

**TELE-INTERVENTION FOR CHILDREN WITH HEARING LOSS:
A COMPARATIVE STUDY**

by

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LIST OF ABBREVIATIONS

dBHL: decibel hearing level

TI: tele-intervention

AVT: Auditory Verbal Therapy

SD: standard deviation

IQR: interquartile range

FORMATING

APA referencing style was utilized in this dissertation.

ABSTRACT

This pilot study compared tele-intervention to conventional intervention for children with hearing loss in terms of communication performance, parent perceptions and clinician perceptions. A within-participant design was employed, including 10 children with hearing loss and their parents who each received a structurally similar tele-intervention and conventional intervention session in a counterbalanced manner. Quality of communication performance was analysed using a modified Tait Video Analysis method. Parent- and clinician perceptions were collected through rating-scale surveys and thematic analysis of qualitative responses. No significant difference ($p>0.05$) was found between tele-intervention and conventional intervention in terms of communication performance of children. Parent perceptions were not significantly different ($p>0.05$) between conventional and tele-intervention in terms of facilitating meaningful communication interaction. Even though tele-intervention and conventional intervention received high ratings by parents, a preference towards conventional intervention was evident in terms of parents' comfort level during the session, whether they found it to be a beneficial experience and whether they would like to continue receiving intervention through this method. Clinician perceptions of conventional and tele-intervention were not significantly different ($p>0.05$) as both methods received similar high scores. This study provides preliminary evidence that, even with its technical challenges and unfamiliarity, tele-intervention is effective for communication intervention and can be a valuable solution to typical barriers such as distance and the shortage of trained interventionists. Outcomes of the current study, along with the growing body of research in the field of tele-intervention, suggests that this method of service-delivery offers an alternative to conventional in-person methods. Tele-intervention could be a valuable option of service delivery especially

for, but not limited to, families of children with hearing loss who reside great distances from specialized services required.

Keywords: tele-intervention, tele-rehabilitation, children with hearing loss, clinical outcomes, communication performance, parent perceptions, clinician perceptions.

1. INTRODUCTION

1.1. Background

According to the World Health Organization, 0.5 to 5 in every 1000 infants have congenital or early childhood onset sensorineural hearing loss (WHO, 2010). The effects of hearing loss in newborns and young infants, if left undiagnosed or untreated, can be pervasive and far-reaching. Infant hearing loss severely disrupts the development of spoken language, subsequently affecting reading comprehension, cognitive development, over-all academic achievement and vocational attainment (Moeller, Tomblin, Yoshinaga-Itano, Connor & Jerger, 2007; Olusanya, Ruben & Parving, 2006; Yoshinaga-Itano, 2004; Yoshinaga-Itano, Sedey, Coulter & Mehl, 1998). Consequent socio-emotional effects of hearing loss can influence emotional well-being, dynamics of family life, affect relationships with significant others and greatly impact interpersonal communication and quality of life (Moeller, 2000; Olusanya et al., 2006; Yoshinaga-Itano, 2003). This also causes feelings of isolation, uncertainty, anger, depression, anxiety and stress in parents of children with hearing loss (Kurtzer-White & Luterman, 2003; Olusanya et al., 2006)

Early detection of hearing loss in newborns and infants before the age of three months, followed by early communication intervention, has emerged as an effective strategy for reducing the disabling developmental effects of permanent hearing loss impairment (Olusanya, Swanepoel, Chapchap, Castillo, Habib, Mukari, et al., 2007). It allows families more time to receive counseling and support, obtain information, make decisions and deal with the grieving process following diagnosis (Kurtzer-White & Luterman, 2003). The first six months of life present a particularly sensitive period in

early language development whilst the first five years are critical for central auditory pathway development (Calderon, 2000; Calderon & Naidu, 2000; Kennedy, McCann, Campbell, Law, Mullee, Petrou, et al., 2006; Moeller, 2000; Snyder & Yoshinaga-Itano, 1999; Yoshinaga-Itano et al., 1998; Yoshinaga-Itano & Snyder, 1999). If hearing loss is identified by six months of age and appropriate early communication intervention is continuously provided within the first five years, the child can develop language abilities similar to normal hearing peers and show significantly improved speech and socio-emotional development (Calderon, 2000; Calderon & Naidu, 2000; Kennedy, McCann, Campbell, Law, Mullee, Petrou, et al., 2006; Moeller, 2000; Snyder & Yoshinaga-Itano, 1999; Yoshinaga-Itano et al., 1998; Yoshinaga-Itano & Snyder, 1999).

Besides the age of identification and initiation of intervention, the level of parent involvement has also been shown to contribute to significant predictions of language outcomes at five years of age (Moeller, 2000). This highlights the importance of implementing family-centred intervention, where parents and other family members take on a larger role as primary facilitators of their child's listening and spoken language development, while the therapist guides parents in facilitating optimal parent-child interaction. This type of therapeutic intervention should be on-going and frequent, e.g. weekly intervention sessions to ensure optimal outcomes.

1.2. Rationale for tele-intervention

In recent years the use of information and communication technology has been proposed as a way of providing this intervention remotely. Through the use of ever-improving tele-communication technology, great advancements have been made in

increasing global connectivity, especially in reaching rural or geographically dispersed areas. Tele-health is an emerging method of health care service delivery via distance technologies. It has been demonstrated to allow for remote screening, diagnosis, intervention, counseling, education and specialized interdisciplinary care (Cason, Behl & Ringwalt, 2012; Swanepoel & Hall, 2010). It also holds promise in specifically addressing the current issues pertaining to the supply and demand of early intervention services. This method of on-going (long-term) distance service delivery is referred to as tele-intervention (Cason et al., 2012; McCarthy et al., 2010).

Tele-intervention allows for service delivery to families living in rural and remote areas where these services were previously unavailable due to barriers such as distance and travelling costs (McCarthy, Muños & White, 2010). Tele-intervention could also provide the solution to one of the major challenges to quality service delivery, the shortage of clinicians trained to provide intervention to children with hearing loss (McCarthy, 2010).

At present, permanent bilateral hearing loss in infants (>40 dB HL) is reported to affect approximately 798 000 newborns worldwide per year with over 90% of them living in developing countries (Olusanya & Newton, 2007; Olusanya et al., 2009). Unfortunately, many of these children in developing countries still do not have access to the necessary early-intervention services (WHO, 2010). According to McCarthy et al. (2010) there could be several reasons for this. Firstly, although deafness occurs more frequently than any other birth defect, it is still considered to be a relatively low-incidence birth condition. Secondly, children with hearing loss do not necessarily reside in the same area, which complicates access to available educational systems.

Thirdly, there is a shortage of appropriately trained professionals to deliver intervention services, specifically for children with hearing loss. Finally, many children with hearing loss live a great distance from the specialized services they require. These services are usually located in metropolitan areas.

Recent advances made in tele-health, together with declining internet connectivity costs, has allowed tele-conferencing software as a possible means of providing high quality tele-intervention services in settings where it is difficult or unnecessarily expensive to have the health care provider and the patient together in the same room at the same time (McCarthy et al., 2010; Swanepoel & Hall, 2010).

1.3. Current evidence for tele-intervention

The growing body of research reporting on the use of tele-health for children with hearing loss which, together with several early intervention programs for infants and toddlers with hearing loss, have been pioneering the use of tele-health to provide the services needed to foster optimal communication development. Reported benefits of tele-intervention include cost-savings and high family satisfaction (Behl, Houston, Guthrie & Guthrie, 2010; Cason, 2009; McCarthy et al., 2010). Evidence from related fields reports improvement in the speech- and language skills of children receiving speech therapy via tele-intervention, along with high family satisfaction (Baharav and Reiser, 2010). Studies regarding assessment of motor speech disorders in patients with acquired neurological impairment (Hill, Theodoros, Russell, Cahill, Ward & Clark, 2006), speech treatment to school-aged children (Forducey, 2006), treatment of specific disorders such as stuttering in children (Sicotte, Lehoux, Fortier-Blanc & Leblanc, 2003), and treatment of articulation and language disorders in school-aged

children (Jessiman, 2003) have demonstrated tele-intervention to be a feasible alternative to conventional in-person approaches. In other fields, such as occupational therapy, physical therapy and psychology, research studies regarding tele-intervention of 0 to 2 year olds have also concluded that it is a viable alternative to in-person treatment and that it allows for time- and resource saving (Heimerl & Rasch, 2009; Kelso, Fiechtl, Olsen & Rule, 2009).

Tele-intervention programs currently underway serving families with children with hearing loss include the RIDBC (The Royal Institute for Deaf and Blind Children) Teleschool in Australia (Dally & Conway, 2008; McCarthy et al., 2010), the Sound Beginnings program at Utah State University in the U.S.A (Behl et al., 2010), the e-AVT program at the Hear and Say Centre in Brisbane, Australia (Constantinescu, 2012), and the ConnectHear Program in Wisconsin, U.S.A. (Lalios, 2012), among others. These programs all show high satisfaction from parents and professionals involved (Behl et al., 2010; Constantinescu, 2012; Dally & Conway, 2008; McCarthy et al., 2010). Parents at the RIDBC Teleschool felt less anxious and valued the weekly contact, support and guidance offered by the specialist (McCarthy et al., 2010). They preferred it to telephone and correspondence services, as the early-intervention specialist is able to directly observe the parent-child interactions and provide responsive feedback which can be applied immediately under supervision of the specialist (Dally & Conway, 2008). They also appreciated the decrease in waiting lists, travel arrangements and cancellations due to unforeseen obstacles, such as weather or illness (Dally & Conway, 2008). Early-intervention providers in the RIDBC Teleschool program (Dally & Conway, 2008) noted that parents seemed to acquire early-intervention skills and techniques more rapidly than in the traditional in-person model, where early-intervention specialist engages directly with the child with only

occasional involvement of the parent (Dally & Conway, 2008). The children in the RIDBC Teleschool appeared to progress at the same rate as with traditional in-home visits, but no data was collected to compare the outcomes of children in the program with others receiving traditional in-person services. Evidence suggested that the remote and in-person service delivery were cost comparative and that, over time, remote services may become even more cost efficient than local delivery options (Dally & Conway, 2008).

The ConnectHear Program in Wisconsin, U.S.A. showed positive outcomes in auditory skill development, spoken language development in children with hearing loss (Lalios, 2012). The Sound Beginnings Program at Utah State University and The Hear and Say Centre in Brisbane, Australia, allows for the delivery of Auditory Verbal Therapy (AVT) via distance technologies. AVT is an effective early intervention approach for children with hearing loss, which guides parents to develop their children's spoken language through listening (Dornan, Hickson, Murdoch & Houston, 2009; Dornan, Hickson, Murdoch & Houston, 2007; Eriks-Brophy, 2004). The active engagement of the parent as the primary facilitator of the child's listening and spoken language development during tele-intervention sessions made it easier for parents at the Sound Beginnings Program to integrate therapy strategies into everyday life (Behl et al., 2010). Their children were more responsive, followed their directions better, and generally showed improved interactions (Behl et al., 2010). Sessions were more predictable and more consistent. Fewer disruptions and cancellations were experienced, thereby improving the children's abilities to reach their listening and spoken goals (Behl et al., 2010). The security of not passing along illnesses is also especially important for children who are medically vulnerable. Video recordings of the

sessions also allowed for monitoring the child's development over time as well as for sharing with other family and friends (Behl et al., 2010; McCarthy et al., 2010).

Although tele-intervention offers a number of benefits to families, implementation of this service in specific settings may pose a challenge. The high quality, broadband internet connectivity needed for reliable video communication between the clinician and the family is usually expensive and often unavailable in the communities where it is needed most (Behl et al., 2010). Extra costs for a computer, camera and microphone also need to be considered. Furthermore, even with all these elements in place, technology can be fickle. Video or audio quality may vary depending on the time of day or other external circumstances and internet connection can be disrupted (Behl et al., 2010; Constantinescu, 2012). Some parents and professionals experience a lack of confidence when using technology and even those who are comfortable with technology may require technical support (Behl et al., 2010). Another challenge for parents is to create a therapeutic space in the house, ideally a quiet carpeted room (for an optimal acoustic environment) with good lighting and no interruptions from other family members (Behl et al., 2010). Finally, some families may simply prefer the support provided by a clinician that is physically present during therapy sessions. Therefore tele-intervention should be considered as just one possible vehicle of delivering quality family centered early intervention services (Behl et al., 2010).

