Canadian Agency for Drugs and Technologies in Health

RAPID RESPONSE REPORT: SUMMARY WITH CRITICAL APPRAISAL

TITLE: Telehealth for Speech and Language Pathology: A Review of Clinical Effectiveness, Cost-Effectiveness, and Guidelines

DATE: 07 April 2015

CONTEXT AND POLICY ISSUES

Difficulties in speech and language development are reported frequently among children. According to American Speech-Language-Hearing Association, the prevalence of language difficulties in preschool-age children was estimated between 2% and 19%.[1] Among school-age children, the prevalence of language impairment ranged from 3.1% to 23.0%.[2] Language impairments at a young age, such as in the first three years of life, have a negative impact on children's academic life and their adulthood and are related to social, emotional, and behavioral problems. Thus, early identification and thorough and specific assessment and treatment are crucial.[1] Access to speech-language pathology (SLP) services, however, may be limited for many children and their families, particularly those residing in rural and remote areas.

Telehealth is a means of providing healthcare services (diagnosis and/or treatment) remotely using communications technologies such as interactive video, audio, computer and other more advanced technologies.[3] The term of telehealth is often used interchangeably with telemedicine, telerehabilitation and telepractice. It is different from the conventional in-clinic models and is particularly important for patients in the remote or rural areas, who usually have limited access to the healthcare services due to the distance, costs, shortages of speech-language pathologists, or parents' commitment to work.[2,4,5] Telehealth has been widely used in various areas of medicine, such as heart disease, stroke, diabetes, psychiatric problems, dermatological disorders, and speech-language disorders or impairments.[4,6,7] This model may enhance the quality of care by optimizing the timing/intensity/sequencing of interventions and allowing more frequent interactions with patients, thus may be associated with more favorable outcome for them. In addition, a unique benefit of telehealth is that the SLP services to be delivered to the patients in their own environment, such as the home, in a local community, school or workplace.[8] The clinical evidence on the effectiveness of telehealth in children with speech-language disorders is uncertain.[2,4,6] With over 80% of Canadian population now using the internet and the rapid growth in various forms of technology,[9] it is necessary to examine the impact of delivering speech pathology services directly into the everyday lives of people with speech-language disorders via telehealth.

The purposes of this review were to identify the evidence regarding the clinical effectiveness and cost-effectiveness of telehealth for the delivery of SLP services to children with speech and language disorders or impairments and to summarize the recommendations from evidence-based practice guidelines regarding the use of telehealth in the target population.

RESEARCH QUESTIONS

1. What is the clinical effectiveness of telehealth for the delivery of speech language pathology services to children with speech and language disorders or impairments?

2. What is the cost-effectiveness of telehealth for the delivery of speech language pathology services to children with speech and language disorders or impairments?

3. What are the evidence-based guidelines regarding the use of telehealth for the delivery of speech language pathology services to children with speech and language disorders or impairments?

KEY FINDINGS

The evidence from two randomized controlled trials suggests that speech-language pathology treatment, delivered via videoconferencing or an in-person service model, improved children's speech-language impairments, and there were no significant differences found between these two models. These findings must be interpreted with caution given the limitations in the evidence.

METHODS

Literature Search Methods

A limited literature search was conducted on key resources including CINAHL, PubMed, The Cochrane Library (2015, Issue 3), University of York Centre for Reviews and Dissemination (CRD) and ECRI databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2010 and March 10, 2015.

Rapid Response reports are organized so that the evidence for each research question is presented separately.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria	
Population	Children with speech and language impairment or disorders Subgroups: • children age 0-5 years • children age ≥ 6 years
Intervention	Telehealth alone Telehealth in combination with in-person SLP services
Comparator	In-person SLP services or no comparator
Outcomes	Q1: Clinical effectiveness Q2: Cost-effectiveness Q3: Guidance regarding the use of telehealth in the study population
Study Designs	Q1: Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies Q2: Economic evaluations Q3: Evidence-based clinical practice guidelines

SLP=Speech Language Pathology

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, were duplicate publications, were published prior to 2010, or if they were referenced in a selected systematic review. Articles were also excluded if they enrolled adult patients only, or when a mixed population of adults and children was enrolled, there were no separate results available for children. Articles were excluded if health-related outcomes were not reported.

