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Vol. 4, No. 2, pp. 39–70
September 2014

In This Issue

Coordinator’s Column by Lyn Tindall Covert.............................................................................. 41

The Evaluation of Children with an Autism Spectrum Disorder: Adaptations to Accommodate a Telepractice Model of Clinical Care
by Anna A. Allen and Howard C. Shane ................................................................................42–51

Parents’ Perspectives on Tele-AAC Support for Families with a New Speech Generating Device: Results from an Australian Pilot Study
by Kate Anderson, Susan Balandin, Roger J. Stancliffe, and Claire Layfield.........................52–60

Language Intervention via Text-Based Tele-AAC: A Case Study Comparing On-site and Telepractice Services
by Nerissa Hall, Michelle Boisvert, Hillary Jellison, and Mary Andrianopoulos.....................61–70
Coordinator's Column

Lyn Tindall Covert

The current issue of Perspectives includes articles that explore the use of telepractice to provide services for individuals using augmentative and alternative communication (AAC) devices. Allen and Shane describe a case presentation of a first attempt clinical assessment approach through telepractice for children with autism spectrum disorders (ASD). Anderson et al., address the lack of ongoing in-person AAC support for children with complex communication needs (CCN) by describing a novel online training and support program through telepractice. Hall et al., address the shortage of speech-language pathologists (SLPs) who can meet the needs of students with severe speech impairments and whose primary means of expressive language is through an AAC device by utilizing telepractice.

Evidence continues to grow that support telepractice as best practice for delivering services. Telepractice can be utilized in many areas of audiology and speech practice from assessment to intervention to support. As the 2014 ASHA convention approaches, a glance at the offerings is indicative of the far-reaching applications of telepractice. As consumers demand telepractice services, this method of service delivery will continue to expand to meet their needs.
The Evaluation of Children with an Autism Spectrum Disorder: Adaptations to Accommodate a Telepractice Model of Clinical Care

Anna A. Allen
Center for Interprofessional Studies and Innovation, MGH Institute of Health Professions
Boston, MA
Boston Children’s Hospital
Waltham, MA
Howard C. Shane
Autism Language Program, Boston Children’s Hospital
Waltham, MA

Financial Disclosure: Anna A. Allen is a doctoral student in the PhD in Rehabilitation Sciences Program at the Center for Interprofessional Studies and Innovation at MGH Institute of Health Professions. She is also a Doctoral Fellow at Boston Children’s Hospital. Howard C. Shane is the Director of the Center for Communication Enhancement and the Autism Learning Program at Boston Children’s Hospital.

Nonfinancial Disclosure: Anna Allen has previously published in the subject area. Howard C. Shane has previously published in the subject area.

Abstract

Telepractice is increasingly applied to assessment and intervention for persons with autism spectrum disorders (ASD), and the use of telepractice for delivering augmentative and alternative communication (AAC) services is expanding. To date, no studies have focused on the assessment of communication in children with ASD who are minimally verbal. This case exploration represents a first attempt to apply the clinical assessment approach (also known as Visual Immersion System) developed in the Autism Language Program in the Center for Communication Enhancement (CCE) at Boston Children’s Hospital (BCH) through a telepractice service delivery model. In this paper we detail an on-site evaluation, and then describe the application of the various evaluation components to telepractice delivery. Our findings provide preliminary evidence that communication assessment information can be successfully obtained for this population via telepractice. The results demonstrated that the telepractice evaluation took greater time to complete than the on-site evaluation, likely due to both technical and cultural factors. Further study is warranted particularly in the delivery of family instruction materials prior to the evaluation and to quality assurance measures.

Telepractice, the application of telecommunications technology to the delivery of speech-language services at a distance (ASHA, 2014), is increasingly applied to assessment and intervention for persons with autism spectrum disorders (ASD). For persons with moderate to severe ASD, who tend to be minimally verbal, augmentative and alternative communication (AAC) is a commonly employed and research-supported intervention, and integral to communication support for this population and their families (Nunes, 2008; Schlosser & Sigafoos, 2009; Shane, 2006; Shane, Blackstone, Vanderheiden, Williams, & DeRuyter, 2011a; Shane et al., 2011b). At present, interest and research is rapidly growing in the use of telepractice for delivering clinical AAC services (Tele-AAC; Cason & Cohn, 2014). Service delivery via telepractice potentially removes common challenges such as travel barriers, schedule rearrangement, and the unfamiliarity of a clinic environment. In many situations it may be a preferred treatment venue (Curtis, 2014). Thus, the Autism Language Program within the Center for Communication Enhancement (CCE) at Boston Children’s Hospital (BCH) that enjoys a long history of on-site
clinical AAC service delivery to individuals with ASD and their families, is examining best practices for telepractice service delivery.

Our proprietary clinical model, the Visual Immersion System (VIS; Shane & Weiss-Kapp, 2008; Shane et al., in press), is an all-inclusive evaluation protocol and set of treatment strategies designed to promote communication and language outcomes for persons with moderate to severe ASD. It incorporates alternative symbolic formats that support both comprehension and expression across seven communicative operations: protests, requests, organization and transitions, directives, comments, questions and social pragmatics. In August 2004, Augmentative Communication News (ACN) published an edition differentiating Visual Scene Displays (whole scenes with live target areas) from traditional grid-based AAC displays. A chief tool of the VIS is the visual scene cue, which is a symbol that represents an entire event or activity. Scene cues can be dynamic (brief, full-scene video clips; e.g., a clip of an individual putting a plate into a dishwasher) or static (e.g., a photograph with a still image of the individual putting a plate into the dishwasher). These cues display not just people and objects within a scene, but the relationship between these objects. Since the overall meaning of the message is contained within the scene itself, neither spoken or written language is required to comprehend intended meaning. For subjects with more advanced language skills, element cues can be incorporated. These cues include photos and graphic symbols meant to represent specific vocabulary, ranging from concrete nouns to more abstract verbs, prepositions, and descriptors. They are often presented in a grid format, requiring an individual to compose phrase or sentence strings with basic syntax, albeit visual. The VIS typically employs technology as a means to secure a learner’s attention, influence behavior, deliver symbolic content, increase language comprehension, and foster expressive communication. Though implementation was possible prior to the introduction of mobile technologies, in this era of widespread connectivity it has now become much more feasible and practical.

Results of reviews by Boisvert, Lang, Andrianopoulos, and Boscardin (2010) and by Lee and McElroy (2012) support telepractice as a viable service delivery model for persons with ASD, but for the studies that involved assessment, most centered on functional behavior analysis rather than communication. Parmanto, Pulantara, Schutte, Saptono, and McCue (2013) successfully developed a remote system and protocol for administering the Autism Diagnostic Observation Schedule (ADOS) assessment to adults with an ASD diagnosis, but participants were relatively high functioning (e.g., able to answer questions regarding usability of the telepractice approach). Boisvert (2012) found evidence for the effectiveness and validity of telepractice service delivery for providing interventions to children with ASD who were generally higher functioning.

To our knowledge, no study has focused on the use of telepractice to assess communication skills of persons with ASD who are minimally verbal. With this population, evaluators normally don’t apply conventional language evaluation protocols, but instead employ non-standardized measures. According to Boisvert et al., 2010, there is a need for further research in order to optimize techniques for administering assessment via telepractice. It follows that the evaluation of individuals with complex communication problems necessitates a different technological infrastructure than mainstream telepractice (Hall & Boisvert, 2014). Thus, the purpose of this paper is to outline how assessment procedures from our clinical setting were adapted for a telepractice service delivery model, in order to determine whether a comparable clinical outcome could be achieved.

**Methods**

**Participants**

Two clinical subjects, one on-site and one at a distance, participated in this exploratory investigation.
**Subject 1 – On-site.** The on-site subject was a 9-year-old boy with a diagnosis of autism. His parents also participated. English was the language spoken at home. Subject 1 pursued evaluation services at our Center, thereby entering our clinical system through the typical referral process.

**Subject 2 – Telepractice.** The telepractice participant was a 17-year-old boy with a diagnosis of autism. His older sister, who spoke English fluently, and his parents, who were proficient in English, also participated. Arabic was the language spoken at home with the participant. Subject 2 resided outside of the United States, making telepractice the only means by which an evaluation in our Center could be conducted.

**Procedure**

The standard clinical assessment protocol conducted in the Autism Language Program (ALP) explores strengths and emerging skills in expressive and receptive language within a framework of seven communication operations: protesting, requesting, following directions, commenting, questions, transitioning, and social pragmatics. Application of individual skills to these operations isolates functional communication behaviors, and assists in the formation of specific therapeutic recommendations for each function. Generally, our proprietary clinical evaluation model is comprised of five sections: pre-intake, family interview, observation, direct assessment, and concluding discussion with family. Each section along with outcome detail is contained within column 1 of Table 1. The timeframe for a typical on-site evaluation is 120 minutes.