When comparing treatment approaches, in most cases, tele-intervention produced similar or better outcomes to conventional in-person approaches and is deemed a feasible, reliable alternative to conventional therapeutic intervention methods of service delivery (Behl et al., 2010; Forducey, 2006; Hill et al., 2006; Jessiman, 2003; McCarthy et al., 2010; Sicotte et al., 2003). Evidence like this suggests that tele-

intervention could be used to overcome barriers like the shortage of trained early-intervention providers and the high costs of providing services to geographically dispersed families of children with hearing loss (Behl et al., 2010; Cason et al., 2012; Cherney & Van Vuuren, 2012; McCarthy et al., 2010).

1.4. Problem statement

Despite the increasing use of tele-intervention for children with hearing loss, there is limited evidence demonstrating comparable clinical outcomes between remote- and in-person methods (Hersh, Helfand, Wallace, Kraemer, Patterson, Shapiro & Greenlick, 2001; McCarthy et al., 2010).

The use of tele-intervention for the widely dispersed hearing impaired paediatric population is an important research priority, considering the existing barriers to the recommended ongoing weekly in-person intervention. For this vulnerable population, tele-intervention could be the key to improved access to intervention services, resultant compliance and improved outcomes.

The current study compared home-based tele-intervention and clinic-based conventional intervention for children with hearing loss in South Africa in terms of communication performance and perceptions of parents and clinicians. The study also served to describe initial responses to receiving tele-intervention and the associated child and family characteristics.

RESEARCH QUESTION

Is tele-intervention comparable to conventional intervention in terms of the quality of communication interaction, parent perceptions and clinician perceptions?

2. METHODOLOGY

2.1. Research aims

Main aim

The main aim of this pilot study was to compare tele-intervention to conventional intervention for children with hearing loss in terms of communication performance, parent perceptions and clinician perceptions.

Sub-aims

The following sub-aims were formulated in order to achieve the main aim:

- Sub-aim 1: To describe the child's communication performance during tele-intervention compared to conventional intervention.
- Sub-aim 2: To describe parent perceptions of tele-intervention compared to conventional intervention.
- Sub-aim 3: To describe clinician perceptions of tele-intervention compared to conventional intervention.

2.2. Research Design

An exploratory, within-subject, quasi-experimental research design was followed, employing quantitative and qualitative measures. According to Maxwell and Satake (1997), an exploratory investigation is aimed at investigating apparent associations

between two or more variables. With a multiple case study design, within-subject comparisons can be made. Within-subject design, also referred to as repeated measures design, is used when two or more measures are obtained from a sample of participants (Salkind, 2010). Conclusions can also be drawn from any significant differences or similarities observed between the two test-environments.

This study was quasi-experimental in nature, as the variables of the experimental environment (the home of the child- and parent participant) could not be fully controlled. Variables in the control condition (conventional intervention) were fully under the control of the researcher and clinician providing the therapy. Quasi-experimental methods often necessitate the use of more control procedures than true experiments and could be considered to be less powerful, but it is generally recommended when true experimentation is not possible. If properly conducted, quasi-experimental designs can be as effective as true experiments (Rossi, Freeman & Wright, 1979). In quasi-experimental studies study units are not randomly assigned to observational conditions as a result of ethical or practical constraints (Shadish, Cook & Campbell, 2002).

Furthermore this study also followed a cross-over design. This is an extended application of counterbalancing used to reduce systematic error (Maxwell & Satake, 1997). Two groups are typically used to evaluate the influence of a certain treatment versus another, with each group serving as its own control (Maxwell & Satake, 1997). Applied to the current study, half of the participants were under the control condition first and the other half under the experimental condition, counter-balanced. Data collection was then conducted. After this, the first half was under the experimental

condition and the second half under the control condition. Data collection then took place again.

The time-dimension of this study was cross-sectional, with one period of data-collection under the control condition (the recording of one conventional intervention session per participant) and one period of data collection under the experimental condition (the recording of one tele-intervention session per participant). Data was then analysed through the use of a communication measurement tool, parent questionnaires and clinician questionnaires.

Mixed quantitative and qualitative methods were used for measurements and data analysis. According to Salkind (2010) applying more than one method to answer a research question can lead to a more precise and holistic perspective of human behavior and experience. In the current study, mainly quantitative methods were used for within-participant and between group comparisons (Maxwell & Satake, 1997). This included:

- 1) a Tait-based communication performance tool (Tait, Nikolopoulos, Lutman, Wilson & Wells, 2001) to measure the communication performance of the child as well as the level of parent involvement (Appendix I)
- 2) rating scales in questionnaire format to measure expert parent perceptions (Appendices L and M)
- 3) rating scales in questionnaire format to measure clinician perceptions (Appendices O and P)

In addition, a qualitative component was added to the parent questionnaires (Appendices L, M and N) and clinician questionnaires (Appendices O, P and Q), in the form of open-ended questions, specifically to add depth to the description of clinician and parent perceptions that were conveyed. Qualitative methods are deemed more appropriate for the description of human behavior, which is complex and dynamic in nature (Maxwell & Satake, 1997). Also, unrestricted by the rigid structure of quantitative techniques it is said to foster the birth of new concepts, explanations and theories Maxwell & Satake, 1997). In this study, control over independent variables was enforced by including a control condition, the conventional in-person intervention, as well as the use of a cross-over design and within-participant comparisons.

2.3. Ethical considerations

Ethical approval was obtained by the Research Ethics Committee of the Faculty of Humanities of the University of Pretoria prior to data collection (Appendix A). Further ethical considerations were taken into account to protect the rights and welfare of participants (Maxwell & Satake, 1997).

Permission

For the current study, an information letter was provided and permission was obtained from the programme director of the *Centre for Listening and Spoken Language* in Pretoria, South Africa, for the purpose of providing clients of the centre with information regarding the study and allowing them (the child and his/her parent) to volunteer as participants in the study (Appendix B). Permission was also obtained from the programme director of the centre herself to participate as a research clinician participant (Appendix B).

Participants' consent

Letters of informed consent were compiled which explained the process to prospective participants in detail (Appendices C and D). One parent and child was randomly selected and asked to participate in a pilot study by signing a letter of informed consent (Appendix C). Nine more parents signed letters in order to allow them (Appendix D) and their minor children (Appendix G) to participate in the study. Older children signed letters themselves to participate in the study after the aim and procedures of the study was explained to them verbally on their own receptive language level in their home language of English or Afrikaans (Appendices E and F). The letters were easily understandable and clearly stated the title and aim of the study, along with a description of participants' rights (Maxwell & Satake, 1997).

Confidentiality

It was further made clear that participants' personal information would remain strictly confidential and that recordings/video footage would be viewed only by the research clinician and the clinician conducting the intervention for the purpose of collecting data.

Participants' rights

Participants were informed that they (child or parent) have the right to withdraw from the study at any time.

Protection from harm, risks and discomforts

Participants were informed that there were no known medical risks or discomforts associated with this study, and that breaks would be provided should the parent or child experience fatigue.

Benefits

Participants were informed that there would be no direct benefit to them from participating in this study. They were informed that there are no known medical risks or discomforts associated with participating in the study. They were further informed that results of the study would help researchers gain a better understanding of how tele-intervention compares to conventional in-person intervention. Participants continued to receive on-going intervention services after termination of the study.

Release of findings

Participants were informed that findings of this study may be published in professional journals or presented at professional conferences.

Plagiarism

Plagiarism refers to the use or close imitation of the words or ideas of another author as one's own original work, without proper acknowledgement to the author (Leedy & Ormrod, 2005). In the current study all sources were appropriately acknowledged in the text as well as in the reference list, in order to avoid any form of plagiarism.

2.4. Participants

In order to reduce the likelihood of bias, selection criteria needed to be specified. Inclusion criteria, along with exclusion criteria formed the eligibility criteria according to which participants were selected for the research study (Salkind, 2010). The participant profile differed for each sub-aim as different sets of participants were required for each sub-aim.

2.4.1. Participants for sub-aim 1

The participants for sub-aim 1 consisted of children with hearing loss and their parents.

Exclusion criteria

Children receiving intervention through manual communication methods (sign language; cued speech; total communication) were excluded as participants, as communication interaction quality was measured according to verbal responses, among others.

Inclusion criteria

Children younger than 7 years of age and who were receiving therapy via an auditory oral method or AVT-method were included. For logistical purposes, parents were required to travel to Pretoria during the data collection period in order to receive one conventional in-person intervention session. High quality, high speed internet connection was required for optimal functionality during the tele-intervention session. Parents required access to a laptop, desktop computer or tablet with a built-in or loose-standing web-camera

Sample size

The sample consisted of ten children with hearing loss and their parents. One child and his/her parent were used for a pilot study to inform the data collection procedures and materials for sub-aim 1 prior to formal data collection.

Sampling technique

Ten children with hearing loss (8 female, 2 male) and their parents were selected from the Centre for Listening and Spoken Language client base, along with their early

interventionist, according to predetermined selection criteria and invited to participate. Participating families needed to be able to travel to Pretoria, where the Centre for Listening and Spoken Language is based, for at least one conventional intervention session and have internet access in their homes. The children and their participating parents (all mothers) provided written consent for their participation and their children's participation in the study. All 10 children started receiving conventional intervention for the development of listening and spoken language prior to the study for varying durations of time (average 32.4 months; range 16 to 61 months; SD 16.1 months). None of the participants had received tele-intervention prior to the onset of the study.

Age of children at the time of data collection ranged from 30 to 79 months (average 53.2 months; 17.3 SD) with their mothers aged 33.4 years on average (range 28 – 40 years; 3.9 SD). Table 1 describes further characteristics of the participating children.

Procedure for participant selection

Permission was obtained from the head of the *Centre for Listening and Spoken Language*, Pretoria, to provide information to all the centre's clients regarding the study and allowing them to volunteer as prospective participants in this study. An information session was held to introduce the researcher to the prospective participants and describing in detail what the study will entail. Clients from the centre then volunteered to participate by reading and signing the letter of informed consent (Appendices B and C).

2.4.2. Participants for sub-aim 2

Inclusion criteria

Parents of the ten children selected for sub-aim 1 were included. Parents needed to be proficient in English to be able to read, understand and answer the questionnaires.

Sample size

Ten parents were included.

Procedure for participant selection

Participants for sub-aim 2 comprised one parent for each of the ten children participating in sub-aim one. Parents, as for the child participants in sub-aim one, were selected randomly from the *Centre for Listening and Spoken Language* in Pretoria, South Africa, who received information regarding the study and ultimately agreed to participate.

2.4.3. Participants for sub-aim 3

Participants for sub-aim 3 consisted of one expert clinician.

Procedure for participant selection

The expert clinician was selected based on her 17 years of experience and specialisation in the intervention of children with hearing loss and their families. She opened the Centre for Listening and Spoken Language in Pretoria in January 2012, which is now serving 40 children with hearing loss and their families in South Africa and a number of neighbouring countries.

Inclusion criteria

The participant needed to have clinical expertise in early intervention for children with hearing loss and needed to be situated in Pretoria, South Africa, for logistical purposes.

2.5. Data collection Material and Apparatus

2.5.1. Data collection material and apparatus for sub-aim 1

Intervention sessions

Each intervention session comprised of one hands-on activity and one corresponding book-reading activity to facilitate joint attention and interaction between the parent and the child. The themes and language content of the intervention sessions corresponded with the titles of the four books, namely “In the Garden”, “Animal Friends”, “In the Park” and “Deep Blue Sea” from the “Fidgety Fingers” series (Graham, 2013). The hands-on activity consisted of small three-dimensional plastic animals corresponding to the animal characters in the books. Each parent and their child were randomly presented with two of the four themes, one during the tele-intervention session and one during the conventional intervention session.