Critical Appraisal of Individual Studies

The quality of the included randomized controlled trials (RCTs) were critically appraised using Downs and Black checklist.[10] Numeric scores were not calculated. Instead, a review of the strengths and limitations of each included study were described.

SUMMARY OF EVIDENCE

Details of study characteristics, critical appraisal, and study findings are located in Appendices 2, 3, and 4, respectively.

Quantity of Research Available

A total of 186 citations were identified in the literature search. Following screening of titles and abstracts, 178 citations were excluded and eight potentially relevant reports from the electronic search were retrieved for full-text review. No potentially relevant publications were retrieved from the grey literature search. Of these potentially relevant articles, six publications were excluded for various reasons, while two RCTs met the inclusion criteria and were included in this report.[11,12] No relevant systematic reviews or meta-analyses, non-randomized controlled

trials or economic evaluations were identified. Appendix 1 describes the PRISMA flowchart of the study selection.

Summary of Study Characteristics

Study Design

The treatment effect of telehealth relative to conventional on-site therapy was assessed in two RCTs conducted by Grogan-Johnson and colleagues.[11,12] The 2013 Grogan-Johnson study included school-age children with speech sound disorders,[11] and the 2010 Grogan-Johnson study enrolled preschool- and school-age children.[12] Randomization in the first trial was carried out by drawing students' names out of a hat and alternately assigning them to one of the two treatment groups thereafter,[11] while the method of randomization was not reported in the second trial.[12] A power calculation was not reported in either study.

Country of Origin

The RCTs that evaluated the treatment effect of telehealth on speech disorders were conducted in the US.[11,12]

Patient Population

Fourteen children with speech sound impairments, aged from 6 to 10 years old were enrolled in the 2013 Grogan-Johnson study.[11] The mean age for the participants was 8.4 years (range: 6.4 to 9.9 years) in the telehealth group and was 9.0 years (range: 7.9 to 10.0 years) in the comparator group.

In the 2010 Grogan-Johnson study, 38 children aged from 4 to 12 years old, with communication impairments (i.e., articulation, language and/or fluency disorders) and followed an Individualized Education Plan that encompassed the provision of SLP services, were included.[12] The results for six children were not reported in this study: three did not receive baseline evaluation, two did not complete therapy and one was dismissed from SLP services due to a change in her condition. The demographic characteristics of the study participants were not reported, so it is unclear how many of them were preschoolers.

Interventions and Comparators

The 2013 Grogan-Johnson study was conducted to compare a speech sound intervention delivered via a telehealth model with a conventional side-by-side service delivery model.[11] Students participating in a 5-week summer speech sound intervention program were assigned to either the telehealth group (computer-based videoconferencing) or the side-by-side treatment group. During the 5-week period, a 30-minute individual session was provided twice a week in both groups. Seven students were assigned to the telehealth group, and another seven to the side-by-side treatment group.

In the 2010 Grogan-Johnson study, participants were randomly assigned to 4-month telehealth therapy (computer-based videoconferencing) followed by conventional on-site therapy (Group A), or 4-month conventional on-site therapy following by 4-month telehealth therapy (Group B).[12] There was no washout period between the two treatments. Seventeen students were assigned to Group A, and another 17 students were assigned to Group B.

Outcomes

The outcome measures in the 2013 Grogan-Johnson study were improvement in speech sound production, which was measured using a standardized assessment tool, the *Sounds-in-Words and Sounds-in-Sentences subtests* of the Goldman-Fristoe Test of Articulation 2 (GFTA-2), and listener judgments that were performed by graduate SLP students to identify improvement in productions of error phonemes noted at baseline evaluation.

The outcome measures in the 2010 Grogan-Johnson study included student progress and participant satisfaction through a survey.[12] Student performance was rated with the scale, *Mastered*, *Making Adequate Progress*, *Making Inadequate Progress* and *Objective Not Initiated*. Two other scales were employed to measure communication impairments and articulation. The Functional Communication Measures (FCMs) are a series of 7-point scales to rate the student's functional change at the start and the end of treatment. The second scale was GFTA-2, which was commonly used in schools to assess articulation and was administered by the investigators at the beginning, middle and end of the study. The data after the first 4-month treatment period were reported in the study.