**Technical Telepractice Description**

Telepractice video connections established between the family and the clinician researchers were enabled using secure videoconferencing software developed by Vidyo Corporation. This software was vetted by the Boston Children’s Hospital Telehealth team prior to its use, and is considered appropriate for the secure transmission of subject health information from both a HIPAA and HITECH perspective. The software was loaded onto encrypted devices with built-in cameras at BCH (MacBook Pro running Mac OS 10.9 Mavericks, and Macintosh desktop running Mac OS 10.6 Snow Leopard). Once consent forms were finalized, the software was loaded onto Subject 2’s iPad. The clinic iPad was used in the evaluation of Subject 1, and both the clinic and family iPads were used during the evaluation of Subject 2. Also for Subject 2, an IPEVO Ziggi HD USB Document Camera was used to demonstrate the features of different apps. Accordingly the distance conferences were made up of the researcher/clinician, the subject/patient, and the iPad (see Figure 1).

**Materials**

Object stimuli were compiled before each evaluation. These consisted of character figurines (agents) and small replicas of everyday objects (e.g., car, ladder, bed). For Subject 1, clinician researchers used a set of objects normally introduced during a clinical session. For Subject 2, clinician researchers mailed an identical set of objects to the family in advance of the evaluation. Clinician researchers also compiled sets of static and dynamic scene cues using the iOS 7 Camera app. These consisted of various combinations of the characters and objects (e.g., a baby in a car, a baby climbing a ladder) that were accessible via the iOS Photos app. The scene cues were transferred electronically to Subject 2’s iPad via Dropbox folder sharing (Dropbox, Inc.) and subsequently transferred into the iOS Photo app. Clinician researchers used intake information to determine what apps to present during the observation section of the evaluation; these apps were downloaded to the iPad by Subject 2’s family prior to the observation. Skitch (Evernote) was used to create screenshots of the relevant app icons from the iTunes store and emailed to Subject 2’s family enabling them to more readily locate the identified apps in the iTunes store. Apps used in this study included: ProLoQuo2Go (AssistiveWare), AutisMate (SpecialNeedsWare), My PlayHome (PlayHome Software Limited), SymbolSupport (Attainment Company), Chalkboard Pro for iPad (Gabe Jacobs Productions), Go Go Xylo (Barrett Productions LLC), BalloonMaker (TegTap LLC), and Writing Wizard (L’Escapadou).
Table 1. Implementation Results for Traditional and Telepractice Service Delivery. “Success” is defined as the ability to obtain needed clinical information

<table>
<thead>
<tr>
<th>Column 1: Evaluation Section</th>
<th>Column 2: On-site prototype (subject 1)</th>
<th>Column 3: Telepractice application (subject 2)</th>
<th>Column 4: Success of application to telepractice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-intake:</strong> Prior to subject’s arrival, clinician researcher reviews forms filled out by the family and/or professionals.</td>
<td>-Material was received (scanned and emailed) and reviewed before interview.</td>
<td>-Material was received (scanned and emailed) and reviewed before interview.</td>
<td>-Successful</td>
</tr>
<tr>
<td><strong>Interview:</strong> Clinician researcher conducts a family interview in order to gain information on the subject’s communication operations and the goals of the family for the evaluation.</td>
<td>-First interaction between clinician researchers and family.</td>
<td>-Second interaction between clinician researchers and family.</td>
<td>-Successful</td>
</tr>
<tr>
<td></td>
<td>-Subject present during interview.</td>
<td>-Subject not present during interview.</td>
<td>-Longer duration via telepractice.</td>
</tr>
<tr>
<td></td>
<td>-Addressed communicative functions, likes and dislikes, family goals for evaluation.</td>
<td>-Addressed communicative functions, likes and dislikes, family goals for evaluation.</td>
<td>-Telepractice application required brief pre-interview first meeting to establish connectivity.</td>
</tr>
<tr>
<td></td>
<td>-45 minutes.</td>
<td>-After interview, without subject present, apps were demonstrated to family members.</td>
<td>-Subject presence during interview differed between the conditions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-100 minutes. -Additional time needed to demonstrate apps.</td>
</tr>
<tr>
<td><strong>Observation:</strong> Clinician researcher observes subject’s responsiveness to a visual interface; generally includes observation while a variety of apps are introduced, depending on the experience and interest of the person being evaluated (e.g., cause/effect, entertainment).</td>
<td>-Evaluator chose and accessed apps in real time.</td>
<td>-Family downloaded and installed apps between sessions (time not accounted for in this table).</td>
<td>-Successful</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-Longer duration via telepractice</td>
</tr>
<tr>
<td></td>
<td>-Evaluator guided subject and provided modeling.</td>
<td>-During observation of subject, family member guided subject and provided modeling.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-20 minutes.</td>
<td>-Clinician researchers watched subject interact with these apps; could see his reaction and indirectly see the screen. Provided guidance to caregiver on how to model and how to set up camera angle.</td>
<td>-Additional time (outside of visit) needed by family to install apps and familiarize themselves with the apps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-60 minutes.</td>
<td>-Clinic vs. naturalized home context</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-In both conditions, clinician researchers were able to observe</td>
</tr>
</tbody>
</table>
**Scene and element cues**

*assessment:*

Clinician researcher conducts direct assessment using an object stimuli kit and visual supports presented on an iPad and/or computer.

<table>
<thead>
<tr>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object stimuli were present in the clinic</td>
<td>-Object stimuli were sent to family in advance via <strong>snail</strong> mail.</td>
</tr>
<tr>
<td>Visual supports (topic boards) were stored and accessed on the clinic iPad, laptop computer, and in a binder.</td>
<td>-Visual supports (scene cues) were sent to family in advance via Dropbox.</td>
</tr>
<tr>
<td>-25 minutes.</td>
<td>-Gave family member spoken directions on administering tasks.</td>
</tr>
<tr>
<td>-45 minutes.</td>
<td>-Would be better to create an exemplar (instructional materials with accompanying video) for family to review beforehand in telepractice condition.</td>
</tr>
</tbody>
</table>

**Conclusions and discussion with family:**

Clinician researcher reviews evaluation findings with the family and plans next steps.

<table>
<thead>
<tr>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion occurred with subject present.</td>
<td>-Discussion occurred without subject present.</td>
</tr>
<tr>
<td>-20 minutes.</td>
<td>-60 minutes.</td>
</tr>
<tr>
<td>-45 minutes.</td>
<td>-Longer duration via telepractice.</td>
</tr>
<tr>
<td>-60 minutes.</td>
<td>-Preferable to have subject not present, due to distraction and pt/family anxiety.</td>
</tr>
</tbody>
</table>

*Visual scene displays portray events, people, actions, objects and activities against the backgrounds within which they occur or exist, whereas element cues refer to particular elements of those scenes (Shane et al., in press).*
Data Analysis

We defined “success” as the ability to acquire constructive clinical information. For each segment of an evaluation, we detailed the clinical information obtained under each condition and amount of time required to complete that section. Narrative descriptions of the implementation for each component were examined for qualitative differences (see Table 1). Where the information obtained was qualitatively equivalent, it was interpreted as successful implementation through telepractice (i.e., no discernable differences in amount or quality of information between the two clinical delivery approaches).

Results

Results are reported according to each clinical evaluation section.

Pre-intake Material

In both cases the pre-intake form was received prior to assessment; for Subject 1, the family returned it to the clinic administrator, and made available to the clinician researcher. The
intake forms for Subject 2 were sent directly to the clinician researcher via email. The forms were reviewed before the initial visit. There were no discernible differences in the process or outcome.

**Interview**

The interview represents the first interaction between the clinician researchers and the family. Subject 1 was present during the interview, which required 45 minutes of the total 120-minute session. For Subject 2, a brief initial meeting was conducted in order to establish connectivity prior to the actual interview. Additionally, as part of Subject 2’s interview, the clinician researchers provided modeling to the family on how to introduce and exploit the apps. This was accomplished by opening an app within view of the clinic’s desktop camera (refer to Figure 1). The interview for Subject 2 was conducted without the subject present and took 100 minutes (across two sessions). During the interview for both clinical cases, clinician researchers covered communicative functions, patient likes and dislikes, and family goals for the evaluation. There was no discernible difference in the amount of clinical information obtained through the interview process.

**Observation with iPad**

Clinician researchers used pre-intake and interview information to select appropriate apps to trial with each subject. For Subject 1, the family observed as the clinician researcher modeled the operation of apps. Presence in the evaluation room enabled the ability to watch the screen as well as the hands and face of the subject. This portion of Subject 1’s evaluation was conducted in 20 minutes. For Subject 2, a family member provided the modeling. Clinician researchers used verbal description as well as a family member’s positioning of the videoconference camera in such a way that the subject’s face and arm/hand holding the iPad (but not the iPad screen directly) were observable at the same time. Family members provided a verbal description regarding the subject’s specific actions within the app, as the screen was not fully visible. That is, they clarified the subject’s navigations (e.g., returning to the home screen, making selections within an app). It took 60 minutes to complete this process (of note, that timeframe does not include any necessary preparation time by the family of Subject 2, such as the time needed to download recommended apps or the time need to become familiar with the apps themselves prior to the actual session).