Tele-intervention Information and Communication Technology (ICT)

Technical apparatus utilised by the clinician in her office included a laptop with Skype™ software installed, asymmetric digital subscriber line (ADSL) internet connection, a web camera, a flexible desk lamp to create optimal lighting during tele-intervention sessions, a white sheet to use as a backdrop to ensure optimal visibility

of the clinician during tele-intervention sessions and a video camera to film all conventional and tele-intervention sessions from the clinician's office.

Technical apparatus utilised by parents included their own personal desktop computer, laptop or tablet with Skype™ software installed, Internet connection and a web camera. Nine parents indicated that they would not need technical assistance; one parent indicated that she might need technical assistance. All ten participants reported that they have access to internet connectivity in their homes (fixed line or 3G cellular network). Due to the fact that in some countries Skype™ is considered to be insufficient for health care interactions, the following was implemented to safeguard the data and protect privacy and confidentiality of participants: strong password protection; dedicated use of the computer or Voice over Internet Protocol (VoIP) system for tele-intervention; virus protection and use of virus-free computers; use of audit controls to record how often data are accessed by or released to internal and outside entities.

Tait-based communication interaction assessment tool

The Tait Video Analysis was originally designed as a method of monitoring preverbal and early linguistic development of children with hearing loss who were wearing amplification devices (Tait, 1993; Tait et al., 2001). This method entails video recording child-adult interactions in a conversational setting, and the subsequent methodical analysis of six aspects of interaction, namely non-looking turns, vocal responses, non-vocal responses, vocal initiatives, non-vocal initiatives and no responses. The Tait Video Analysis has been shown to be a reliable method for assessing the level of auditory communication in children beyond the preverbal stage of language development (Percy-Smith, 2010; Tait et al., 2007). It has also demonstrated high

inter-observer reliability for assessing communicative skills of young children (Tait et al., 2007). The original Tait Video Analysis (Tait et al., 2001) was modified for the current study by adding eye-contact as another aspect of interaction, since eye-contact indicates communicative intent and contributes to the quality of communication interaction. This included eye-contact between child and parent or between child and clinician. In this study, the modified tool was used to analyse and compare each participant's quality of communication interaction in a single-recording during one tele-intervention and one conventional intervention session (Appendix H).

2.5.2. Data collection material and apparatus for sub-aim 2

The material and apparatus used to collect data for sub-aim 2 consisted of three questionnaires, which respectively addressed:

1. Parent perceptions regarding conventional intervention (Appendix K)
2. Parent perceptions regarding tele-intervention (Appendix L)
3. Parent's overall perceptions (Appendix M)

Each questionnaire comprised of closed-ended and open-ended questions to convey the parent's perceptions regarding conventional intervention versus tele-intervention. The three questionnaires were completed by 10 participants, bringing the total amount of questionnaires to 30.

2.5.3. Data collection material and apparatus for sub-aim 3

The material and apparatus used to collect data for sub-aim 3 consisted of three questionnaires, which respectively addressed:

1. Clinician perceptions regarding conventional intervention (Appendix N)
2. Clinician perceptions regarding tele-intervention (Appendix O)

3. Clinician's overall perceptions (Appendix P)

Each questionnaire comprised of closed-ended and open-ended questions to convey the clinician's perceptions regarding conventional intervention and tele-intervention.

2.6. Data Collection Procedures

2.6.1. Data collection procedures for sub-aim 1

One in-person preparation session was conducted with each research unit (child and parent) to describe the data collection process. One test-run tele-intervention session was conducted with each child and parent. Five of the families were part of the control group (receiving conventional intervention) for their first therapy session and part of the experimental group (receiving tele-intervention) for their second therapy session. The other five families were part of the experimental group (receiving tele-intervention) for their first session and part of the control group (receiving conventional intervention) for their second session. The clinician took additional field notes during each intervention session (Appendix I). Initially, one child and his parent, was used in a pilot study to determine the validity and reliability of the data collection procedures and materials for sub-aim 1.

Structure of a conventional or tele-intervention session

Parent orientation consisted of a five minute greeting, inquire about parent's past week and inquire about child's performance. The two predetermined activities that were to be used during the session were then discussed along with therapy techniques that were required to be used by the parents and clinician during the therapy session.

Intervention consisted of a demonstration by the clinician of how the parent can conduct each activity with the child. Parents were then asked to perform the activity with the child, while the clinician gave constructive guidance and coaching.

Thereafter, feedback consisted of a discussion between the clinician and parent regarding any difficulties that were experienced with therapy techniques and activities. In tele-intervention sessions, this also included the clinician and technical support personnel providing possible solutions to any technical difficulties that might have been experienced. Any activities that parents found difficult to execute were re-demonstrated by the clinician if necessary.

Video recordings of conventional- and tele-intervention sessions

Tele-intervention sessions were conducted via synchronous (real-time) video-communication software (Skype™). This application was selected based on factors such as video clarity, audio clarity, speed of audio and visual signal delivery, additional functions, compatibility with different types of operating systems (e.g. Microsoft/Apple), user-friendliness, installation process, availability, cost and internet connectivity required. Each conventional- and tele-intervention session was video recorded and stored electronically in DVD format.

Ten minutes of video footage, considered to be the best representation of the child's communication performance, was selected from the conventional intervention and tele-intervention recordings, respectively. The usefulness of the sample was heavily dependent on the extent to which it represented the normal interaction between a particular parent and child (Cole & Flexer, 2009).

As listed in Cole and Flexer (2009), the following steps were considered when attempting to obtain a representative sample:

- Recording/videotaping in a setting that is familiar to the child
- Discussing the purpose and planned use of the recording with the parent
- Waiting 5 to 10 minutes after setting up, before starting the actual recording, to allow the parent and child to become more comfortable around the equipment
- A recording should be at least 10 to 15 minutes in duration

2.6.2. Data collection procedures for sub-aims 2 and 3

The ten parent participants completed two questionnaires each. The clinician participant completed two questionnaires for each of the ten families after the analysis of all the video clips. Each of the questionnaires consisted of 5-point Likert-scale questions as well as open-ended questions.

The questionnaires respectively addressed the following:

1. Parent perceptions regarding conventional intervention (Appendix K)
2. Parent perceptions regarding tele-intervention (Appendix L)
3. Clinician perceptions regarding conventional intervention (Appendix N)
4. Clinician perceptions regarding tele-intervention (Appendix O)

Questionnaires were completed in the order that each child and parent received the conventional- and tele-intervention sessions.

For Questions 1 to 4 in these questionnaires the parents or clinician was able to select the answers “strongly disagree”, “disagree”, “not sure”, “agree” or “strongly agree” from a 5-point Likert scale. Questions 5 and 6 consisted of open-ended questions.

The parent or clinician lastly completed a final questionnaire regarding their over-all perceptions regarding conventional and tele-intervention, based on their experience thus far (Appendix M and Appendix P). The final questionnaire consisted of one closed-ended and three open-ended questions.

2.7. Data analysis procedures

2.7.1. Data analysis procedures for sub-aim 1

Representative samples from the ten tele-intervention sessions and 10 conventional intervention sessions were transcribed and analysed by the clinician participant and the first author using the modified Tait Video Analysis communication interaction tool. Each dependant variable assessed by the tool, namely: amount of vocal turn-taking, amount of non-vocal turn-taking, amount of vocal initiatives, amount of silent initiatives, amount of no responses, amount of non-looking vocal responses and amount of eye-contact were scored, e.g. 3/7. Statistical analysis software (SPSS v.21) was used to investigate within-participant differences in communication performance between conventional and tele-intervention sessions.

2.7.2. Data analysis procedures for sub-aims 2 and 3

For questions 1 to 4 in the questionnaires (Appendices K, L, N and O) the parents and the clinician were able to select the answers “strongly disagree”, “disagree”, “not sure”, “agree” or “strongly agree” from a 5-point Likert scale. Analysis was performed on these questions with a non-parametric test called the Wilcoxon Signed-Rank test. In this case it was used to examine the difference between paired measurements. The distribution of the 10 parents’ scores on the 5-point Likert-scales was calculated to

means, which displayed the perceived differences or similarities between the two-test environments (tele-intervention and conventional intervention) for each participant. Each of the ten parents and the clinician lastly completed a final questionnaire (Appendix M and P) consisting of four questions regarding their over-all perception of tele-intervention, based on their experience thus far. By means of these open-questions, a detailed description of answers given to closed-ended questions was provided. Thematic analyses of these answers were conducted (Salkind, 2010). Any central themes, trends or common ideas that were found within the participants' answers were identified and organised (See Table 4 in Chapter 3 and Appendix Q).

3. TELE-INTERVENTION FOR CHILDREN WITH HEARING LOSS: A COMPARATIVE PILOT STUDY

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3.1. Abstract

Introduction: This pilot study compared tele-intervention to conventional intervention for children with hearing loss in terms of communication performance, parental perceptions and clinician perceptions.

Methods: A within-subject design was employed, including 10 children with hearing loss and their parents who each received a structurally similar tele-intervention and conventional intervention session in a counterbalanced manner. Quality of communication performance was analysed using a modified Tait Video Analysis method. Parent- and clinician perceptions were collected through rating-scale surveys and thematic analysis of qualitative responses.

Results: No significant difference ($p > 0.05$) was found between tele-intervention and conventional intervention in terms of communication performance of children. Parent perceptions were not significantly different ($p > 0.05$) between conventional and tele-intervention in terms of facilitating meaningful communication interaction. Significant

differences were evident for parents' comfort level during the session, whether they found it to be a beneficial experience and whether they would like to continue receiving intervention through this method. Clinician perceptions of conventional and tele-intervention were not significantly different ($p>0.05$) and tele-intervention was deemed a valuable method of service delivery for clients.

Discussion: This study provides preliminary evidence that tele-intervention is effective for communication intervention and can be a valuable solution to typical barriers such as distance and the shortage of trained interventionists.

Keywords

Tele-intervention, tele-rehabilitation, children with hearing loss, clinical outcomes, communication performance, parent perceptions, clinician perceptions.

3.2. Introduction

Early detection, identification and diagnosis of hearing loss, allows for timely delivery of early intervention services.¹ If family-centered early communication intervention commences before the age of six months and is continuously provided throughout the critical period of central auditory pathway development (0-5 years), a child can develop language abilities which are similar to their normal-hearing peers.²⁻⁸

Of the estimated 32 million children living with disabling hearing loss worldwide, 90% reside in developing countries and many in geographically dispersed areas with limited access to the necessary intervention and educational services.⁹⁻¹² Additionally, there is a major shortage of appropriately trained professionals who deliver intervention services to children with hearing loss.¹³⁻¹⁹ A recent global survey has revealed that the

gap between the need and available services for individuals with hearing loss in sub-Saharan Africa is among the largest in the world and that many sub-Saharan countries lack trained health personnel, education facilities, data and national plans to address the needs of those living with ear and hearing problems.¹²

Alternative methods are pursued as a necessity to increase access to services across sub-Saharan Africa.¹⁶ These methods include the use of automation, telehealth and now also mobile health. Telehealth is a method of providing health care services remotely via distance technologies and has been demonstrated to allow for remote screening, diagnosis, intervention, counseling, education and specialised interdisciplinary care.²⁰⁻²² It also holds promise in addressing the supply and demand of intervention services by increasing access of families with children who have hearing loss to appropriately trained clinicians.^{15,16} This method of remote service delivery is referred to as tele-intervention.^{15,22} Tele-intervention allows for intervention service delivery to families living in rural and remote areas where services were previously unavailable, due to barriers such as distance and travelling costs.¹⁵ Recent advances in telehealth, together with declining internet connectivity costs, is enabling tele-conference software as a viable means of providing high quality tele-intervention services in settings where it is difficult or unnecessarily expensive to have the health care provider and the patient meeting in person.^{15,21}