Summary of Critical Appraisal

Both studies stated their objectives and inclusion/exclusion criteria. Even though they both indicated that they were RCTs, the quality of these two studies was compromised. In the 2013 Grogan-Johnson study, treatment allocation was assigned on the basis of a pseudo-random sequence (i.e., alternation), and the method of randomization was not described in the 2010 Grogan-Johnson study. The power calculation and sample size determination were not reported in either study. The study results should be interpreted with caution given the range of sample sizes (n = 14[11] to 38[12] participants). Also, the 2013 Grogan-Johnson study did not specify if the intention-to-treat approach was used in the statistical analyses, while in the 2010 study, the results were reported based on the participants who had completed the treatment. In the 2010 Grogan-Johnson study, participant satisfaction was reported. The results, however, must be interpreted with caution given the survey response rates among the students (76.3%), parents (66.7%) and staff (55.6%).

English was the primary language in the study participants. In addition, participants in both studies were recruited in Ohio, US, so it is unclear whether the findings can be generalized to broader patient populations.

Summary of Findings

1. *What is the clinical effectiveness of telehealth for the delivery of speech language pathology services to children with speech and language disorders or impairments?*

   In the 2013 Grogan-Johnson study, the mean number of sessions attended by the study participants was similar between the two treatment groups, 9.3 sessions in the telehealth group and 9.4 sessions in the side-by-side treatment group. The results showed that children in both groups demonstrated some improvement in their speech sound production at the end of the intervention; however, there were no statistically significant between-group differences in assessments after the treatment. The authors concluded that both models helped improve children's speech sound productions.

The 2010 Grogan-Johnson study evaluated the effect of telehealth SLP services and conventional on-site SLP services on articulation disorders in young children. The performance of the majority of the preschool- and school-age students from both groups was rated as *Mastered* or *Making Adequate Progress.* This rating was not defined in the article. At the end of the first treatment period, there was no statistically significant difference in GFTA-2 scores between telehealth and on-site service (p=0.06). The authors indicated that telepractice was a viable approach to deliver services to children with articulation disorders in a public school setting.

2. *What is the cost-effectiveness of Telehealth for the delivery of Speech Language Pathology services to children with speech and language disorders or impairments?*

There were no economic evaluations identified.

3. *What are the evidence-based guidelines regarding the use of Telehealth for the delivery of Speech Language Pathology services to children with speech and language disorders or impairments?*

There were no evidence-based clinical practice guidelines identified.

Limitations

The literature search did not identify health technology assessments, systematic reviews, non-randomized controlled trials, or economic evaluations regarding the comparative clinical and cost-effectiveness of telehealth relative to conventional in-person SLP services. The evidence from two RCTs (n = 14[11] and 38[12] participants) was reported. The method for randomization was questionable in one study and unknown in another. Given that there was no power calculation in either study and an intention-to-treat analysis was not reported, study findings should be interpreted with caution. Also, the generalization of the study results to other populations remained uncertain because of the patient characteristics in these two studies, where eligible participants were all from Ohio, US, and English was required to be their primary language.

In the study that enrolled preschoolers,[12] the proportion of children younger than 5 years old was not reported, and there were no results available for this particular subgroup. Furthermore, videoconferencing was the only telehealth technology that was examined in the included studies. Patient-reported outcomes, such as health-related quality of life, functional status and long-term academic performance, were not evaluated in these studies that ranged from five weeks[11] to eight months[12] in duration.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING

The clinical evidence regarding the comparative effectiveness of telehealth relative to conventional in-person speech-language pathology services on children with speech and language impairments or disorders was limited. Two RCTs examined the use of videoconferencing in school-age children with speech sound impairments and communication impairments. The study findings suggested that an improvement in children's speech-language impairments was observed by using standard speech instrument or by speech-language pathologists in either treatment arm. No significant differences, hence, were found between the interventions.

There are uncertainties around the data interpretation given the low quality of the evidence. In addition, there are no data reported for children younger than five years old, and no data available for technologies other than videoconferencing. The cost-effectiveness of the application of telehealth model in the study population remains unknown. Guidelines regarding the use of telehealth for speech and language pathology in children were not identified.