**Scene and Element Cues Assessment**

For both subjects, pre-intake, interview, and observational information were used to determine the level of visual representation (i.e., symbol, photograph, text, etc.) to introduce during the assessment. As Subject 2 presented with a greater language comprehension deficit, visual scene cues were introduced, since neither spoken nor written language is required to understand intended meaning of a directive. In contrast, Subject 1 exhibited strong vocabulary skills, but highly scripted output and considerable difficulty with syntax and semantic relations and highly scripted output, warranting intervention that included development of symbol syntax. This part of the assessment required 45 minutes to complete for Subject 2, and 25 minutes for Subject 1.

**Conclusions and Discussion with the Family**

The summary discussion for Subject 1 was conducted with the subject present and required 20 minutes to complete. Subject 2, in contrast, was not present during the discussion, and the summary discussion required 60 minutes to complete. In both cases, the discussion consisted of a summary of observations and findings, an outline of recommendations, and planning next steps including follow-up visits. There was no discernible difference in the type or amount of information exchanged during the telepractice vs. on-site conditions. Please refer to Table 1 for a summary of these findings.

**Discussion**

Application of the Autism Language Program VIS proprietary evaluation procedures to telepractice service delivery met pre-established criteria for success. Specifically, the amount of clinical information gathered in all components of the evaluation (including pre-intake, interview,
observation, scene/element cues assessment, and concluding discussion) was comparable across the two conditions. For instance, for both on-site and telepractice evaluation, we were able to use pre-intake and interview data to select appropriate apps to trial with the subject, and to determine what type of visuals to present to the subject. In both conditions, when assessing use of scene or element cues, we were able to gather information that was comparable in clinical relevance and thoroughness.

Caution should be used, however, in direct comparison of evaluation outcomes for Subject 1 and Subject 2. Due to unavoidable patient availability constraints, they differed on several variables, including age, native language, and site of evaluation (i.e., home vs. clinic). In particular, the subjects exhibited different skill levels that resulted in the introduction of different apps for the observation, and different activities conducted during the scene/element cues assessment. Subject 1 exhibited noticeably higher morpho-syntactic skills and was able to use element cues, while Subject 2 had greater comprehension deficits, warranting the use of scene cues. Still, when viewed as an initial attempt to expand an existing assessment model to telepractice delivery, this case exploration provides preliminary evidence that communication assessment information can be effectively obtained for this population via telepractice. This has important implications especially for individuals residing in remote locations, and/or who experience difficulty traveling or transitioning to an unfamiliar setting. Telepractice service delivery could be useful for these individuals and their families, giving greater access to clinicians who specialize in AAC for ASD.

Delivering services via telepractice also has the potential to improve treatment efficiency while reducing overall clinical costs (Terry, 2009). That being said, the time difference across conditions in this case exploration merits further discussion. There are several possible explanations for the finding that the telepractice assessment took nearly twice as long to complete. Differences in the observation and scene/element cues assessment components may be partly explained by the difference in the subjects’ levels of functioning. Time differences in the interview and concluding conversations could be due to differences in education levels, and/or prior technology exposure. Intermittent connectivity issues occurred in the telepractice condition (e.g., breakup of audio, dropped calls), necessitating repetition of the conversation; it is possible that these were further exacerbated due to Subject 2 being located outside of the United States. Also, the varying English language skills of Subject 2’s family members contributed to finding of greater time needed to complete aspects of the evaluation. For example, Subject 2’s sister occasionally needed to interpret to her parents in order clarify a question or comment by the clinician researchers. Finally, because this was an initial attempt at an interaction of this nature, additional time and verbiage was needed for positioning and explanation of procedures for Subject 2. If telepractice assessment within the VIS model became a standard clinical procedure, it would become routine and manualized (i.e., explanatory materials would be distributed advance, using contemporary electronic options such as YouTube training videos). For instance, Hay-Hansson et al. (2013) used videoconferencing to train caregivers how to implement discrete trial teaching. As the use of telepractice for such clinical practice expands, time differences will likely equalize because the instruction will be conducted prior to the encounter. The potential to reduce informant distractions by not having the subject present in the interview or concluding discussion, without the issues in connectivity mentioned here, could also improve speed.

Had Subject 2’s family member not been well-versed in technology, the observation and assessment components would likely have been even lengthier in the telepractice condition—if not impossible. Use of a trained facilitator at the client’s location could be another solution. Though our technical telepractice setup was effective for Subject 2, subjects having other skill levels might warrant different configurations. In procedures used during this investigation, the clinician researcher’s iPad could appear on the subject’s computer screen, but the subject’s iPad was not screen-shared with the clinician researcher. For the purpose of observing a subject interact with cause and effect apps (vs. generate utterances), in a situation where the family member was familiar with mobile technology, this was acceptable. However, a direct tele-AAC
setup with two devices and screen sharing, as detailed by Hall and Boisvert (2014), would be more flexible for the future.

**Conclusion/Future Directions**

This case exploration was a first attempt at our Center to assess the feasibility of delivering, via telepractice, communication assessment for persons with ASD within our VIS clinical model. These results provide a first attempt to explore the use of telehealth to explore the communication abilities of individuals with moderate to severe ASD and their families. It offers further evidence as to the potential for implementing effective assessment via telepractice, thereby providing consumers with wider access to experts in AAC for children who are minimally verbal. As a result, barriers such as travel, scheduling, and subject behavior can be reduced. Future research with more closely matched subjects is warranted. Though this investigation was successful in obtaining comprehensive clinical information for both subjects, the telepractice evaluation was overall more time-consuming. In the future, use of video tutorials, associated instructional material, and exemplars could be used to better prepare a family of a telepractice patient and that would likely increase the efficiency.

**Acknowledgements**

This research was supported in part by the CVS Caremark Foundation. The authors also wish to acknowledge Patrick McCarthy and Sean Farrell of the Boston Children’s Hospital Telehealth team for their invaluable guidance in technology support, concept/pilot testing, and operationalization of telehealth procedures, and three anonymous reviewers for helpful comments on the manuscript.

**References**


Parents’ Perspectives on Tele-AAC Support for Families with a New Speech Generating Device: Results from an Australian Pilot Study

Kate Anderson
Faculty of Health Sciences, University of Sydney
Lidcombe, New South Wales, Australia

Susan Balandin
School of Health & Social Development, Faculty of Health, Deakin University
Melbourne, Victoria, Australia

Roger J. Stancliffe
Centre for Disability Research and Policy, University of Sydney
Lidcombe, New South Wales, Australia

Claire Layfield
Faculty of Health Sciences, University of Sydney
Lidcombe, New South Wales, Australia

Financial Disclosure: Kate Anderson is a Doctoral Candidate with the Disability and Community Faculty Research Group at the Faculty of Health Sciences, University of Sydney, Australia. Susan Balandin is the Inaugural Chair in Disability and Inclusion in the School of Health and Social Development, Faculty of Health, at Deakin University. Roger J. Stancliffe is Professor of Intellectual Disability at the Centre for Disability Research and Policy at the University of Sydney, Australia. Claire Layfield is a Doctoral Candidate with the Disability and Community Faculty Research Group at the Faculty of Health Sciences, University of Sydney, Australia

Nonfinancial Disclosure: Kate Anderson has previously published in the subject area. Susan Balandin has previously published in the subject area. Roger J. Stancliffe has previously published in the subject area. Claire Layfield has no nonfinancial interests related to the content of this article.

Abstract

Telepractice is rapidly gaining popularity as a cost-effective and convenient alternative to in-person services for a range of speech-language pathology (SLP) applications. To date, there has been little research investigating the use of telepractice to support families with a new speech generating device (SGD). This paper reports on the outcomes of a novel online training and support program, trialed with 4 underserviced Australian families of children with a new SGD. The program consisted of 6 video-narrated lessons on SGD use, along with an online supervision and practice component conducted via videoconference. Semi-structured interviews were undertaken with parents following their completion of the program. Parents noted the telepractice support model offered a range of benefits, including convenient service access and flexible learning options. Challenges included technology limitations and increased pressure on parents to coordinate home practice. Overall, parents reported that the telepractice program was a positive experience for them and their children. Findings indicated that telepractice is a promising mode of service delivery for those learning to use a new SGD. Further research in this area is warranted.