Tele-intervention has been deemed, in a number of studies and literature reviews, to be a viable alternative to its conventional counterpart in speech- language pathology,^{15,23,24} specifically for the assessment of motor speech disorders,²⁵ language development in school-aged children²⁶ and treatment for stuttering,²⁷ speech

disorders,²⁸ acquired neurologic speech and language disorders²⁹ and parent training in early autism.³⁰ In related fields, such as occupational therapy, physical therapy and psychology, research studies involving 0 to 2 year olds have also concluded that tele-intervention is a viable alternative where in-person services are not feasible³¹ and that it allows for time- and resource saving.³²

Parent-reported benefits include high family satisfaction, cost-savings, fewer waiting lists, fewer travel arrangements, fewer unforeseen obstacles and reduced feelings of anxiety and depression, due to the emotional support, reassurance and guidance provided by the therapist on an on-going or weekly basis.^{15,33-35} Parents felt that their children were reaching their listening and language goals and were satisfied with their progress in therapy.^{15,35} Benefits reported by clinicians involved in tele-intervention programs for children with hearing loss, include active parental engagement and more rapid acquisition of early intervention skills, allowing for easier integration of therapy strategies into everyday life.^{15,33,35,36} In this family-centered model of intervention, the parent takes on the role as the child's primary communication partner with limited physical involvement from the clinician/therapist.^{15,33} Clinicians furthermore reported increased participation by fathers and other family members.^{15,33}

Even though tele-intervention offers benefits, implementation of services in certain settings may pose a number of challenges.³⁷ The infrastructure, equipment and high-quality broadband internet connectivity, which is necessary for reliable video communication between the clinician and the family, is often expensive and even unavailable in communities where children and their families need it most.^{35,36} Even with these elements in place, technology can be fickle with audio/video quality varying,

depending on the time of day or other external circumstances.³⁵ Some families may experience a lack of confidence with technology and even those who are comfortable using technology might need technical support. Another challenge is creating an ideal therapy space in the house, taking acoustic and visual elements into account. Lastly, some families may simply prefer the physical presence of the clinician. It is thus important to bear in mind that tele-intervention is merely one possible vehicle of delivering quality family centered early intervention services.^{35,36}

Even with its challenges, preliminary evidence suggests that tele-intervention could be used to overcome barriers like the shortage of trained early-intervention providers and the high costs of providing services to geographically dispersed families of children with hearing loss.^{15,22,35} Despite increasing use of tele-intervention for children with hearing loss there is limited evidence on its clinical efficacy compared to conventional intervention.^{15,38,39,51} The current study therefore investigated home-based tele-intervention for children with hearing loss compared to clinic-based conventional intervention in South Africa according to communication performance and perceptions of parents and clinicians. In particular the current study served also to describe initial responses to receiving tele-intervention and the associated child and family characteristics that impact perceptions.

3.3. Methods

This within-subject study compared tele-intervention to conventional intervention for ten children with hearing loss and their families using a counterbalanced cross-over design to compare quality of communication performance, and parent and clinician

perceptions. Ethical clearance was obtained from the appropriate ethics committees prior to the onset of the study.

Research participants

Ten children with hearing loss (8 female, 2 male) and their parents were selected from the Centre for Listening and Spoken Language client base, along with their early interventionist, according to predetermined selection criteria. Participating families needed to be able to travel to Pretoria, where the Centre for Listening and Spoken Language is based, for at least one conventional intervention session and have internet access in their homes. The children and their participating parents (all mothers) provided written consent for their participation and their children's participation in the study. All 10 children started receiving conventional intervention for the development of listening and spoken language prior to the study for varying durations of time (average 32.4 months; range 16 to 61 months; SD 16.1 months). None of the participants had received tele-intervention prior to the onset of the study.

Age of children at the time of data collection ranged from 30 to 79 months (average 53.2 months; 17.3 SD) with their mothers aged 33.4 years on average (range 28 – 40 years; 3.9 SD). Table 1 describes further characteristics of the participating children.

Table 1. Participant characteristics

Average age of child	53.2m (17.3 SD)
Gender	8 Female; 2 Male
Degree of hearing loss *	1 Moderate (41-55dB) 1 Moderate-to-severe (56-70dB) 4 Profound (71-90dB) 4 Profound (>90dB)
Type of hearing loss	8 Sensorineural 1 Mixed 1 Auditory Neuropathy Spectrum Disorder

Amplification	5 Bilateral Cochlear Implants
	2 Bilateral Hearing Aids
	1 Bilateral Bone Anchored Hearing Aids
	1 Bimodal amplification
	1 No amplification
Device used for tele-intervention session in current study	1 Desktop PC
	7 Laptop
	2 Tablet
Parent has used Skype™ before	8 Yes
	2 No
Parent comfortable using Skype™	1 No
	7 Yes
	2 Somewhat

* Degree of hearing loss was categorised using the calculated average pure-tone air-conduction thresholds at 0.5, 1, and 2 kHz in the better ear.^{40,41}

Material

Intervention sessions. Each intervention session comprised of one hands-on activity and one corresponding book-reading activity to facilitate joint attention and interaction between the parent and the child. The themes and language content of the intervention sessions corresponded with the titles of the four books, namely “In the Garden”, “Animal Friends”, “In the Park” and “Deep Blue Sea” from the “Fidgety Fingers” series.⁴²⁻⁴⁵ The hands-on activity consisted of small three-dimensional plastic animals corresponding to the animal characters in the books. Each parent and their child were randomly presented with two of the four themes, one during the tele-intervention session and one during the conventional intervention session.

Tele-intervention Information and Communication Technology (ICT). Technical apparatus utilised by the clinician in her office included a laptop with Skype™ software installed, asymmetric digital subscriber line (ADSL) internet connection, a web camera, a flexible desk lamp to create optimal lighting during tele-intervention sessions, a white sheet to use as a backdrop to ensure optimal visibility of the clinician

during tele-intervention sessions and a video camera to film all conventional and tele-intervention sessions from the clinician's office.

Technical apparatus utilised by parents included their own personal desktop computer, laptop or tablet with Skype™ software installed, Internet connection and a web camera. Nine parents indicated that they would not need technical assistance; one parent indicated that she might need technical assistance. All ten participants reported that they have access to internet connectivity in their homes (fixed line or 3G cellular network). Due to the fact that in some countries Skype™ is considered to be insufficient for health care interactions, the following was implemented to safeguard the data and protect privacy and confidentiality of participants: strong password protection; dedicated use of the computer or Voice over Internet Protocol (VoIP) system for tele-intervention; virus protection and use of virus-free computers; use of audit controls to record how often data are accessed by or released to internal and outside entities.

Tait-based communication interaction assessment tool. The Tait Video Analysis was originally designed as a method of monitoring preverbal and early linguistic development of children with hearing loss who were wearing amplification devices.^{46,47} This method entails video recording child-adult interactions in a conversational setting, and the subsequent methodical analysis of six aspects of interaction, namely non-looking turns, vocal responses, non-vocal responses, vocal initiatives, non-vocal initiatives and no responses. The Tait Video Analysis has been shown to be a reliable method for assessing the level of auditory communication in children beyond the preverbal stage of language development.^{48,49} It has also demonstrated high inter-observer reliability for assessing communicative skills of young children.⁴⁹ The original

Tait Video Analysis⁴⁷ was modified for the current study by adding eye-contact as another aspect of interaction, since eye-contact shows communicative intent and contributes to the quality of communication interaction. This included eye-contact between child and parent or between child and clinician. In this study, the modified tool was used to analyse and compare each participant's quality of communication interaction in a single-recording during one tele-intervention and one conventional intervention session.

Parent- and clinician perception questionnaire. Parent- and clinician perceptions were surveyed through the use of a questionnaire completed after each tele- and conventional intervention session. Each questionnaire comprised four rating scale questions and two open-ended questions, to add qualitative depth to the descriptions of perceptions conveyed by participants. On completion of both the tele- and conventional sessions, parent participants and the clinician participant completed a third questionnaire consisting of one closed-ended and three open-ended questions to determine the parents' and the clinician's overall perceptions and opinions pertaining to the use of tele-intervention.

Procedures

Participants were divided into two equal groups according to the convenience in the scheduling of appointments. Child- and parent participants in the first group received a clinic-based conventional intervention (control condition) session first, followed by a home-based tele-intervention session (experimental condition) two weeks later. Using a counterbalanced cross-over design to reduce systematic error, participants in the

second group first received a tele-intervention session followed by a conventional intervention session two weeks later.

Tele-intervention sessions were conducted with the parent and child in their own home, communicating with the clinician in her office via synchronous (real-time) video-communication software (Skype™). On the day prior to recording tele-intervention sessions, a Skype™ test-call was conducted with each parent participant to troubleshoot for any video- or audio-quality difficulties. Tele-intervention sessions were recorded at 06:30 a.m. on weekdays, as arranged with each parent individually. All conventional intervention sessions were conducted by the clinician participant at the Centre. Conventional intervention sessions were scheduled during the timeslot of each child's existing weekly intervention session. All conventional and tele-intervention sessions were 30 minutes in duration and structurally similar in terms of activities and materials to ensure minimal variability in the amount of opportunities to communicate for comparative purposes. Each tele-intervention session started with a technical check of two-way audio and video signal between the parent at home and the clinician at the clinic. The conventional and tele-intervention would commence in the same way with the clinician introducing and discussing the predetermined activities and therapy techniques that will be used during the session. The parent was encouraged to lead the session during which the clinician provides ongoing feedback or suggestions to the parent on how to provide effective intervention. The clinician intervened directly with the child in cases where techniques or activities needed to be demonstrated to the parent.

Samples that represented each child's range of communicative abilities were selected by the first author, in consensus with the clinician participant, from the video recordings of the tele- and conventional intervention sessions of each participating family. As the usefulness of a sample depends on the degree to which it is representing normal interaction between parent and child, specific measures specified by Cole and Flexer (2007) were used to ensure natural interaction between the parent and child during observational videotaping.⁵⁰ Each sample comprised of 40 communicative turns between the child and the parent and was selected from the onset of either the hands-on activity or the book-reading activity.

Data analysis

The representative samples were transcribed and analysed by the clinician participant and the first author using the modified Tait Video Analysis communication interaction tool.⁴⁷ Independent analyses by the participating clinician and first author (objective coder) were subsequently compared. A third external objective coder was consulted in cases where the clinician participant and first author had conflicting results in the analyses of the samples. Statistical analysis software (SPSS v.21) was used to investigate within-subject differences in communication interaction between conventional and tele-intervention sessions. Parent and clinician ratings were averaged and compared between conventional and tele-intervention sessions using the Wilcoxon Signed Ranks Test (significance set to $p < 0.05$).

Thematical analysis of open-ended questions allowed for common trends or central themes to be identified among the parent and clinician participants. In this study, central themes together with illustrative quotes from parents' and clinician's

perceptions of conventional- and tele-intervention sessions were extracted following a thematic analysis approach.

3.4. Results

Quality of communication interaction

The quality of communication interaction in the conventional compared to tele-intervention sessions, assessed using the Tait-based communication interaction tool across 7 categories, demonstrated no significant difference ($p > 0.05$; Wilcoxon) between within-subject scores (Table 2).