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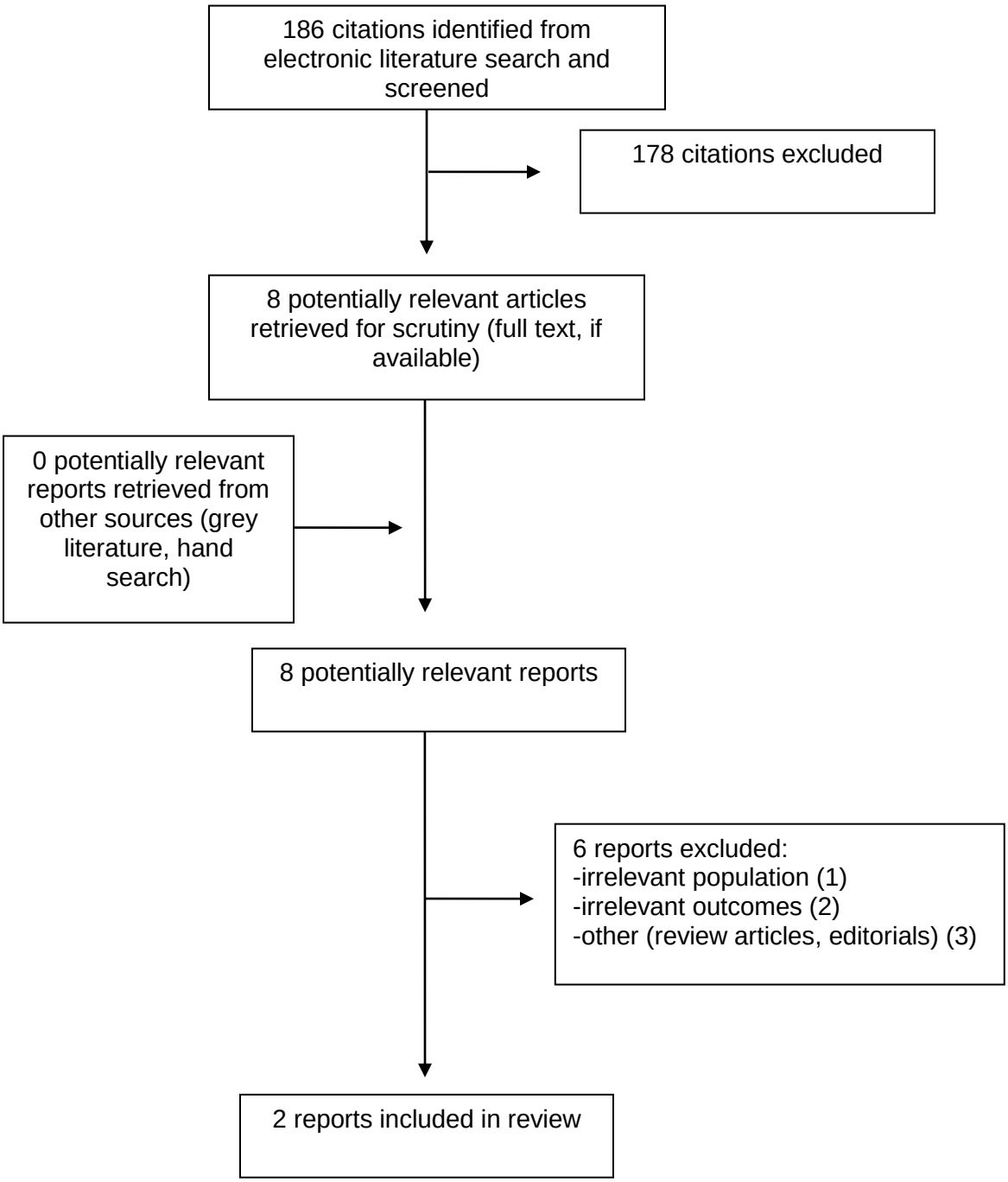
APPENDIX 1: Selection of Included Studies