Children with complex communication needs (CCN) who have little or no functional speech may benefit from the use of speech generating device (SGD) technology.
Mastering an SGD presents a steep learning curve for children with CCN and their communication partners, including parents, as language representations and programming demands for these devices are often complex (Bailey, Parette, Stoner, Angell, & Carroll, 2006; Baxter, Enderby, Evans, & Judge, 2012; McCall, Marková, Murphy, Moodie, & Collins, 1997; McNaughton et al., 2008). Inadequate training and support for communication partners increases the risk of device abandonment (Johnson, Inglebret, Jones, & Ray, 2006) and disengagement from intervention (Anderson, Balandin, & Stancliffe, 2014a).

Tele-AAC for SGD Support

Telepractice is rapidly gaining popularity as a cost-effective and convenient alternative to in-person services for a range of speech-language pathology applications (Reynolds, Vick, & Haak, 2009). One emerging area is tele-AAC: the use of telecommunications technology to provide augmentative and alternative communication (AAC) assessment, intervention, and consultation services at a distance (Anderson et al., 2012; Hall & Boisvert, 2014). Burns et al. (1998) reported the use of videoconferencing technology to provide device training for an adult with CCN living in a group home. More recently, Hall (2013) explored the use of remote consultation to support the use of SGDs in a school setting. In Hall’s study, aided language intervention was delivered by a pre-professional (student) speech-language pathologist (SLP), acting under the guidance of an experienced SLP using webcam and screen sharing technology. Positive results from these two studies indicated that tele-AAC models can be viable for SGD support. However, there is no research exploring the use of tele-AAC to support children with CCN and their families to use a new SGD in the home environment.

Implementing a Telepractice Program for Families with a New SGD

The current pilot program arose from the findings of preliminary interview and focus group research conducted in Australia with families and SLPs of children who used an SGD (Anderson et al., 2014a, 2014b). These participants reiterated several issues raised in previous research into SGD support, including a lack of ongoing in-person AAC services for children with CCN (Iacono & Cameron, 2009; Marshall & Goldbart, 2008; McNaughton et al., 2008). Iacono and Cameron (2009) identified a number of factors impacting on service provision within the Australian AAC field, including limitations in SLP staffing and lack of training for SLPs in AAC-specific skills. These concerns were echoed by both the parents and SLPs who participated in the preliminary Australian interview study (Anderson et al., 2014a). Additional challenges to families accessing in-person SGD support included travelling distance and the demands of family life, inflexible training schedules, service exclusion policies, and unreliable service coordination (Anderson et al., 2014a). Finally, participants in our study highlighted additional disadvantages experienced by families living in rural and regional areas of Australia. Similar service issues affect a wide range of SLP practice areas across Australia (Ruggero, McCabe, Ballard, & Munro, 2012) as well as internationally (Shprintzen & Golding-Kushner, 2012). Parents in our interview study were amenable to the concept of telepractice as a way of delivering support and training to families with a new SGD (Anderson et al., 2014b).

In response to this preliminary research, the research team developed a telepractice training and support program to address the early training and support needs of families with an SGD. The program was piloted with four underserviced Australian families whose children had received their first SGD less than six months prior to the study. For recruitment purposes, “underserviced” was defined as families accessing SLP services less than once a month. These families were also unable to access other forms of SGD training or support at the time of the study. Families nominated one parent to be the primary interventionist for the duration of the study. Their details are summarized in Table 1. Pseudonyms have been used to protect the participants’ identity. The four nominated parents spoke fluent English (two parents spoke English as a second language), and all had access to a desktop or laptop computer and a high speed Internet connection. Three parents also had
access to a USB or inbuilt webcam and microphone for their computer—the research team provided the fourth parent with a USB audio-visual webcam for use in the study. As recommended by Boisvert and Hall (2014), parents received training in using the Adobe® Connect™ web conferencing platform and were given the opportunity for a “trial run” with the technology prior to their first intervention session.

Table 1. Demographic and Service Details for Parents and their Children.

<table>
<thead>
<tr>
<th>Parent pseudonym</th>
<th>Child pseudonym</th>
<th>Child’s Age</th>
<th>Child’s disability</th>
<th>Parent’s Occupation</th>
<th>SLP service access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allie</td>
<td>Madeline</td>
<td>6</td>
<td>CP</td>
<td>Part-time work</td>
<td>School only</td>
</tr>
<tr>
<td>Ciara</td>
<td>Theo</td>
<td>12</td>
<td>CP, ID</td>
<td>Full-time at home</td>
<td>Less than monthly</td>
</tr>
<tr>
<td>Marnie</td>
<td>Jaya</td>
<td>5</td>
<td>CP</td>
<td>Part-time study from home</td>
<td>Less than monthly</td>
</tr>
<tr>
<td>Sonia</td>
<td>Seamus</td>
<td>14</td>
<td>Autism</td>
<td>Full-time work</td>
<td>School only</td>
</tr>
</tbody>
</table>

Note. CP = cerebral palsy; ID = intellectual disability; SLP = speech-language pathology.

Program Overview

The six-week telepractice training and support program consisted of three components: (a) six self-directed DVD lessons separated into two modules (“Core Vocabulary” and “Aided Language Modelling”), each containing three 20-minute lessons, (b) twice-weekly home practice sessions, and (c) twice-weekly remote consultation sessions. Parents completed a staggered baseline (5–7 sessions long), followed by the six-week training program (12 sessions in total). Three families completed a further eight maintenance home practice sessions following the training, where they continued their twice-weekly webcam practice sessions without the accompanying lessons or remote support component. Three families completed two follow-up practice sessions at three months post intervention.

Self-Directed DVD Lessons

The DVD lessons were presented as a continuous PowerPoint slideshow. Video segments for each lesson were narrated by the first author, and were accompanied by a written summary. The Core Vocabulary module contained information about the language system used on the children’s SGDs, which in this case were all Minspeak®-based devices. Minspeak is a strategy for vocabulary representation that involves combining two or more picture icons to form words and phrases (Semantic Compaction Systems, 2009). The module included a brief explanation of how Minspeak works, and why it can be beneficial for children with CCN. The module also introduced parents to 50 of the most commonly used sequences, “core” vocabulary items such as pronouns, prepositions, adjectives, as well as common nouns and verbs. The lessons included dynamic device screen shots of the SLP accessing these target words, with built-in pauses encouraging parents to practice on their own device. They also provided walk-through demonstrations of programming tasks such as adding and modifying vocabulary items and personalizing the device settings.

The Aided Language Modelling module introduced parents to home practice strategies including following the child’s lead, creating communication opportunities, and using language teaching techniques (e.g., modelling, repeating, and recasting messages) using the device. This module also included short video examples of these techniques in use.

Practice Sessions and Remote Consultations

The remote SLP (first author) observed all the home practice sessions via webcam, using the browser-based Adobe® Connect™ web conferencing platform. Parents accessed the secure
online meeting room via a one-time URL e-mailed immediately prior to the session commencing. All sessions were recorded by the SLP with parents’ consent, using the Adobe Connect recording feature. Skype™ and telephone contact were used as backup systems in the event of Adobe Connect failure, however these options were only required on a few occasions with one family.

The SLP typically observed the practice sessions with her webcam turned off, to reduce unnecessary bandwidth consumption. This helped to improve the quality of the video data transmitted by families. She offered occasional audio guidance only when necessary, for example when device troubleshooting was required. Practice sessions lasted for approximately 15 minutes. At the end of the session, the SLP turned on her webcam and offered feedback on the session. Parents were invited to discuss any questions arising from the lessons or their home practice. In addition to feedback and questions, parents in our study also used their consultation time for service coordination, problem-solving (e.g., around advocacy for SGD use in school or other environments), and future planning (e.g., around literacy teaching and generalization). On average these consultation sessions were 15 minutes long, but occasionally lasted up to an hour. Other telepractice studies (e.g., Wilson, Onslow, & Lincoln, 2004) have reported longer session times for telepractice compared with clinic-based in-person models. To date, no direct comparisons between home-based telepractice and home-based, in-person SLP sessions have been made.

**Program Evaluation**

**Session Attendance and Lesson Completion Rates**

Session attendance and lesson completion patterns were tracked for each parent throughout the study. The first author diarized both scheduled and attended appointments, as well as reasons given by parents for rescheduling. A percentage attendance rate was calculated using the following formula for each participant:

\[
\text{Attendance Rate} = \left( \frac{\text{number of sessions attended}}{\text{total number of scheduled sessions}} \right) \times 100
\]

Lesson completion rates were based on participant self-report only.

**Parents’ Experiences**

At the end of the program, the fourth author and another external researcher conducted follow-up interviews with the parents. Both interviewers had been uninvolved in the research until this point. The interviews were semi-structured and probed parents’ views about, and approaches to the lessons, practice sessions, and remote supervision component of the program. The interviewers also asked about any challenges or benefits that parents had encountered with the telepractice format.