Table 2. Quality of children’s interactive turns (Tait-based communication interaction tool) in conventional and tele-intervention sessions (n=10)

	Mean (SD)	Range	p-values
1. Vocal responses			p=0.944
<i>Conventional</i>	10.8 (4.3 SD)	4 - 16	
<i>Tele-intervention</i>	10.9 (5.0 SD)	3 - 17	
2. Non-vocal responses			p=0.391
<i>Conventional</i>	3.2 (2.6 SD)	0 - 8	
<i>Tele-intervention</i>	2.8 (2.1 SD)	0 - 6	
3. Vocal initiation			p=0.888
<i>Conventional</i>	3.6 (1.9 SD)	0 - 6	
<i>Tele-intervention</i>	3.5 (3.5 SD)	0 - 10	
4. Non-vocal initiation			p=0.340
<i>Conventional</i>	1.8 (2.4 SD)	0 - 6	
<i>Tele-intervention</i>	2.4 (3.4 SD)	0 - 10	
5. No response			p=0.317
<i>Conventional</i>	0.7 (0.8 SD)	0 - 2	
<i>Tele-intervention</i>	0.4 (0.7 SD)	0 - 2	
6. Eye-contact			p=0.812
<i>Conventional</i>	14.5 (5.1 SD)	6 - 20	
<i>Tele-intervention</i>	15.2 (4.7 SD)	6 - 20	
7. Non eye-contact			p=0.677
<i>Conventional</i>	4.8 (5.0 SD)	0 - 14	
<i>Tele-intervention</i>	4.4 (4.7 SD)	0 - 14	

Parental perceptions

Conventional compared to tele-intervention was rated higher ($p < 0.05$; Wilcoxon) in terms of comfort level during the session, how beneficial they experienced the session to be and whether they would like to continue receiving intervention through this

method (Table 3). There was no significant within-subject difference between parent ratings of conventional compared to tele-intervention in terms of facilitating meaningful communication interaction between the parent and their child ($p>0.05$; Wilcoxon).

Table 3. Parents’ perception regarding conventional and tele-intervention sessions

Questions	Conventional Intervention Median (IQR)	Tele-Intervention Median (IQR)	Significance
Felt comfortable during session	5.0 (0)	4.0 (1)	$p<0.05^*$
Found this intervention to be a beneficial experience for me and my child	5.0 (0)	4.0 (1)	$p<0.05^*$
Found this intervention to facilitate meaningful communication interaction between me and my child	5.0 (0)	5.0 (1)	$p>0.05$
Would like to continue intervention through this service delivery method	5 (0)	4.5 (3)	$p<0.05^*$

IQR= Interquartile range

Based on the ratings of “strongly agree (5)”, “agree (4)”, “not sure (3)”, “disagree (2)” or “strongly disagree (1)”.

*Significantly different scores (Wilcoxon Signed Ranks Test)

After completing the conventional and tele-intervention sessions, parents were asked whether tele-intervention could be utilised with the same success as conventional intervention. Five parents (50%) indicated “Yes”, one (10%) indicated “No” and four (40%) indicated that they were “Not Sure”.

Parents were further requested to substantiate their ratings with qualitative descriptions (Table 4). Main themes that presented in the qualitative component included the benefits, such as convenience of tele-intervention, the comfort level of the child and less travelling, but also challenges such as the technical difficulties, parental therapeutic skill level and distractions in the home environment which may play a role in the outcome of such a session.

Table 4. Central themes and illustrative quotes from parents' perceptions of conventional- and tele-intervention sessions

Themes	Illustrative Quotes
Conventional intervention	
Familiarity	- <i>"My child is used to conventional therapy."</i>
Physical presence of therapist	- <i>"It is what we know."</i> - <i>"Having the therapist present gives me confidence..."</i> - <i>"It gives me as a parent guidance on what to focus on with my child."</i>
"Gold standard" for therapy	- <i>"In-person therapy remains the best means of intervention as it allows for transmission of subtle cues that may not be visible or apparent in a tele-intervention. As such a tele-intervention remains a viable second option in my opinion and should not replace conventional therapy where latter is available."</i> - <i>"If close to therapist, then conventional therapy is the most optimal option"</i>
Tele-intervention	
Convenience	- <i>"Convenient for our family with small children."</i> - <i>"Technology is very advanced now and a great part of our daily lives. So this tele-intervention would be a success. And we still see (the therapist) on the screen so it wouldn't be difficult to proceed with our normal sessions."</i>
Distance & travelling	- <i>"We live very far, so tele-intervention would be ideal for us."</i> - <i>"Staying at home in own comfort zone and less travelling."</i> - <i>"(Tele-intervention might be beneficial) where geographical constraints limit the possibility of having regular conventional sessions. E.g. if the child lives in another city of country."</i>
Comfort level of child	- <i>"My child tends to react more comfortably in his own environment."</i> - <i>"My child reacts better in her own surroundings..."</i>
Technical issues	- <i>"Frustrated with constant loss of signal"</i> - <i>"Too many external factors consuming valuable time, such as loss of signal, power outages etc."</i> - <i>"Technical issues might prevent having meaningful sessions."</i>
Distractions	- <i>"Child might be distracted easily with his own toys he wants to play with instead of paying attention to session."</i> - <i>"Busy environment at home made the session almost impossible"</i> - <i>"Our younger child made the session very difficult."</i>
Parents' therapeutic and technical skill	- <i>"As the parent, I feel we would benefit with a bit of training first."</i> - <i>"(Tele-intervention would not be beneficial) if the parent does not know what to do exactly."</i>

Clinician perceptions

The clinician was surveyed regarding her experience of the conventional and tele-intervention session (Table 5). There was no statistically significant difference between the clinician's perceptions of conventional compared to tele-intervention ($p > 0.05$; Wilcoxon) in any of the four aspects addressed in the 5-point rating scale questions.

Table 5. Clinician’s perception regarding conventional and tele-intervention sessions.

Questions	Conventional Intervention Median (IQR)	Tele-Intervention Median (IQR)	Significance
Felt comfortable during session	5.0 (0)	5.0 (1)	p> 0.05
Found this intervention to be a beneficial experience for parent and child	5.0 (0)	5.0 (1)	p> 0.05
Found this intervention to facilitate meaningful communication interaction between parent and child	5.0 (0)	5.0 (1)	p> 0.05
Would like to continue to provide intervention through this service delivery method	5.0 (0)	5.0 (1)	p> 0.05

IQR= Interquartile range

Based on the ratings of “strongly agree (5)”, “agree (4)”, “not sure (3)”, “disagree (2)” or “strongly disagree (1)”.

The clinician was further requested to substantiate her ratings with elaborative descriptions (Table 6). Main themes that presented themselves included the unfamiliarity of tele-intervention, the comfort level of the child during the session, technical issues and distractions during the sessions, the level of parents’ therapeutic and technical skills and the use of tele-intervention as a viable alternative to conventional intervention.

Table 6. Central themes and illustrative quotes from clinician perceptions of conventional- and tele-intervention sessions

Themes	Illustrative Quotes
Conventional Intervention	
Conventional or tele-intervention viable options	<ul style="list-style-type: none"> - “Easy family to work with, could work either way with them.” - “This family is so much further along in the process, either Skype or conventional could work.”
New/ inexperienced families	<ul style="list-style-type: none"> - “(Conventional intervention) currently important for building a relationship” - “(Child) is beginning to understand how session works, and is engaging more”
Tele-intervention	
Unfamiliarity	<ul style="list-style-type: none"> - “Would probably need a few sessions before one could really get a therapeutic session going with this child.” - “(Child) was a little shy; would need to get used to this type of therapy”
Comfort level of child	<ul style="list-style-type: none"> - “(Child) was much less distractible at home; saw more skills demonstrated than seen in conventional therapy.” - “Would rather want to work with this child via tele-intervention – he was more at ease in his own home.” - “(Child) much more comfortable in her home environment.” - “This child responds as well and is comfortable with technology.”

	<ul style="list-style-type: none"> - <i>"In this particular case, the child demonstrated a higher quality interaction + better language skills in the safety of her home, with her family around."</i> - <i>"This child much more trusting in his own home; more comfortable engaging with mom."</i>
Technical issues	<ul style="list-style-type: none"> - <i>"Require a more stable connection so as not to stress/frustrate the parent."</i> - <i>"...dropped once during the session. But quickly re-established connection."</i> - <i>"Closer to 8a.m. we began experiencing signal issues."</i> - <i>"Signal a little poor; but did not lose contact."</i> - <i>"Many, many technical difficulties, kept losing video on one or both sides."</i> - <i>"Delayed video transmission, but sound good."</i>
Distractions	<ul style="list-style-type: none"> - <i>"Could continue but would need to plan sessions very carefully to include sibling."</i> - <i>"Difficulties experienced with sibling present..."</i>
Parents' therapeutic and technical skills	<ul style="list-style-type: none"> - <i>"Easy family to work with. Both mom and daughter relaxed with the technology and mom's skill level makes it easy."</i> - <i>"Mother and son comfortable with the technology and Mom's skills base good"</i> - <i>"Inexperienced parents might be a challenge."</i>
Valuable alternative to conventional therapy	<ul style="list-style-type: none"> - <i>"It would appear it could be a valuable method of service delivery to parents away from the centre/therapy base."</i>
Follow-up sessions	<ul style="list-style-type: none"> - <i>"More regular follow-up with 'out-of-towners'"</i>

3.5. Discussion

This study compared one 30-minute conventional clinic-based session to one 30-minute home-based tele-intervention session in terms of communication performance, parental perceptions and clinician perceptions. The quality of children's communication performance in tele-intervention was comparable to that of conventional intervention with no significant within-subject differences. Previous case control studies reported on language outcomes of children with hearing loss receiving conventional and tele-intervention longitudinally. Constantinescu et al. (2014) reported similar language outcomes between a control group and children receiving eAVT (tele-Auditory Verbal Therapy) at a two-year assessment.³⁹ Blaiser et al. (2013) reported higher mean scores for receptive and expressive language in a tele-intervention group, compared to a control group.³⁶ The current study, however, compared actual communication performance between one conventional and one tele-intervention

session within subjects. This provides further evidence in support of the efficacy of tele-intervention for facilitating quality communication interaction.

Benefits of tele-intervention reported in the current study included reduction in travel time and expense, which are in agreement with findings reported by McCarthy et al. (2010).¹⁵ Parents felt that it was convenient to have the sessions in their homes as also indicated by Behl et al. (2010)³⁵ and reported that their children interact more comfortably in their own homes.³³

Reported challenges of tele-intervention in the current study included technical difficulties, parental therapeutic skill level and distractions in the home environment. External factors, such as the time of day, type and strength of internet connectivity and hardware and software caused technical issues, such as varying quality of video and audio output. Similar challenges were reported in previous studies regarding tele-intervention for children with hearing loss ^{35,51,52} and was also reported in a study regarding tele-intervention for acquired neurological speech disorders.²⁹ In the current study, time of day had a significant effect on connectivity and audio and video output. Poorer audio and video output and interruptions in connectivity was experienced after 08:00 a.m. on weekdays, when working hours commence and Internet usage in the area increased. Overall, these reported technical challenges were found to directly correlate with parents' perceptions on whether they thought that tele-intervention could be used with the same success as conventional intervention. One parent indicated that she would benefit from sufficient therapeutic and technical training in order to conduct successful and quality tele-intervention sessions. McCarthy et al (2010) also

reported that training is strongly recommended for parents involved with tele-intervention.¹⁵

Parents rated conventional intervention significantly higher than tele-intervention in three of the four areas. They felt more comfortable during the conventional intervention session, found it to be a more beneficial experience for them and their children and would like to continue receiving conventional intervention in the future. It should be noted that all participants received conventional intervention services prior to the study, which is likely to cause some bias due to the mere-exposure effect, where persons develop a preference to something merely because of its familiarity.⁵³ Behl et al. (2010) also reported that some parents prefer the physical presence of the therapist in conventional in-person intervention, due to familiarity.³⁵ Interestingly, parents perceived no significant difference between tele- and conventional intervention in terms of facilitating meaningful interaction between them and their children, which was also reported by Behl et al. (2010).³⁵ This suggests that even with a preference for conventional intervention, parents acknowledge the ability of tele-intervention to allow for the facilitation of meaningful interaction between them and their children in the same way as conventional intervention.

The clinician reported that children's comfort level with the use of technology during tele-intervention was noteworthy. Five children (50%) appeared more comfortable in their home environment and displayed larger varieties of communication skills than what is usually observed in the conventional intervention context. This was reported previously by Constantinescu (2012), Behl et al. (2010) and McCarthy et al. (2010).^{15,35,52} The clinician perceived tele-intervention as a valuable method of service

delivery to families who may live far from therapy centres to allow more regular follow up. Tele-intervention could therefore overcome barriers of distance and the shortage of early interventionists in some cases.^{15,22,29,35} In the current study, the clinician indicated that two participating families (20%) in particular would do well in receiving further intervention through tele-intervention as their parents had received sufficient therapeutic training and were comfortable with the use of technology.

