treatment methods and facilitating techniques were the same for both face-to-face and telehealth groups. Measures included the *Perceptual Judgments of Voice Quality*. Each participant recorded both pre and post treatment samples. Each individual's sample was then presented with its matched diagnostic pair from from the other group, and two experienced speech-language pathologists then determined which of the two samples demonstrated better voice quality. Live voice samples of a sustained /a/ were also obtained and analyzed on the Visi-Pitch II system. No significant differences were found between the face-to-face setting and the telehealth setting; therefore the authors concluded that telehealth would be an effective model to deliver voice therapy.

Study 4 Summary
Waite, Cahill, Theodoros, Busuttin, & Russell (2006) conducted a preliminary validation of an Internet-based telehealth system for assessing speech disorders in a group of young children. Six children participated in this study, and had previously been diagnosed with a speech disorder ranging from mild to moderately severe. Using a single word articulation test which required the child to name 62 pictures and therefore produced each of the English consonants in initial, medial, or final word positions, outcome data was collected. Two speech-language pathologists were involved; one who presented the pictures on the computer screen, and later scored the assessment using the video recording, and the other who sat beside the child to score. Results indicated that there was a high overall agreement between the two speech-language pathologists. Authors suggested that

telehealth assessment for children with speech disorders was a feasible option.

Study 5 Summary

Georgeadis, Brennan, Barker, & Baron (2004) set out to determine if story retelling performance by participants with neurogenic communication disorders was affected by either the face-to-face or telehealth setting. The participants included were forty adults (23 male and 17 female) who had a recent history of traumatic brain-injury or stroke. All forty of the individuals performed the task in both the telehealth setting, as well as the face-to-face setting. This study used two randomly selected story sets from the Story Retell Procedure (SRP) as their primary stimuli. The Percent Information Unit (%IU) was used to evaluate participant's performance on the SRP, and then performances across settings were compared. Results from this study indicate that across all participants, performance was higher in the telehealth setting compared to the face-to-face setting.

Study 6 Summary

Hill, Theodoros, Russell, Cahill, Ward, & Clark (2006) explored the feasibility and effectiveness of an Internet-based telerehabilitation application for the assessment of motor speech disorders in adults with acquired neurological impairment. Participants included nineteen speakers who had been previously diagnosed with a dysarthria that was both stable and perceptible, and associated with an acquired neurological impairment. Each individual was assessed in a clinical face-to-face setting, as well as an online setting. Specific tasks administered were conversational speech samples, reading aloud a standard passage, Assessment of Intelligibility of Dysarthric Speech (ASSIDS), and the Frenchay Dysarthria Assessment (FDA). This study showed no statistically significant difference between the two settings on severity rating of conversational speech intelligibility as well as on the speech sample analysis. The scores on both the ASSIDS and the FDA scored just outside the clinical criterion for effectiveness. In conclusion, the authors concluded that the majority of the perceptual assessment can be administered using telehealth applications.

Study 7 Summary

A study by Kully (2000) discussed one male patient who had previously received stuttering therapy through the ISTAR program in Alberta who agreed to enroll in a follow-up program delivered through telehealth. This program involved the practice of specific speech skills and strategies which he had learned during his previous program. The program also included a discussion targeting self-management and problem solving skills. Upon completion of the program, the patient reported satisfaction with the program materials, but described the telehealth situation as "challenging but manageable", and "less demanding on fluency control than the phone". The clinician reported that the technology was high quality, and this aided in accurate judgments about the patient's performance. The author concluded that more research needs to be conducted in this area, but if research proves telehealth to be both successful as well as cost-effective, then this may be an addition to speech delivery models which could be implemented.

Discussion

The studies each contribute novel information to the literature regarding the effectiveness of telehealth delivery of speech and language services. However, each study possesses weaknesses which will be discussed below.

Study 1 Critique

The study conducted by Carey et al. (2010), was generally a very well designed study. It was a non-blinded RCT, but blinding the participants and the speech-language pathologist was not possible. The observer was blind to the identification of the participants, the group to which they belonged to, and the timing of the assessment. The sample size in this study could have been larger, as it was forty individuals who were randomized into two groups of twenty. The authors controlled for any bias that would have been introduced if using different SLPs for the two conditions by using the same SLP for both conditions. There were three participants who dropped out during the duration of the study, but authors included intention to treat data. All participants, whether they dropped out of the study or not were accounted for by being included in the

group to which they were originally randomized, in comparison to introducing bias by completely eliminating the participants who dropped out.(Carey et al., 2010). Limitations of the study were minimal, therefore both validity and importance of this article is compelling.

Study 2 Critique
Lewis et al., (2008) conducted phase II of their study, and its design was an RCT. Although an RCT is a high level of evidence, the groups being compared were not appropriate. The study set out to determine if telehealth was an effective way to deliver treatment of the Lidcombe program. To do this, they randomized participants into two groups; those who received treatment via telehealth, and those who received no treatment. The results of this study although statistically significant, must be interpreted with caution since it only shows that telehealth delivery of the program is better than no treatment at all. The importance is compelling, as further studies could be designed comparing telehealth and traditional face-to-face therapy, but the validity is equivocal.