All interviews were digitally recorded, transcribed verbatim, and analyzed with the aid of QSR International’s NVivo 10 software. Transcripts were initially open-coded by the first author, a process that involved identifying and labelling manifest “themes” in each utterance, such as “twice-weekly sessions demanding” or “video footage essential”. These initial codes were continually refined and organized through a process of constant comparison between and within interviews (Padgett, 2012). This resulted in a condensed list of themes (e.g., “pressure of intensity”, “benefits of remote service model”); some of these were shared by all parents in the study, and others were unique to individual parents. The coding schema and associated interview data was then reviewed by the fourth author, and any coding disagreements between the first and fourth authors were discussed until a consensus was reached (Padgett, 2012). Individual summaries of the resultant themes, illustrated with quotes, were sent to each parent for checking. One parent asked for some minor changes to the wording of her quotes, and no other alterations were requested.
Results and Discussion

This paper explores parents’ views around attending the practice and consultation sessions, completing the DVD lessons, working with technology, and managing pressures and demands arising from the program. Parents’ attendance patterns and challenges encountered in delivering this remote intervention will also be shared.

Attending Sessions

Families attended an average of 76% of scheduled sessions (ranging from 48–100% across families). Attendance patterns have been examined in previous home-based telepractice studies, including telephone-administration of the Lidcombe program for childhood stuttering (Wilson, Onslow, & Lincoln, 2004), and a comparison of in-person versus telepractice administration of Auditory Verbal Therapy (AVT; Constantinescu et al., 2014). Mean attendance rates reported by Constantinescu and colleagues (82.5% for in-person AVT and 80% for tele-AVT sessions) are slightly higher than observed in the current study, and varied far less across families. The high variation in attendance seen in the current study is similar, however, to observations from other telepractice researchers. For example, Wilson and colleagues (2004) reported that two of the five families participating in the telehealth Lidcombe program showed notably lower treatment compliance and/or session attendance, and attributed this to the high demand that home-based data collection entailed for the parents.

Appointments in the current study were rescheduled for a range of reasons, suggesting that personal and child-related factors played a large part in each family’s capacity to attend the telepractice sessions. The most commonly cited reason for cancelling the sessions was illness of the child or another family member (12 sessions, or 16% of all scheduled sessions across baseline and training periods). This is perhaps unsurprising, given the poorer average health status and higher number of school absences reported for children with developmental disability, particularly learning disability, cerebral palsy, and seizure disorders (Boyle, Decouflé, & Yeargin-Allsopp, 1994). Other reasons for rescheduling included double-booked appointments, lack of preparation, and competing home priorities (e.g., waiting for the fridge repair specialist, or having to get to the butchers before they closed). While parents’ ability to cancel sessions at the last minute created inconvenience and increased workload for the remote clinician, this flexibility was viewed by the parents as being a key advantage of the telepractice model: “I didn’t really feel like we had to pursue it. Like if Madeline wasn’t well or she was overtired … I didn’t feel like: “oh, someone’s driving all the way here so we have to do it regardless”. (Allie)

Parents viewed telepractice as being more convenient than in-person services. Marnie, who lived four hours from her nearest therapy center, remarked, “That’s way easier for us than getting somewhere.” Other parents like Sonia and Allie, who had experienced home-visits from therapists in the past, commented on the non-intrusive nature of the telepractice session: “…there’s only one room that needs to be tidied… you don’t have to worry about other things, really, it’s just convenient” (Sonia). It also maintained children’s focus on their parents as the primary interventionist, as Allie explained: “…if anyone else had been in the room that’s all [my daughter] would have focused on…she didn’t disengage with me in order to engage with the other person.” This advantage has not been raised in previous studies of home-based SLP telepractice, and may warrant further investigation.

Home-based telepractice also enabled regular involvement of the child’s siblings with three of the families. For Ciara, whose younger son Tai also had an intellectual disability and CCN, it presented an opportunity for both boys to benefit from the practice sessions: “For Tai, just to stay there and sit for the whole session, just to watch, it means he’s interested. He’s benefiting as well.”

Initially parents agreed to attend two practice and consultation sessions each week for the duration of the study, but all experienced difficulty fitting these around their existing family schedule. Nonetheless, all four parents remarked that having a set routine with frequent, enforced
practice sessions had been essential to their progress. Marnie reflected: “...it was really demanding to fit two appointments in a week, really, really demanding, but also really, that’s where we got the benefit from.” And, as Ciara pointed out, the telepractice model was no more demanding than receiving equivalent in-person service: “...even if you take them to [the] speech therapist, it’s gonna take same time anyway.”

Completing the Lessons

Parents reported completing all lessons, although two parents asked for extra time to complete their final lesson. Parents approached the DVD lessons in different ways. For example, Marnie said she “...often just rushed them in before getting to a session” whilst Ciara fitted them around her other daily activities: “...when I’ve got time and I don’t sort of pressure myself.” Several parents appreciated the ability to revisit lesson content when required. Sonia in particular enjoyed the ability to practice the exercises in private until she gained more confidence, “It was non-threatening, because I could just watch it alone. And practice on your device however many times you needed to. You could...stop the session at any time and go over it if you needed to.”

Another feature that parents reported making good use of was the handouts. Allie reflected that for her, the handouts were more helpful than the lessons themselves, “as a reminder and a guide” during home practice. Parents also valued the inclusion of video examples of each teaching technique, although Allie pointed out that in future interventions it would also be important to address: “...some of the challenges that parents are going to have”, such as slow progress and difficulties in managing children’s behavior or motivation, through the use of real-life case-studies with children who have a range of disabilities.

One limitation with the generic lesson content was that it was impossible to accommodate parents’ specific learning needs. Each parent identified some content areas that had been irrelevant due to their child’s age, diagnosis, interests, or capabilities, or had overlapped with prior training and practice. Several parents advocated for greater flexibility in the program structure, including allowing parents to choose lesson content based on their current needs and priorities. Lack of content relevance has been previously identified as a factor for dropout from parent training programs (Wade, Walz, Carey, & Williams, 2009) and is an important consideration in the development of future online training resources for families with an SGD.

Working with Technology

As Hall and Boisvert (2014) stated, “The success of a telepractice program hinges on the technological infrastructure that supports it” (p. 20). Parents in this study viewed video-conferencing as the lynchpin to this program’s success and acceptability as an in-person service alternative. Allie stated, “without the video component yes there would have been huge disadvantages.”

Successful two-way video connection helped to establish rapport between the SLP, the parent, and the child, and promoted comfortable interactions. As Ciara observed, “it’s as if she’s present.” Synchronous video transmission also offered a solution to device troubleshooting. Sonia recalled, “I could show her what I was doing with my device ...because it’s very mechanical!” Unfortunately, establishing a reliable audio-video (AV) connection accounted for the highest number of technology-related complications in the study. As Allie pointed out, “there were times that it would take as long to get it set up and working as it would actually take to do the 15 minute session!” Of a total 77 sessions attempted across the baseline and training periods, 16 had considerable technical difficulties, 13 continued following initial set-up difficulties, one session dropped out halfway through data collection, and two required rescheduling due to insurmountable technical troubles. Difficulty in establishing a clear AV connection was the most frequent cause of delay (13 instances), followed by browser/software incompatibilities (3), deteriorating signal quality (2), and internet connection drop-out (1).
A separate technology limitation was the inability for telepractice sessions to take place outside of the camera zone:

“...we were a bit limited in what we could do just because of this space, and we didn’t have the technology to be able to extend it... if [the treating SLP] had been here in person we could have gone anywhere we wanted” [Allie].

During the later stages of the program, several parents discussed a desire for input around generalization to other activities or settings (e.g., mealtimes, personal care, and café visits). Indeed, parents in other studies have reported that generalizing SGD use into community settings can be especially challenging (McNaughton et al., 2008). Although this was not possible within the current study, the increasing availability of mobile devices and wireless webcam technology may facilitate better generalization of treatment targets in future telepractice programs for this population.

**Pressures on Parents**

Given the consultative nature of the program, training and feedback sessions focused around empowering parents in their role as the child’s primary communication interventionist. At times, all four parents found this new responsibility confronting, onerous, or overwhelming. Ciara reflected on the conflicting nature of this process: “I get some tips, and I feel like I’m one of the speech pathologists as well. And so it was good, and at the same time nervous.” During each practice session parents were expected to implement language modelling within naturalistic play activities or conversational interactions with their children. At first, some parents like Sonia felt uncomfortable about being in the spotlight, under the SLPs watchful eye: “I was a bit scared actually, initially. And then I got used to it.” As Ciara explained, “I want it to be the best all the time so I’m cautious of how my son and I will perform.”

Several parents reported struggling to apply what they had learned to home practice. As Allie explained, “I knew how to say the words but... I found I was continuously racking my brains for ways of engaging her and then using the vocabulary.” Language modelling on-the-fly also required a degree of proficiency from parents in accessing vocabulary items on the device. Ciara described the preparation this entailed,

“I have to be confident on what I’m showing Theo [on the device]. And when we’re doing recording, I must know where to go. So also I spend a bit of time scripting...what we are going to do in the session.”