The clinician's main concerns regarding tele-intervention, was the unfamiliarity to all the participating families, the technical challenges involved, the technical and therapeutic skill level of the parents and possible distractions in the home. These aspects were noted by the clinician as a possible cause of frustration that could hinder the performance of parents and children. Behl et al. (2010) also reported that a lack of parental confidence with the use of technology is a significant barrier in tele-intervention.³⁵

The clinician preferred conventional intervention for 3 of the participating families as these families were new to the intervention process and needed further therapeutic training before tele-intervention should be considered. The clinician suggested conventional methods for intervention and parent guidance for families who are new to the intervention process. Constantinescu (2012) also recommended a higher number of in-person sessions for new families⁵² and trial tele-intervention sessions were recommended by the clinician in the McCarthy et al. (2010) study to allow families in the Royal Institute for Deaf and Blind Children (RIDBC) Tele-intervention program to become familiar to the set-up and to become confident in troubleshooting when technical difficulties present themselves.¹⁵

Other studies investigating parent and clinician perceptions in tele-intervention programs have reported high satisfaction with and a preference for tele-intervention due to the high quality of services provided.^{15,22,35,52} However, tele-intervention studies with larger populations and longitudinal monitoring of actual communication outcomes in children with hearing loss are still required.³⁸

Initial challenges faced by the researcher in implementing tele-intervention included ensuring sufficient bandwidth and to re-establish connections when failures occurred. All participants had previous exposure to conventional intervention but none to tele-intervention, which was a limitation. Participants of future studies should ideally have no exposure to either tele-intervention or conventional methods. The clinic- and home-based environments also varied in terms of visual and auditory aspects, which could affect children's communication performances in the different environments.

Since this pilot study included only one clinician and 10 children, future studies with larger numbers will allow for a more comprehensive investigation. The small sample size of parent and clinician perceptions in this pilot study is a limitation that may have restricted the ability to determine statistically significant relationships. The relationship between parental therapeutic skill level and the child's communication performance in tele-intervention would be a valuable aspect to investigate. The relationship between parental openness to tele-intervention and factors such as parents' past video-conference experience, education level and the child's age would also be valuable to investigate. The quality of connectivity and possible association with whether families would continue to use tele-intervention would also be worth investigating. Lastly, future

studies that focus on how to prepare and train families in utilizing tele-intervention methods and on what training clinicians require in providing parent guidance and coaching online would be valuable.

Conclusion

Communication performance in children with hearing loss elicited during tele- and conventional intervention was similar. Whilst most parents indicated a willingness to continue with tele-intervention they preferred conventional intervention, which may in part be due to prior familiarity. Tele-intervention challenges included technical difficulties, distractions in the home environment and parents lacking in technical and/or therapeutic skills. The clinician generally perceived both tele-intervention and conventional intervention to be equally effective, except where families were new to the intervention process and in-person parent training was required. This study provides preliminary evidence that tele-intervention could be a valuable solution to typical intervention barriers such as distance and the shortage of trained interventionists.

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Conflict of interest

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4. DISCUSSION AND CONCLUSION

4.1. Summary and discussion

This study compared intervention outcomes between conventional clinic-based and home-based tele-intervention sessions in terms of communication performance, parental and clinician perceptions. The quality of children's communication performance in tele-intervention was comparable to that of conventional intervention with no significant within-participant differences. Previous case control studies reported on language outcomes of children with hearing loss receiving conventional and tele-intervention longitudinally. Constantinescu et al. (2014) reported similar language outcomes between a control group and children receiving eAVT (tele-Auditory Verbal Therapy) at a two-year follow-up assessment. Blaiser et al. (2013) reported higher mean scores for receptive and expressive language in a tele-intervention group, compared to a control group. The current study, however, compared actual communication performance between one conventional and one tele-intervention session within participants. This provides further evidence in support of the efficacy of tele-intervention for facilitating quality communication interaction.

Benefits of tele-intervention reported in the current study included reduction in travel time and expense, which are in agreement with findings reported by McCarthy et al. (2010). Parents felt that it was convenient to have the sessions in their homes as also indicated by Behl et al. (2010) and reported that their children interact more comfortably in their own homes.

Reported challenges of tele-intervention in the current study included technical difficulties, parent therapeutic skill level and distractions in the home environment. External factors, such as the time of day, type and strength of internet connectivity, hardware and software caused technical issues, such as varying quality of video and audio output. Similar challenges were reported in previous studies regarding tele-intervention for children with hearing loss (Behl et al., 2010; Blaiser et al., 2013; Constantinescu, 2012) and was also reported in a study regarding tele-intervention for acquired neurological speech disorders (Cherney & Van Vuuren, 2012). In the current study, time of day had a significant effect on connectivity and audio and video output. Poorer audio and video output and interruptions in connectivity was experienced after 08:00 a.m. on weekdays, when working hours commence and Internet usage in the area increased. Overall, these reported technical challenges were found to directly correlate with parents' perceptions on whether they thought that tele-intervention could be used with the same success as conventional intervention. One parent indicated that she would benefit from sufficient therapeutic and technical training in order to conduct successful and quality tele-intervention sessions. McCarthy et al (2010) also reported that training is strongly recommended for parents involved with tele-intervention.

Parents rated conventional intervention significantly higher than tele-intervention in three of the four areas. They felt more comfortable during the conventional intervention session, found it to be a more beneficial experience for them and their children and would like to continue receiving conventional intervention in the future. It should be noted that all participants received conventional intervention services prior to the study, which is likely to cause bias due to the mere-exposure effect, where persons

develop a preference to something merely because of its familiarity (Zajonc, 2001). Behl et al. (2010) also reported that some parents prefer the physical presence of the therapist in conventional in-person intervention, due to familiarity. Interestingly, parents perceived no significant difference between tele- and conventional intervention in terms of facilitating meaningful interaction between them and their children, which was also reported by Behl et al. (2010). This suggests that even with a preference for conventional intervention, parents acknowledge the ability of tele-intervention to allow for the facilitation of meaningful interaction between them and their children in the same way as conventional intervention.

The clinician reported that children's comfort level with the use of technology during tele-intervention was noteworthy. Five children (50%) appeared more comfortable in their home environment and displayed larger varieties of communication skills than what is usually observed in the conventional intervention context. This was reported previously by Behl et al. (2010), Constantinescu (2012) and McCarthy et al. (2010). The clinician perceived tele-intervention as a valuable method of service delivery to families who may live far from therapy centres to allow more regular follow up. Tele-intervention could therefore overcome barriers of distance and the shortage of early interventionists in some cases (Behl et al., 2010; Cason et al., 2012; Cherney & Van Vuuren, 2012; McCarthy et al., 2010). In the current study, the clinician indicated that two participating families (20%) in particular would do well in receiving further intervention through tele-intervention as their parents had received sufficient therapeutic training and were comfortable with the use of technology.

The clinician's main concerns regarding tele-intervention, was the unfamiliarity to all the participating families, the technical challenges involved, the technical and therapeutic skill level of the parents and possible distractions in the home. These aspects were noted by the clinician as a possible cause of frustration that could hinder the performance of parents and children. Behl et al. (2010) also reported that a lack of parent confidence with the use of technology is a significant barrier in tele-intervention.

The clinician preferred conventional intervention for 3 of the participating families as these families were new to the intervention process and needed further therapeutic training before tele-intervention should be considered. The clinician suggested conventional methods for intervention and parent guidance for families who are new to the intervention process. Constantinescu (2012) also recommended a higher number of in-person sessions for new families and trial tele-intervention sessions were recommended by the clinician in the McCarthy et al. (2010) study to allow families in the RIDBC Tele-intervention program to become familiar to the set-up and to become confident in troubleshooting when technical difficulties present themselves.

Other studies investigating parent and clinician perceptions in tele-intervention programs have reported high satisfaction with and a preference for tele-intervention due to the high quality of services provided (Behl et al., 2010; Cason et al., 2012; Constantinescu, 2012; McCarthy et al., 2010). However, tele-intervention studies with larger populations and longitudinal monitoring of actual communication outcomes in children with hearing loss are still required (Hersh et al., 2001).

4.2. Clinical implications and recommendations

Communication performance in children with hearing loss elicited during tele- and conventional intervention was similar. This provides evidence tele-intervention could be used as an alternative of similar quality as conventional methods. Constantinescu et al. (2014) provides further evidence that children with hearing loss receiving tele-AVT achieved similar language outcomes to a control group receiving in-person AVT. Whilst most parents indicated a willingness to continue with tele-intervention they generally preferred conventional intervention, which may in part be due to prior familiarity. It should be noted that some parents could have shown a preference towards tele-intervention simply due to the fact that they reside far from the therapy base and have no alternative option. Some parents may also have given higher ratings to tele-intervention merely due having previous experience with Skype™. It would thus be beneficial to initially train all parents in the use of distance technologies to increase their confidence in using distance technologies and dealing with technical challenges which may arise.

Tele-intervention challenges included technical difficulties, distractions in the home environment and parents lacking in technical and/or therapeutic skills. The clinician generally perceived both tele-intervention and conventional intervention to be equally effective, except where families were new to the intervention process and in-person parent training was required. Some professionals may need initial technical training to be able to provide high quality tele-health services.

The attitudes and perceptions of clinicians and health professionals may also play a vital role in the implementation of such services on a broader scale. Furthermore, this would also influence the training of students in the field of tele-audiology.

The current pilot study, along with the growing body of research suggests that the parents and professionals who are currently utilizing tele-intervention are reporting many benefits, few challenges and high levels of satisfaction (Behl et al., 2010; Constantinescu, 2012; McCarthy et al., 2010). There is, however, still a reluctance amongst some professionals regarding the privacy and security, licensure, risk management and reimbursement aspects of providing tele-intervention (Houston, Behl & Walters, 2013).

Implementation of tele-intervention services can pose several challenges as mentioned above, especially in countries with a unique context, such as South Africa, with added economical, geographical, technological and social matters to address. However, tele-intervention services could be a valuable solution to typical intervention barriers such as distance and the shortage of trained interventionists, even more so as global fuel prices increase and the cost of internet connectivity decrease. The global increase in the usage of smartphones as well as the employment of different models of tele-intervention service delivery such as synchronous (real-time), asynchronous (store-and-forward) or hybrid models could further increase access of these services to underserved communities (Swanepoel et al., 2010).

4.3. Critical evaluation

Strengths of study

Although other studies have investigated developmental outcomes in children with hearing loss compared to control groups, to the authors' knowledge, this pilot study is currently the only within-participant comparison of its kind, where each participant's actual communication performance in conventional intervention is measured and compared to his/her own performance in tele-intervention. This adds valuable data to the current body of research evidence pertaining to the use of tele-intervention for children with hearing loss. The value of the study is further strengthened by additionally investigating a second and third component for each participant, namely parent- and clinician perceptions of tele-intervention compared to conventional intervention.

Limitations of study

Initial challenges faced by the researcher in implementing tele-intervention included ensuring sufficient bandwidth and re-establishing connections when failures occurred. All participants had previous exposure to conventional intervention but none to tele-intervention, which was a limitation. Participants of future studies should preferably have no prior exposure to either tele-intervention or conventional methods. The home-based environments also varied in terms of visual and auditory aspects, which could affect children's communication performances in the different environments, but results are regarded as accurate and meaningful as these environments represented realistic home settings.

Since this pilot study included only one clinician and 10 children, future studies with larger numbers will allow for a more comprehensive investigation. The small sample size of parent and clinician perceptions in this pilot study is a limitation that may have restricted the ability to determine statistically significant relationships.

4.4. Future research

For generalization of research findings, it is suggested that larger randomized studies are undertaken with long-term or longitudinal monitoring of communication performance in more children and that perceptions of more parents and more than one clinician are determined.