Study 3 Critique
The study by Mashima et al., (2003) was an RCT, and authors did an excellent job randomizing the participants, as well as matching the groups evenly according to voice pathology. The sample size was the largest out of all the papers reviewed, and the distribution between males and females was even. The largest limitation of this study was that there was not post-treatment data for all participants, and no intention to treat was used to account for the dropouts. This may have affected their results, since authors did not include these participants in their data. Also, therapy between groups was almost identical, but no manual laryngeal techniques were used in the telehealth group because of technical barriers. Overall, this was a strong study with few limitations, and possessed compelling information surrounding the validity and importance of telehealth in voice therapy.

Study 4 Critique
The study by Waite et al., (2006) was a cohort study. This would be considered the main weakness, as it would have been feasible to expose the groups of children to both the telehealth and face-to-face settings (within-groups crossover

design). Another weakness is the small sample size. With only six children participating in the study, it is difficult to make generalizations beyond the study. Furthermore, the results indicate that there were a variety of phonemes which the telehealth therapist was unable to decipher, but the face-to-face therapist was able to, which indicated discrepancies between the two environments. Despite this information, Waite et al., concluded that telehealth is a feasible option for assessing childhood speech disorders. Results also indicated that there were difficulties performing the oro-motor exam via telehealth, but again, the authors concluded that telehealth is a feasible option. These conclusions may be inappropriate given the data, so one must interpret the study results with caution. The study's validity is suggestive, and the importance is suggestive, and therefore needs further exploration in future studies.

Study 5 Critique
The main weakness in the study by Georgeadis et al., (2004) lies within the study design. This study design was a within-groups crossover design. The authors did randomize which setting the participant would perform in first, but a non-blinded RCT would seem feasible, as demonstrated in other studies previously discussed in this paper. No participants dropped out, and all outcome measures and statistical analyses used were appropriate. One final limitation of this study was the setting of the telehealth condition. In this study, the telehealth condition was set up in a quiet room at the clinic, and the clinician simply was in the adjacent room. Telehealth is supposed to connect clinicians from clinics to patients in their home. To research the effectiveness of telehealth, the research should be conducted in a manner that closely resembles what telehealth would look like in practice. In spite of these weaknesses, overall, both the validity and the importance of this study were compelling.

Study 6 Critique
The study by Hill et al., (2006) was a within-groups crossover design, which is a major limitation, as it would have also been possible to conduct this study as a non-blinded RCT. The sample size was only nineteen participants, and 79% of the participants were male, which may introduce bias. Although the study used a variety of tests to assess, they did not select the "gold

standard" tests. For example, typically the "Computerized Assessment of Intelligibility in Dysarthric Speech" is used to assess motor speech disorders, yet they chose not to include this test. Furthermore, because of technical issues such as camera versatility, some subtests were not included in the telehealth condition. These subtests include items such as oral-motor examinations, which are crucial in making a diagnosis of a motor speech disorder (Hill et al., 2006). Because of these limitations, this study's validity is equivocal and the importance is suggestive.

Study 7 Critique
Kully (2000) published her paper on a single-case study. This is a weak level of evidence, as it only is applicable to this one individual. There were no outcome measures in this study, and all judgments made were based off auditory information. There were never any baseline and post-treatment formal evaluations, just subjective judgments which must be interpreted with caution. Obviously, the validity of this study is low, but it is still important, as it was an early-published paper in this area, and its conclusions led to more research conducted by other professionals in the area of telehealth and speech-language pathology.

Conclusion

After reviewing current literature on providing speech and language services via telehealth, it is clear that there is sufficient evidence supporting its effectiveness. Although there are some limitations in the literature reviewed in this paper, overall the validity, reliability, and clinical importance of the studies are compelling.

It is recommended that further research on this topic be completed, using level I evidence (RCT) or higher in order to further validate the current research. In order to improve upon the evidence in the current literature, it is recommended that the future research take the following into account:

    a) Adequate sample sizes and distribution into experimental vs. control groups to make the study's results more powerful and also to limit bias

b) For any participants who drop out of the study, it is recommended that researchers use the intention to treat principles in order to maintain the validity of their study.

c) Completion of assessments using appropriate/ "gold standard" tests which would ensure the results of the assessment are both reliable and valid.

d) Telehealth settings should be set up in the most naturalistic way as possible. The interaction should include a clinician based out of their office or clinic, and the patient at their home where they would likely be receiving their therapy.

e) Technology in the study should be reasonable to what we would see in practice. A patient will likely be using their computer in the home, so it is necessary to continue research using standard desktop/laptop computers that would be found in the average home.

f) Further research needs to be completed in other areas of cost, patient satisfaction with telehealth treatment, and any effects that age, education, technology experience, and gender may have on satisfaction.

Clinical Implications

More research in the area of telehealth and speech-language pathology is needed, but current evidence suggests that telehealth is an effective way to delivery speech and language therapy services. As stated above, more research needs to be conducted with regards to patient satisfaction with telehealth services, but thus far, patients have been receptive to telehealth (Dunkley, Pattie, Wilson & McAllister, 2010). In Dunkley et al., 2010, patients stated that they would rather have face-to-face treatment, but if no other option was feasible, telehealth was also effective. Telehealth has the potential to deliver services to individuals who cannot access them, and can also provide more comprehensive follow-ups and family education appointments which is often inhibited by driving. Currently, if an SLP is using telehealth to deliver a

service, he/she must exercise caution in the aforementioned areas. If research continues to progress as it has, telehealth delivery of speech and language services may not only be as effective as traditional face-to-face therapy, but also readily accessible and accepted by patients and thus creating equal access opportunities for all.

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