Carefully managing workload demands and performance pressures is essential to ensuring ongoing parent compliance and engagement in telepractice interventions. While parents in this study found the example activities and videos somewhat useful, they recommended including a wider range of activity suggestions in future programs to help alleviate these pressures. Parents also viewed the remote consultation component (i.e., the ability to troubleshoot issues around their child’s motivation and behavior with an SLP) as being the key to successful implementation of the teaching strategies. As Sonia explained,

“Trying to organize what to do with Sean the day that we’re going to be recorded...without him getting anxious or bored, or upset...I had a rough ride with that. But Kate [treating SLP and first author] gave me a lot of ideas and it worked out in the end.”

Having contact with a professional during parent training has been correlated with increased self-efficacy and reductions in parent stress (Keen, Couzens, Muspratt, & Rodger, 2010), and the ongoing reassurance provided by the SLP in the present study was highly valued by parents. “I’m fully trained in... early childhood education and it was challenging for me” said Allie. “And I just think that other families might well get discouraged without that [reassurance].…”

**Changing Perspectives**

Despite technical setbacks and some early reticence, parents in the study reported that telepractice had been a positive experience both for themselves, and for their child. “I was surprised...
actually because I thought I would prefer it to be face-to-face, but I think a remote model with the video aspect of it was really good” (Allie). Parents reported changes in their opinion towards telepractice over the course of the study. As Ciara reflected, “before I don’t understand. How can you study online? I said: ‘It just won’t work’. And then I said, ‘It’s probably too hard’. But now I know that it can be done.”

Nonetheless, parents emphasized that, like in-person service models, telepractice should not be viewed as a one-size-fits-all solution. As Marnie cautioned: “some families might really need face-to-face support. . . . and some might even just be comfortable having the DVDs. . . . a finished training package might have different faces for different people and where they’re at”. Parents in other studies have also stressed the importance of having flexible, customized SGD training and support available to families (McNaughton et al., 2008). Parents’ experiences in this study also highlight the importance of having ongoing professional support available to families with a new device: “If it [consultation component] wasn’t there, if she didn’t help me out throughout the course, then I would have been lost. So that was fantastic.” (Sonia)

Ultimately, parents in the study reported that telepractice had been an empowering, effective, and at times preferable alternative to in-person services. As Sonia summed up, “I think it’s just a lovely program that helps parents to make things happen.”

**Conclusion**

Although the small scale of this study limits the ability to generalize these findings, the satisfaction these four families reported indicates promise for tele-AAC as a means to bridge the service gap for families with a new speech generating device, and suggests that ongoing research in this area is warranted.

**Acknowledgements**

The authors wish to thank the four parents and their families for dedicating so much of their time, energy, and enthusiasm to this project. We also thank Dr. Liora Ballin for her assistance with collecting interview data.

**References**


Language Intervention via Text-Based Tele-AAC: A Case Study Comparing On-site and Telepractice Services

Nerissa Hall  
Commūnicāre, LLC/C.A.R.E. Consortium  
Westfield, MA

Michelle Boisvert  
WorldTide, Inc./C.A.R.E. Consortium  
Williamsburg, MA

Hillary Jellison  
Commūnicāre, LLC/C.A.R.E. Consortium  
Westfield, MA

Mary Andrianopoulos  
Department of Communication Disorders, University of Massachusetts  
Amherst, MA

Financial Disclosure: Nerissa Hall is a Speech-Language Pathologist at Commūnicāre, LLC/C.A.R.E. Consortium. Michelle Boisvert is a CCC speech-language pathologist at WorldTide, Inc./C.A.R.E. Consortium. Hillary Jellison is a Speech-Language Pathologist at Commūnicāre, LLC/C.A.R.E. Consortium. Mary Andrianopoulos is an Associate Professor in the Department of Communication Disorders at the University of Massachusetts.

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Abstract

There is a shortage of qualified speech and language pathologists (SLPs) to not only meet the needs of students with a variety of communicative disabilities, but also the needs of those students with severe impairments who use augmentative and alternative communication (AAC). Special education administrators need to consider additional methods of service delivery, such as telepractice. However, there is limited evidence regarding the efficacy of services delivered to students using AAC via telepractice as opposed to face-to-face services. This study examines the effectiveness of services provided using both methodologies, and aims to provide some validation of telepractice as an alternative treatment method. Using a single-subject design to compare performance outcomes, a 7 year-old male participant, who used a Vantage Plus™ device with an 84-sequenced overlay, was studied over an eight-week period, with four weeks of on-site therapy immediately followed by four weeks of telepractice therapy. Student progress was measured by comparing outcomes in both conditions to baseline data with respect to short-term goals focused on grammatical morphemes. The results indicate that the performance outcomes were comparable in both conditions. The authors discuss the implications of using telepractice to deliver direct intervention and future applications of telepractice as a service delivery model for individuals using AAC.

Augmentative and alternative communication (AAC), a subset of assistive technology (AT), is an evolving and expanding area of need within rehabilitative services. In school-based settings, the use of AAC devices to enhance individuals’ communication accounts for approximately 3–5% of all K-12 students (Matas, Mathy-Laikko, Beukelman, & Legresley, 1985) and 12% of all preschoolers (Binger & Light, 2006). Data analyzed from the US National Survey of Children...
with Special Health Care Needs (CSHCN) revealed that 12% of special needs children require communication, hearing or mobility devices such as those typically provided by rehabilitation professionals and as many as 14% of these children are reported to have unmet needs (Benedict & Baumgardner, 2009, p. 586).

The Individuals with Disabilities Education Act (IDEA; 2004) and the No Child Left Behind Act (NCLB; 2001) mandate that students with communication disabilities who use AT (including AAC), should receive evidence-based services from highly-qualified professionals. However, due to a shortage of rehabilitation professionals qualified to provide such services, many schools are unable to meet the needs of their students (American Association of Employment in Education, 2008; American Speech Language Hearing Association, 2014). As a result, many eligible students with complex communication needs do not receive services, or receive services from unqualified personnel (Boisvert, Lang, Andrianopoulos, Boscardin, 2010; Rule, Salzbert, Higbee, Menlove, & Smith, 2006). Additional data analysis from the National Survey of Children with Special Health Care Needs revealed that the “prevalence of unmet need for assistive devices among children with a reported need [was] ... 24.7% for communication aids” (Dusing, Skinner, & Mayer, 2004, p. 450). This discrepancy between documented need and access to medically appropriate services adversely impacts students’ advancement of critical communication skills, academic achievement, and development of essential social relationships.

The demand for evidence-based services conducted by highly-qualified licensed speech language pathologists and/or assistants has lead researchers to consider technology, such as telepractice, as a means to provide services to students impacted by this personnel shortage. According to ASHA (n.d.), telepractice can be used to provide professional services at a distance for assessment, intervention and/or consultation. Telepractice involves the application of communication technologies (e.g., videoconferencing software and the Internet), which enables specialists to deliver real-time, interactive services over a geographical distance (Dudding, 2009). The implementation of telepractice is a promising method to overcome the impact of the personnel shortage as it enables experts to provide services to students in both their school and home environments.

Case Study

In an effort to directly address the documented need for AT and AAC intervention and shortage of speech language pathologists (SLPs), this case study was designed to explore the use of telepractice for an individual using AAC.

Purpose

This study aimed to: (a) determine the feasibility of providing direct services via telepractice to an individual using AAC, and (b) compare the individual’s progress in meeting speech and language goals and objectives when services were provided on-site versus via telepractice.

Experimental Design

For this feasibility study, a single case, ABC design was used to evaluate the effectiveness of language intervention for a non-verbal device user (outputted using AAC) to generate three target grammatical morphemes. Services were delivered for an equal number of sessions and weeks both onsite and via telepractice settings. Stable baseline probes were established over the course of four weeks per service delivery modality. Each intervention condition was four sessions in length, for a total of eight intervention sessions.

Dependent Variables

The dependent variables consisted of three (3) target morphemes for intervention services with respect to the appropriate use of: (a) progressive verb form –ing; (b) past tense verb form –ed; and (c) the plural –s at the four-word sentence level. Probe data were obtained at the beginning of the onsite and telepractice intervention sessions with respect to the frequency of generating each morpheme and the frequency of each morpheme’s use. No prompting or cueing was provided when probe data were measured.
Independent Variables

The independent variables in this investigation were the method of service delivery, specifically: (a) in-person onsite intervention services, and (b) intervention provided via telepractice.