Participants of future studies should ideally have no exposure to either tele-intervention or conventional methods. Since this pilot study included only one clinician and 10 children, future studies with larger numbers will allow for a more comprehensive investigation. The relationship between parent therapeutic skill level and the child's communication performance in tele-intervention would be a valuable aspect to investigate. The relationship between parent openness to tele-intervention and factors such as parents' past video-conference experience, education level and the child's age would also be investigated in future studies. The quality of connectivity and possible association with whether families would continue to use tele-intervention would also be worth investigating. Future studies that focus on how to prepare and train families in utilizing tele-intervention methods and on what training clinicians require in providing parent guidance and coaching online would be valuable. Lastly, there are no studies, to the authors' knowledge, where reliability of administering formal assessments for children with hearing loss (e.g. language assessment tools)

via tele-methods have been investigated. This could be investigated further in future studies.

4.5. Conclusion

Communication performance in children with hearing loss elicited during tele- and conventional intervention was similar. Whilst most parents indicated a willingness to continue with tele-intervention they preferred conventional intervention, which may in part be due to prior familiarity. Tele-intervention challenges included technical difficulties, distractions in the home environment and parents lacking in technical and/or therapeutic skills. The clinician generally perceived both tele-intervention and conventional intervention to be equally effective, except where families were new to the intervention process and in-person parent training was required. Despite certain challenges experienced in the implementation of tele-intervention, findings in this study indicate that tele-intervention yields comparable communication performance in children as conventional methods. This provides preliminary evidence, alongside the growing body of existing evidence, that tele-intervention could be a valuable solution to typical intervention barriers such as distance and the shortage of trained interventionists.

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APPENDICES

Appendix A: Formal ethical clearance letter



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Research Ethics Committee

22 August 2013

Dear Prof Swanepoel

Project: Tele-intervention for children with hearing loss: A comparative study
Researcher: E Havenga
Supervisor: Prof D Swanepoel
Department: Communication Pathology
Reference number: 27126219

Thank you for your response to the Committee's letter of 1 July 2013.

I have pleasure in informing you that the Research Ethics Committee formally **approved** the above study at an *ad hoc* meeting held on 22 August 2013. Please note that this approval is based on the assumption that the research will be carried out along the lines laid out in the proposal. Should your actual research depart significantly from the proposed research, it will be necessary to apply for a new research approval and ethical clearance.

The Committee requests you to convey this approval to the researcher.

We wish you success with the project.

Sincerely

Prof. Sakhela Buhlungu
Chair: Research Ethics Committee
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: sakhela.buhlungu@up.ac.za

Research Ethics Committee Members: Dr L Blokland; Prof S Buhlungu (Chair); Prof M-H Coetzee; Dr JEH Grobler; Prof KL Harris; Ms H Klopper; Prof A Mlambo; Dr C Panebianco-Warrens; Prof GM Spies; Prof E Taljard; Dr FG Wolmarans; Dr P Wood

Appendix B: Clinician letter of informed consent



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Humanities
Department of Communication Pathology

May 2013

Ms. Brenda Schmid
Programme Director: Centre for Listening and Spoken Language
Pretoria
Gauteng
South Africa

Dear Ms. Schmid

RE: PERMISSION FOR PARTICIPATION OF CLIENTS FROM THE CENTRE FOR LISTENING AND SPOKEN LANGUAGE AS PARTICIPANTS IN A RESEARCH PROJECT:

I am a Masters student at the Department of Communication Pathology, University of Pretoria conducting a study entitled, *Tele-Intervention for Children with Hearing Loss: A Comparative Study*. This study will aim to compare tele-intervention with conventional face-to-face intervention in a sample of hearing impaired children. It would be greatly appreciated if you would inform caregivers of hearing impaired children receiving services from the Centre for Listening and Spoken Language about the research project to ascertain whether they would be willing to consider possible participation in the study. I would, furthermore, wish to invite you to participate in the study yourself as a research participant.

The main aims of this study is to describe:

- The quality of communication interaction during tele-intervention compared to conventional intervention.
- Clinicians' perceptions of tele-intervention compared to conventional intervention.
- Caregivers' perceptions of tele-intervention compared to conventional intervention.

Procedure:

Each child and his/her caregiver will be asked to participate in a conventional face-to-face therapy session and a tele-intervention session (not necessarily in this order) with a clinician. The conventional intervention session and the tele-intervention session will last approximately 1 hour each. These sessions will be recorded and each child's performance in both sessions will be measured and analysed. Caregivers and the clinician providing the therapy (clinician participant) will be asked to complete two short questionnaires regarding their experience of the conventional intervention session and the tele-intervention session, respectively. A third questionnaire is to be completed by the caregivers and the clinician after both intervention sessions have been completed. Each questionnaire should take approximately 5 minutes to complete. All intervention sessions will be scheduled at the caregivers' and clinicians' convenience.

Voluntary participation:

Participation in the study is completely voluntary and the respondents will be able to withdraw from the study at any time with no negative consequences. All identifying information in the informed consent letters and questionnaires will be handled with strict confidentiality and anonymity.

Risks and benefits:

There are no known medical risks or discomforts associated with this project. Should any fatigue be experienced during intervention sessions, by the caregiver, child or clinician, break periods will be provided.

University of Pretoria
PRETORIA 0002
Republic of South Africa

Tel: 012 420 4280
Fax: 012 420 3517

dewet.swanepoel@up.ac.za
www.up.ac.za



There are no known direct medical benefits to the caregiver or the child for participating in this study. However, the results of the study may help researchers gain a better understanding of how tele-intervention compares to conventional face-to-face intervention.

Confidentiality:

All intervention sessions will be recorded for the purpose of collecting data. Recordings will be viewed only by the research clinician and the clinician who conducted the therapy. All personal information will remain strictly confidential. The results of this study may be published in professional journals or presented at professional conferences, but my records or identity will not be revealed, unless required by law. The research data from this study will be stored at the Department of Communication Pathology, University of Pretoria for 15 years, for research and archiving purposes.

In order to conduct this study, children and caregivers who are clients of the Centre for Listening and Spoken Language in Pretoria will be considered as possible participants based on their willingness to participate. As an expert in early intervention for children with hearing loss, your participation as a research participant will also be invaluable.

We appreciate your consideration of this request and look forward to receive your feedback.

For any further information, please contact me, Estienne Havenga, via email at estienne.havenga@gmail.com or telephonically at 074 146 6746.

Thank you in advance for your time and co operation.

Yours sincerely,

Estienne Havenga
Researcher

Prof De Wet Swanepoel
Supervisor

Miss Talita le Roux
Supervisor

Prof Bart Vinck
HEAD: DEPARTMENT OF COMMUNICATION PATHOLOGY



May 2013

Dear Ms. Havenga

RE: PERMISSION TO PROVIDE CLIENTS FROM THE CENTRE FOR LISTENING AND SPOKEN LANGUAGE WITH INFORMATION REGARDING POSSIBLE PARTICIPATION IN THIS RESEARCH PROJECT

Thank you for your information letter regarding your study entitled, *Tele-intervention for Children with Hearing Loss: A Comparative Study*.

I, Ms. Brenda Schmid, as programme director, hereby consent to the clients from the Centre for Listening and Spoken Language receiving information regarding possible participation in the research project titled: *Tele-intervention for children with hearing loss: A comparative study*. I understand what the research study is about and how it is being conducted. I, furthermore, agree to participate in the study and understand my rights as a participant.

Permission:



(Ms. Brenda Schmid)

Date:

01/05/2013

I look forward to participating in this study.

Yours sincerely,



Ms. Brenda Schmid

PROGRAMME DIRECTOR
Centre for Listening and Spoken Language

Appendix C: Pilot study letter of informed consent



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Humanities
Department of Communication Pathology

Dear parent/caregiver,

RE: Participation in pilot study regarding tele-intervention

I am a Masters student at the Department of Communication Pathology, University of Pretoria conducting a study entitled, *Tele-Intervention for Children with Hearing Loss: A Comparative Study*. This study will aim to compare tele-intervention with conventional face-to-face intervention in a sample of hearing impaired children. It would be greatly appreciated if you and your child could participate in a pilot study that would be preceding the collection of data for the study. A pilot study is a crucial first step in streamlining the process of data collection to obtain the most accurate results.

Details of the study are listed below.

1. **Purpose of the Study:**

The purpose of this study is to compare tele-intervention with conventional face-to-face intervention within 10 children with hearing loss.

2. **Main aims of the Study:**

- To describe the quality of communication interaction during tele-intervention compared to conventional intervention
- To describe clinicians' perceptions of tele-intervention compared to conventional intervention
- To describe caregivers' perceptions of tele-intervention compared to conventional intervention

3. **Procedure:**

My child and I will be asked to participate in a conventional face-to-face therapy session and a tele-intervention session (not necessarily in this order) with a clinician. The conventional intervention session and the tele-intervention session will last approximately 1 hour each. These sessions will be recorded and my child's performance in both sessions will be measured and analysed. I will also be asked to complete 3 questionnaires regarding my attitudes towards the conventional intervention session and the tele-intervention session. Each questionnaire should take approximately 5 minutes to complete. All intervention sessions will be scheduled at my convenience.



4. Voluntary participation:

Participation in this study is completely voluntary and my child and I will be able to withdraw from the study at any time with no negative consequences. All identifying information in the informed consent letter and questionnaires will be handled with strict confidentiality and anonymity.

5. Risks and Benefits:

There are no known medical risks or discomforts associated with this project. Should any fatigue be experienced during intervention sessions, by me or my child, break periods will be provided.

There are no know direct medical benefits to me or my child for participating in this study. However, the results of the study may help researchers gain a better understanding of how tele-intervention compares to conventional face-to-face intervention.

6. Confidentiality:

All intervention sessions will be recorded for the purpose of collecting data. Recordings will be viewed only by the research clinician and the clinician who conducted the therapy. My child's and my name and other personal information will remain strictly confidential. It should be noted that the results of the pilot study will not be included in the results of the study. The results of this study may be published in professional journals or presented at professional conferences, but my records or identity will not be revealed, unless required by law. The research data from this study will be stored at the Department of Communication Pathology, University of Pretoria, for 15 years for research and archiving purposes.

7. If I have any questions or concerns, I can contact Estienne Havenga telephonically at +28 74 146 6746 or by email at estienne.havenga@gmail.com at any time.

Thank you in advance for your time and co-operation.

Yours sincerely,

Estienne Havenga
Researcher



Miss Talita le Roux
Supervisor

Prof Bart Vinck
HEAD: DEPARTMENT OF COMMUNICATION PATHOLOGY



Informed consent form

I understand what the study is about and how and why it is being done. I understand my rights as a research subject, and I voluntarily consent to participation in this pilot study.

Subject's signature _____

Researcher's signature _____

Date _____

Appendix D: Parent letter of informed consent



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Humanities
Department of Communication Pathology

Dear parent/caregiver,

RE: Participation in study regarding tele-intervention

I am a Masters student at the Department of Communication Pathology, University of Pretoria conducting a study entitled, *Tele-Intervention for Children with Hearing Loss: A Comparative Study*. This study will aim to compare tele-intervention with conventional face-to-face intervention in a sample of hearing impaired children. It would be greatly appreciated if you and your child could participate in the study.

Details of the study are listed below.

1. Purpose of the Study:

The purpose of this study is to compare tele-intervention with conventional face-to-face intervention within 10 children with hearing loss.

2. Main aims of the Study:

- To describe the quality of communication interaction during tele-intervention compared to conventional intervention
- To describe clinicians' perceptions of tele-intervention compared to conventional intervention
- To describe caregivers' perceptions of tele-intervention compared to conventional intervention

3. Procedure:

My child and I will be asked to participate in a conventional face-to-face therapy session and a tele-intervention session (not necessarily in this order) with a clinician. The conventional intervention session and the tele-intervention session will last approximately 1 hour each. These sessions will be recorded and my child's performance in both sessions will be measured and analysed. I will also be asked to complete 3 questionnaires regarding my attitudes towards the conventional intervention session and the tele-intervention session. Each questionnaire should take approximately 5 minutes to complete. All intervention sessions will be scheduled at my convenience.