APPENDIX 2: Characteristics of Included Publications

Table A1: Characteristics of Included Clinical Studies

First Author, Publication Year, Country	Study Design	Patient Characteristics	Intervention(s)	Comparator(s)	Clinical Outcomes
Grogan-Johnson, 2013[11] USA	RCT Key exclusions: significant hearing loss/visual impairment, autism, cerebral palsy, cognitive impairment, cleft lip/palate, neurological impairment.	School-age children with speech sound impairments (had motoric/phonetic-based speech sound disorders characterized by difficulty producing 1 to 3 specific speech sounds at levels of isolation, syllables or words, but with generally intelligible speech). English should be the primary language. N=14, ages: 6-10 years, 13 of them were receiving speech sound intervention at enrolment, 1 had no current intervention.	Telehealth service delivery model: twice a week for 30-min individual sessions during a 5-week summer intervention program. N=7.	Side-by-side service delivery model: twice a week for 30-min individual sessions during a 5-week summer intervention program N=7.	Improvement in speech sound production, measured by a standardized assessment tool (subtest of GFTA-2) and listener judgments.
Grogan-Johnson, 2010[12] USA	RCT Key exclusions: autism, pervasive developmental disorder, severe cognitive deficit or severe emotional disturbance.	Preschool- and school-age children with communication impairments (i.e., articulation, language and/or fluency disorders). English should be the primary language. N=38 (results	4-month telehealth therapy followed by 4-month on-site therapy, no washout period between the two phases. N=17.	4-month on-site therapy followed by 4-month telehealth therapy, no washout period between the two phases. N=17.	Student progress, communication impairments measured by FCMs, articulation measured by GFTA-2, participant (students, parents and staff) satisfaction.

Table A1: Characteristics of Included Clinical Studies					
First Author, Publication Year, Country	**Study Design**	**Patient Characteristics**	**Intervention(s)**	**Comparator(s)**	**Clinical Outcomes**
		available for 32 students), ages: 4-12 years.			

FCM = Functional Communication Measures; GFTA = The Goldman-Fristoe Test of Articulation; RCT = randomized controlled trial

APPENDIX 3: Critical Appraisal of Included Publications

Table A2: Strengths and Limitations of Randomized Controlled Trials using Downs and Black checklist[10]

Strengths	Limitations
Grogan-Johnson, 2013[11]	
• Objectives were stated • Intervention, comparator and outcomes were clearly described • SLPs conducted the speech sound intervention sessions were certified and had multiple years of experience as SLPs providing intervention for children through telehealth; investigators who assessed speech sound productions had no knowledge of the research purpose • P values were reported • Conflict of interest was reported.	• Quasi-randomized trial • Patient characteristics (e.g. time since initial diagnosis, previous treatment, comorbidity, etc.) were not reported in details • No justification of sample size selection • No information regarding loss to follow up.
Grogan-Johnson, 2010[12]	
• Objectives were stated • Intervention, comparator and outcomes were clearly described • P values were reported • Conflict of interest was reported.	• Method of randomization was not reported • Patient characteristics (e.g. definitive diagnosis, time since initial diagnosis, previous treatment, comorbidity, number of preschool-age children, etc.) were not reported in details • No justification of sample size selection • Findings were not reported in details (e.g. results before cross over) • Survey response rate was low (for the outcome of participant satisfaction)

SLP = speech language pathologist

APPENDIX 4: Main Study Findings and Author's Conclusions

Table A3: Summary of Findings of Included Studies	
Main Study Findings	**Author's Conclusions**
Grogan-Johnson, 2013[11]	

Student progress:
• Individual descriptive data showed that levels of speech sound impairments varied at baseline, but all students advanced to higher levels of speech sound production after the treatment.
• GFTA-2 scores:
  ○ No significant differences between groups, p=0.44 for raw scores, p=0.644 for standard scores;
  ○ There was statistically significant difference in scores between pre- and post-intervention in both groups, p=0.020.
• Listener judgments
  ○ Statistically significant difference was observed between baseline and end of treatment in both groups, p=0.007;
  ○ No significant difference was observed between mean listener judgments in the amount of xchange across time in either group.
	• School-age children improved their speech sound production whether traditional intervention services were provided via telepractice or side-by-side delivery models. Furthermore, there was no significant difference in the performance of the children who received services in the telepractice condition compared with the side-by-side condition according to independent judges. (pg.218)
	• Both groups benefited from intervention and that benefit was the same regardless of type of intervention. (pg.215)

Grogan-Johnson, 2013[11]	
• Student progress: Performance of the students rated as *Mastered* or *Making Adequate Progress* at end of 1st treatment period: Telehealth: 75.3% On-site therapy: 75.6%, p value NR. GFTA-2 scores at end of 1st treatment period: There was no statistically significant difference in between telehealth and on-site service, p=0.06. Participant satisfaction: Students, parents and staff expressed satisfaction with telehealth delivery model. Response rate to the survey was 76.3%, 66.7% and 55.6%, respectively.	• Videoconferencing appears to be an effective and reliable service delivery method for school age children who receive speech language therapy services in public schools. (pg.139)