Participant

A 7 year-old male diagnosed with schizencephaly, a rare developmental birth defect characterized by abnormal clefts in the cerebral hemispheres of the brain, participated in this study. Children diagnosed with this syndrome commonly exhibit delays in development, the acquisition of speech and language, and problems with brain-spinal cord communication (National Institute Neurological Disorders and Stroke, 2012). The participant presented with significant expressive language deficits inherent to the syndrome and was prescribed a Vantage Plus™ AAC device. The participant presented with a left hemiparesis, but accessed his device via direct selection using his index finger of his right hand. At the time of this investigation, the participant was using an 84-sequenced overlay to communicate and received services under an Individualized Education Program (IEP) for speech and language. To be included in this feasibility study, the following inclusion criteria were met: (a) a formal diagnosis of an expressive language disorder assessed and confirmed by a certified and licensed SLP; (b) a prescription of an AAC device to facilitate expressive language output; (c) demonstrated use of the AAC device for functional verbal communication; (d) demonstrated ability to follow directions; (e) demonstrated attentiveness for more than 10 minutes; (f) normal hearing and visual ability; and (g) minimal manual dexterity to operate the keyboard and engage in button selections on the AAC device. The participant selected for study met all inclusionary criteria.

The participant and his family were motivated to partake in this study and completed the informed consent form required for participation. This study was approved by the University of Massachusetts-Amherst’s Internal Review Board (IRB) and was conducted by the first author as a third year doctoral student at the University of Massachusetts-Amherst in the Department of Communication Disorders. At the time of this study, the first and second authors were funded under a grant received by the fourth author from the U.S. Department of Education Office of Special Education Programs (H325D080042).

Setting and Materials

One-on-one onsite and telepractice intervention services were provided to the participant in his home in a consistent location. The participant had access to a table with the required intervention equipment while seated in his wheelchair. As depicted in Figures 1 and 2, during all sessions the participant was seated facing Computer 1. The purpose of Computer 1 was to display activities and material, which remained constant for both onsite and telepractice conditions. Computer 1 was oriented slightly to the participant’s left. The participant used his right hand to access his device. Therefore, his Vantage Plus™ AAC device was placed to his right in an optimal position for efficient device access. For all onsite and telepractice sessions, Computer 1 was used consistently to display materials and activities for therapy.

Figure 1. Onsite Service Delivery
During onsite sessions, the clinician was seated to the participant’s right, and a parent was seated to the participant’s left (see Figure 1). The positioning of equipment and the parent’s seating was maintained when services were provided via telepractice. However, during the telepractice sessions, the second computer (Computer 2) was placed to the left of the participant in the location where the parent was positioned (with his device remaining on the right) as the second computer needed to be plugged into an electrical outlet on the left (see Figure 2). The screen of Computer 2 was used for videoconferencing and allowed for the clinician to be recorded during the telepractice intervention sessions.

Probe and intervention materials were developed in Microsoft Office Word 2007 and Boardmaker Studio™. The same intervention materials were used onsite and in-person, as well as during the offsite services delivered via telepractice phase.

**Equipment**

During the onsite phase, the clinician used a Hewlett-Packard (HP) TouchSmart tx2 (without implementing the touchscreen feature), Boardmaker Studio™, and Microsoft® Office Word software programs. The HP ran a Microsoft Vista™ operating system and had a 2.20 GHz processor with 4GB memory. Similarly, for the telepractice services, the clinician used the same HP TouchSmart tx2 with the above-mentioned software programs. All electronic material was screen-shared from the clinician’s computer to the participant’s laptop computer. In addition, the clinician utilized a second eMachine desktop computer with a Microsoft LifeCam external webcam mounted on top of the monitor to engage in real-time videoconferencing through Skype™. The eMachine ran the Microsoft Windows 7 operating system and had a 3.1GHz processor and 3GB memory. The Microsoft webcam had an auto-focus lens and captured 720p HD video with 30 frames per second. The clinician’s eMachine desktop computer used for videoconferencing (Computer 2) and was connected to high-speed Internet through an Ethernet cable. The HP TouchSmart tx2, as previously mentioned was used to present activities and material to the participant through screen sharing, and was connected wirelessly to high speed Internet.

At the participant’s home location, the parents’ desktop Dell Pavilion dv6 computer (with a Windows 7 operating system, a 2.3GHz processor, 8GB memory and built-in TrueVision HD Webcam with an integrated digital microphone) was used solely for videoconferencing purposes. The participant also used a Dell Inspiron 1505 laptop (with Windows XP™, Intel® Core™2 Duo processor, and 2GB of memory) to view materials through screen-sharing software and interact with the clinician. The computers in the participant’s home used a wireless Internet connection for both videoconferencing and screen sharing.

For the onsite sessions, the participant’s AAC device was connected to the clinician’s computer using a standard USB printer cable. During the second phase, services switched to telepractice sessions. The participant’s device remained connected to the Dell laptop computer.
using the same standard USB printer cable. The output feature of the participant’s AAC device was turned on to ensure that the messages generated on his device were presented in the body of a word-processing document (i.e., in the message window on Boardmaker Studio™ or directly into the body of the document in Microsoft® Office Word) and were subsequently screen-shared with the clinician. Using screen sharing capabilities, all messages inputted through the device were immediately visible to the clinician irrespective of the clinician’s physical location.

Videoconferencing software was used during the telepractice session to simulate the face-to-face interactive nature of direct services. Skype™, a free desktop videoconferencing application, was used for the video and audio communication. Skype™ software uses 256-bit Advanced Encryption Standard (AES) encryption to encrypt communication between users, is compatible with Macintosh and Windows operating systems, and has voice, video call, and instant messaging functionality (Skype Technologies S. A., 2011). Adobe® ConnectNow, was used for screen-sharing purposes during the telepractice phase of the investigation. Using this software, intervention materials were shared between the clinician and participant (located at the two different sites). Adobe® ConnectNow is a web conferencing system used for online meetings, eLearning, and webinars. The system is flash-based and offers free online meetings for up to two people per meeting. Adobe® ConnectNow implements Secure Sockets Layer (SSL) technology for both server authentication and data encryption.

**Procedures**

**Baseline Sessions**

Baseline data were obtained outside of the intervention environment four weeks prior to the onset of the study. During this time, the participant was not introduced to telepractice technology or the associated material. The objectives were derived from the participant’s IEP speech and language goals and performance outcomes during the baseline observations. The participant produced only limited spontaneous productions on his device of the grammatical morpheme targets with respect to the following morphemes: progressive verb form –ing; the past verb form –ed; and the plural –s. The participant was presented with prompt questions to elicit and assess the use of target objectives in an independent setting. The data for the baseline prompts were collected in the absence of any cueing or support from the clinician. However, informal observations during the baseline phase revealed that the participant relied on moderate-to-maximum support from paraprofessionals, clinicians, teachers, and parents in the form of visual, verbal, and tactile prompting to generate any grammatical morphemes using his speech-generating device via icon selection rather than spelling.

**Intervention Sessions**

Intervention sessions were 60 minutes in length and consisted of two parts: (1) a pre-intervention grammatical morpheme probe; and (2) grammatical morpheme intervention. The pre-intervention probe task consisted of presenting two pictures representing plurality and four pictures representing verbs. Probe questions were randomly selected and varied throughout the course of the study to account for a learning effect. The participant’s responses to probe questions were produced by selecting icons on his speech-generating device (rather than spelling on the keyboard), which was connected to the computer. A text-based response was generated for each probe. As previously stated, during the probe tasks the participant did not receive any prompting or cueing from the clinician or his parents. Each probe task was approximately 10–15 minutes in duration. Following the probe phase, the target grammatical morpheme intervention activities consisted of models, recasts, and contrastive statements provided by the clinician to support the participant’s use of appropriate grammatical morphemes within the context of books and self-generated stories. These activities lasted approximately 40–45 minutes in duration.

During the four-week onsite implementation condition, the clinician traveled 30 minutes each way to the participant’s home for four, 60-minute intervention sessions. Prior to the start of
each session, the participant’s device was connected via a USB cable to Computer 1 to ensure that all phrase and sentence constructions generated through selection of icon sequences were represented on the monitor. The clinician provided services at the participant’s home and all probes and treatment materials were presented using the computer at the participant’s home. The participant responded by using his device, which was connected to the computer. For example, when presented with a probe picture and subsequent question, the participant responded by using his device to select icons that displayed a text answer in the text field on the computer. This enabled the participant, parent, and the clinician to view a text-based representation of the device output on the computer monitor.

For the telepractice setting, the participant’s parents turned on the workstation and connected to the clinician via Skype™ and Adobe® ConnectNow for the four, 60-minute intervention sessions. Similar to the onsite interventions, the participant’s device was connected to the computer and all probe and therapy material was presented on the monitor. Through the screen-sharing application on Adobe® ConnectNow, the participant was able to view all stimuli (i.e., probe and intervention activities) presented by the clinician and respond to questions using his device. The clinician transferred control of the mouse to the participant if the therapy material presented during the session on the shared screen required a response. The clinician and participant interacted via videoconferencing. Responses to all stimuli occurred through inputting messages into text-based programs (through selection of icon sequences for the participant and through typing for the clinician) onto the computer, consistent with the onsite interactions.

Data Analysis

Statistical analyses and comparisons of baseline data and the two intervention stages were performed using visual inspection as well as non-parametric analysis using an Improved Rate Difference (IRD) and the Tau-U analysis. The IRD calculation is supported in the literature as an appropriate and effective statistic for use in medical research (Parker, Vannest, & Brown, 2009) and it is applied to single case research to express the difference in performance outcomes between baseline and the subsequent intervention measurements. The IRD is determined by comparing the improvement rate between two phases (i.e., measuring non-overlapping data points) and is better correlated than frequently utilized effect/size measurements with percent of non-overlapping data (Parker et al., 2009).

The Tau-U is a nonparametric method for measuring the non-overlapping data between two phases. The Tau-U combines non-overlap between phases with trends from within each intervention phase. It is a “distribution free” technique that results in a z-score and level of significance value (Parker, Vannest, Davis, & Sauber, 2011). This analysis enabled the authors to compare and determine if there was a correlational difference in the participant’s outcomes based on probe and intervention data when services were delivered in an onsite versus telepractice setting. For all statistical analyses, the level for non-directional, statistical significance was set at .05.

Probe data were collected at baseline and throughout treatment phases for both onsite and telepractice intervention conditions. The baseline probe data were compared to the onsite treatment probe data collected from the first condition using the IRD calculation. The Tau-U calculation was used to compare the baseline probe data to the probe data from the two treatment conditions. This method was also implemented to compare probe data collected during the onsite condition to the probe data collected during the telepractice condition. Similarly, the number of independent responses observed during the onsite condition was compared to the number of independent responses observed during the telepractice condition.

Results

Table 1 illustrates that the participant’s documented baseline probe outcomes as compared to the onsite probe outcomes yielded an IRD of 1.00, which suggests that all treatment probe data
exceeded baseline probe data. These results support that the intervention had a “large to very large” (Parker et al., 2011, p. 147) effect. The Tau-U analysis suggests that a statistically significant correlation between baseline probe data and onsite probe data exists (p < .05).

Moreover, a statistically significant correlation was evident when comparing baseline probe data to telepractice probe data (p < .05). A comparison of the probe data from the two treatment conditions resulted in a non-statistically significant correction (p = 0.25), which supports that intervention outcomes did not vary when services were delivered via onsite versus telepractice. The Tau-U method was used to compare the number of independent responses the participant made during intervention when receiving onsite services as compared to telepractice services. This analysis resulted in a statistically significant correlation between the numbers of independent responses made during the onsite condition as compared to the telepractice condition (p < .05); however, the authors believe that this outcome may be more a reflection of a learned skill rather than a statistical difference due to service delivery method.

Table 1. Statistical Analysis for Participant.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>IRD</th>
<th>Tau-U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Probe vs. On-site Probe</td>
<td>1.00</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>Baseline Probe vs. Telepractice Probe</td>
<td></td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>On-site Probe vs. Telepractice Probe</td>
<td></td>
<td>p = .25</td>
</tr>
<tr>
<td>On-site Independent Responses vs. Telepractice Independent Responses</td>
<td></td>
<td>p &lt; .05</td>
</tr>
</tbody>
</table>

Figure 3 illustrates that the participant achieved and maintained target goals across intervention settings regardless of service delivery method. Visual inspection of pre-intervention probe data (i.e., probe data obtained at the start of each session) revealed an increase in the participant’s use of icon selections to generate the target morphemes, progressive verb form –ing, the past tense verb form –ed, and the plural –s grammatical during the intervention phases. The participant’s accuracy on pre-intervention probe tasks steadily increased from 33% to 83.3% to 100% during subsequent sessions.

Figure 3. Percentage Probe Accuracy

As illustrated in Figure 4, data obtained from the intervention seasons during structured and unstructured intervention tasks revealed that the participant’s use of the target grammatical morphemes increased, as did his level of independence producing the targets as evidenced by the contrasting prompted versus independent data. Visual inspection of prompted versus independent productions of the grammatical targets illustrated that independent responses increased, while prompted responses decreased as the intervention progressed.
To ensure experimental control of the independent variable, the onsite and offsite conditions were controlled for the number of session per service condition (four onsite vs. four telepractice sessions) and length per session regardless of method of service delivery (60 minute sessions). The treating clinician, material used, and location of the participant during services remained constant between the two conditions.

Treatment fidelity was estimated by comparing the collection of the probe data in which the participant engaged during the intervention activities without clinician cueing and prompting. The participant’s responses to activities presented during the intervention phases were also text-based and to ensure the reliability of the data collected, judgments were made to determine whether a response was either independent or required clinician prompting. A second trained coder viewed 20% of the total data (a standard set by Fey, Cleave, Long, & Hughes, 1993) and judged whether the participant’s responses were independent or prompted.

Inter-rater reliability was determined using point-by-point inter-observer agreement. This was calculated by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100. The inter-observer agreement scores for the prompting provided were 98%, suggesting a high level of agreement.

Discussion

Research investigating the use of tele-AAC, telepractice for direct services with students who use AAC devices, is extremely limited. The lack of research may be due to the more recent emergence of telepractice as a potentially effective therapeutic method, and/or the perceived limitations of this method of intervention with respect to individuals with severe complex communication needs.

This present study examined what differences, if any, were evident in a participant’s progress and treatment outcomes on three target grammatical skills when intervention was delivered in an onsite setting as compared to a telepractice setting. Results of the probe data revealed a significant increase in target grammatical productions when the intervention sessions were compared to the baseline data. The findings also suggest that there was not a significant correlated difference between the probe data collected during the onsite intervention condition as compared to the telepractice intervention condition. A comparison of the number of independent responses found that there was a statistical correlated difference between the two treatment conditions in that the participant demonstrated an increase in the number of independent responses during the telepractice condition. The visual inspection of intervention data supports this finding and suggests that the participant’s independent productions of grammatical targets increased, while prompted productions decreased.
However, as previously mentioned, these results must be interpreted with caution as the authors believe that the level of independence demonstrated during the second treatment condition may reflect the participant’s learning throughout the investigation period. It is plausible that this observation would have been noted regardless of the order of intervention settings.

This feasibility study was conducted with one participant; however, the clinical implications of these preliminary results are promising. This study demonstrates that the implementation of an evidence-based protocol during an AAC intervention program onsite as compared to a telepractice delivery method were equivalent. This finding was evidenced by the non-significant correlated relationship between probe data during the onsite versus telepractice sessions.

The authors speculate that the use of text-based intervention materials supported the transition between onsite and offsite services. In addition, during the telepractice setting, the representation of the participant’s device output into a shared document compensated for the clinician’s inability to directly zoom in and view the participant’s device via videoconferencing software. Thus, the clinician was able to provide individually-tailored feedback based on the shared document irrespective of the physical location.

The results of this study have several implications for clinical practice and intervention for individuals with AAC. First, this study found that grammatical morpheme intervention is successful when implemented through onsite versus telepractice service delivery. Second, this study demonstrated that telepractice can be successful with nonverbal individuals who have complex and severe communication needs and physical disabilities. As such, professionals can now feel more confident when considering the use of telepractice as a method to provide intervention to individuals irrespective of their geographical location. Despite the shortage of well experienced SLPs, especially with expertise in AAC, service delivery via telepractice has the potential to significantly improve access to intervention services for students with special needs, including those who require assistive technologies such as AAC systems.

Limitations

This feasibility study employed a single-subject research design with only one participant and one treating clinician. The ability to generalize the results to other AAC device users is limited. In addition, as the goal of this feasibility study was to determine whether or not telepractice is a viable mode of service delivery for individuals utilizing assistive technologies, this investigation did not include a reversal phase to further confirm the participant’s progress. Lastly, this investigation used text-based responses and intervention materials to compensate for difficulties viewing the device screen when using internal webcams and as a result, cannot generalize to individuals with literacy-based challenges.

Directions for Future Research

This study is one investigation that was data driven and controlled for various factors, thus it provides some evidence regarding the success of providing intervention services via telepractice to a non-verbal AAC device user. Telepractice is one means to address the critical shortage of speech and language specialists. It is suggested that future research explore the use of tele-AAC with a greater number of AAC device users using a variety of AAC systems and data driven, or evidence-based interventions. It is suggested that clinical researchers also examine the use of telepractice with individuals with other communicative disabilities, such as those with significant cognitive and physical disabilities, to determine what additional supports, hardware, software, and techniques can be implemented within the therapeutic context. Additional research is needed to explore these issues and to further investigate the components required to deliver services in a systematic framework that will support the implementation, sustainability, fidelity, and validity of telepractice services.
References


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