4. Voluntary participation:

Participation in this study is completely voluntary and my child and I will be able to withdraw from the study at any time with no negative consequences. All identifying information in the informed consent letter and questionnaires will be handled with strict confidentiality and anonymity.

5. Risks and Benefits:

There are no known medical risks or discomforts associated with this project. Should any fatigue be experienced during intervention sessions, by me or my child, break periods will be provided.

There are no known direct medical benefits to me or my child for participating in this study. However, the results of the study may help researchers gain a better understanding of how tele-intervention compares to conventional face-to-face intervention.

6. Confidentiality:

All intervention sessions will be recorded for the purpose of collecting data. Recordings will be viewed only by the research clinician and the clinician who conducted the therapy. My child's and my name and other personal information will remain strictly confidential. The results of this study may be published in professional journals or presented at professional conferences, but my records or identity will not be revealed, unless required by law. The research data from this study will be stored at the Department of Communication Pathology, University of Pretoria, for 15 years for research and archiving purposes.

7. If I have any questions or concerns, I can contact Estienne Havenga telephonically at +28 74 146 6746 or by email at estienne.havenga@gmail.com at any time.

Thank you in advance for your time and co-operation.

Yours sincerely,

Estienne Havenga
Researcher

Prof De Wet Swanepoel
Supervisor



Miss Talita le Roux
Supervisor

Prof Bart Vinck
HEAD: DEPARTMENT OF COMMUNICATION PATHOLOGY



Informed consent form

I understand what the study is about and how and why it is being done. I understand my rights as a research subject, and I voluntarily consent to participation in this study.

Subject's signature _____

Researcher's signature _____

Date _____

Appendix E: Child letter of informed consent – English version



Assent form for children - English

36 to 60 months receptive language development level

Name of child participant: _____

Age of child participant: _____

Child participant's receptive
language level in months: _____

Photo of child participant:

Estienne wants to see if we can have therapy on a computer.

Brenda will be giving me and my mom/dad therapy on a computer at my house once.

The therapy session will be kept on a computer, so that it can be watched again.

Mom/dad and I will also have therapy with Brenda in her therapy room once.

There will be a video camera recording me and mom/dad in Brenda's therapy room, so that it can be watched again.

The therapy will be like my usual therapy sessions with Brenda.

If I want to stop doing the therapy session, I can just tell Estienne or Brenda. They won't be angry.

I will do my best to help Estienne to learn about giving therapy on the computer.

This is my name:

This is a drawing of me:



Appendix F: Child letter of informed consent – Afrikaans version



Assent form for children - Afrikaans
36 to 60 months receptive language development level

Name of child participant: _____

Age of child participant: _____

Child participant's receptive
language level in months: _____

Photo of child participant:

Estienne wil sien of mens terapie kan gee op 'n rekenaar.

Brenda gaan vir my en ma/pa eenkeer terapie gee op 'n rekenaar by my huis.

Die terapisessie sal op die rekenaar gebêre word, sodat hulle dit later weer kan kyk.

Ek en ma/pa sal ook een terapisessie saam met Brenda in haar terapiekamer hê.

Die terapisessie in Brenda se terapiekamer, sal op 'n videokamera opgeneem word, sodat hul dit later weer kan kyk.

Die terapie gaan baie soos die terapie wees wat ek gewoonlik by Brenda kry.

As ek wil stop met die terapie, kan ek net vir Estienne of Brenda sê. Hul sal nie kwaad wees nie.

Ek sal my bes doen om vir Estienne te help om te leer oor hoe ons rekenaars kan gebruik vir terapie.

Hier is my naam:

Hier is 'n tekening van my:





Appendix G: Assent form for minors



Assent form for minors
0 to 35 months receptive language development level

Name of child participant:	_____
Date of birth of child participant:	_____
Child participant's receptive language level in months:	_____
Parent/legal guardian:	_____

Photo of child participant:

Due to my child's current level of receptive language development, he/she is unable to understand and sign the assent form for this study. Thus, I, _____, parent/legal guardian of _____ (name of child participant) hereby consent to my child participating in this study.

I understand:

- what the study is about and how and why it is being done
- the purpose and procedures of the study and that there are no medical risks or discomforts involved for my child
- my child's rights as a research subject
- that participation is voluntary and that I may withdraw my child from the study any time I feel it is necessary to do so
- that break periods will be provided, should any fatigue be experienced by my child during the intervention session
- that all of my child's identifying information will be handled with strict confidentiality

I give my consent to **video/dvd recordings** being made of my child during **one** intervention session delivered by Brenda Schmid at the Centre for Listening and Spoken Language as well as a recording of **one** tele-intervention session, also delivered by Brenda Schmid.

I agree that video/dvd recordings of my child may be viewed by the researcher, clinician and one external expert professional for **research purposes**, i.e. data collection for **this study**.

Parent/ legal guardian's signature	_____
Researcher's signature	_____
Date	_____

Appendix H: Modified Tait Video Analysis tool

Child performance measuring tool for therapist/clinician

<u>Tait-based Communication Performance Measuring Tool</u>	
Clinician:	_____
Child participant:	_____
Parent participant:	_____
Date:	_____
Type of intervention:	_____

<u>Transcript (minimum 20 turns)</u>

Amount of vocal turn-taking	___ out of ___	___ %
Amount of non-vocal turn-taking	___ out of ___	___ %
Amount of vocal initiatives	___ out of ___	___ %
Amount of silent initiatives	___ out of ___	___ %
No response	___ out of ___	___ %
Amount of non-looking vocal response	___ out of ___	___ %
Amount of eye-contact	___ out of ___	___ %

Appendix I: Clinician field notes form

<u>Therapist field notes</u>	
Therapist:	_____
Child participant:	_____
Parent participant:	_____
Date:	_____
Type of intervention:	_____
<u>Field notes:</u>	

Appendix J: Technology questionnaire

Technology and -usage in the home

Parent/Caregiver name: _____

Child's name: _____

Resident town: _____

Resident country: _____

Please answer each of the following questions by marking the appropriate block with an X.

1. Which one of the following do you own?

Desktop PC Laptop Tablet

2. Which one of the above-mentioned devices are you most comfortable with using?

Desktop PC Laptop Tablet

3. Which one of the above-mentioned devices would you be most comfortable with using for this study?

Desktop PC Laptop Tablet

4. **Would you be willing to use your own above-mentioned device for the study?**

Yes No

(If 'no', you will be supplied with a device by the University of Pretoria)

5. **Would you require technical assistance in using this device?**

Yes No

6. **Do you have internet connectivity at home?**

Yes No

7. **If so, is your internet connectivity landline or wireless?**

ADSL Wireless (3G or HSPA)

8. **If ADSL, select the appropriate bandwidth speed:**

384kbps 512kbps 1mbps 4mbps and above n.a.

9. **If wireless, select the appropriate bandwidth speed:**

EDGE 3G HSPA 4G(LTE) iBurst Wireless Other
 n.a.



10. If wireless, please name your mobile service provider:

11. Do you have an uncapped service or a fixed per-month data bundle?

12. If you have a fixed per-month data bundle, what is its size (in Gigabyte)

13. Would you be willing to use your own bundled data for the tele-intervention session in this study?

(If 'no', you will be supplied by internet connectivity by the University of Pretoria)

14. Have you ever used Skype?

15. Are you comfortable with using Skype?

16. Do you have a Skype account?



Yes No

17. If not, have you ever used Google Plus Hangouts?

Yes No

18. Are you comfortable with using Google Plus Hangouts?

Yes Somewhat Not at all

19. Do you have a Gmail account?

Yes No

20. Would you require technical assistance for installing Skype or creating a Google Plus account on your device?

Yes Maybe No

21. Additional comments:

Thank you for taking the time to complete this questionnaire. Please return the completed questionnaire to estienne.havenga@gmail.com or hand in with Brenda Schmid at your next visit to The Centre for Listening and Spoken Language.

Appendix K: Parent questionnaire regarding conventional intervention

Caregiver questionnaire post-conventional intervention

Caregiver Questionnaire: Conventional Intervention	
Therapist:	_____
Child participant:	_____
Parent participant:	_____
Date:	_____

CIRCLE THE APPROPRIATE NUMBER

STRONGLY DISAGREE	1
DISAGREE	2
NOT SURE	3
AGREE	4
STRONGLY AGREE	5

1) As a caregiver, I felt comfortable during the conventional intervention session.	1	2	3	4	5
2) I found conventional intervention to be a beneficial experience of early intervention service delivery to me and my child.	1	2	3	4	5
3) I found the conventional intervention session to facilitate meaningful communication interaction between my child and I.	1	2	3	4	5
4) I would like to continue receiving intervention through conventional intervention methods.	1	2	3	4	5
5) State a reason for your answer in					



question number 4.	
6) Were any difficulties experienced	
during the conventional	
intervention session?	

Appendix L: Parent questionnaire regarding tele-intervention

Caregiver questionnaire post-tele-intervention

<u>Caregiver Questionnaire: Tele-intervention</u>	
Therapist:	_____
Child participant:	_____
Parent participant:	_____
Date:	_____

CIRCLE THE APPROPRIATE NUMBER

STRONGLY DISAGREE	1
DISAGREE	2
NOT SURE	3
AGREE	4
STRONGLY AGREE	5

<p>1) As a caregiver, I felt comfortable during the tele-intervention session.</p> <p>2) I found tele-intervention to be a beneficial experience of early intervention service delivery to me and my child.</p> <p>3) I found the tele-intervention session to facilitate meaningful communication interaction between my child and I.</p> <p>4) I would like to continue receiving intervention via tele-intervention.</p> <p>5) State a reason for your answer in question number 4.</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">1</td> <td style="width: 20%;">2</td> <td style="width: 20%;">3</td> <td style="width: 20%;">4</td> <td style="width: 20%;">5</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> </table> <hr/> <hr/>	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
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1	2	3	4	5																	
1	2	3	4	5																	



6) Were any difficulties experienced during the tele-intervention session?	<hr/> <hr/> <hr/>
--	-------------------

Appendix M: Parent overall perception questionnaire

Caregiver questionnaire post-intervention (tele- and conventional intervention)

<u>Final Caregiver Questionnaire</u>	
Child participant:	_____
Parent participant:	_____
Date:	_____

Please mark the appropriate block with an X

1.) Based on your experience thus far, do you think tele-intervention could be used with the same success as conventional intervention?

YES NO NOT SURE

2.) Please elaborate on the answer selected in question 1:

3.) In what instances do you feel tele-intervention may be effective/beneficial?

4.) In what instances do you feel tele-intervention might not be effective/beneficial?

Appendix N: Clinician questionnaire regarding conventional intervention

Therapist/clinician questionnaire post-conventional intervention

Therapist Questionnaire: Conventional Intervention	
Therapist:	_____
Child participant:	_____
Parent participant:	_____
Date:	_____

CIRCLE THE APPROPRIATE NUMBER

STRONGLY DISAGREE	1
DISAGREE	2
NOT SURE	3
AGREE	4
STRONGLY AGREE	5

1) As a therapist, I felt comfortable during the conventional intervention session.	1	2	3	4	5
2) I found conventional intervention to be a beneficial experience of early intervention service delivery to the caregiver and his/her child.	1	2	3	4	5
3) I found the conventional intervention session to facilitate meaningful communication interaction between the caregiver and his/her child.	1	2	3	4	5
4) I would like to continue to provide intervention to this child and caregiver through conventional intervention methods.	1	2	3	4	5



<p>5) State a reason for your answer in question number 4.</p>	<hr/> <hr/>
<p>6) Were any difficulties experienced during the conventional intervention session?</p>	<hr/> <hr/>

Appendix O: Clinician questionnaire regarding tele-intervention

Therapist/clinician questionnaire post-tele-intervention

<u>Therapist Questionnaire: Tele-intervention</u>	
Therapist:	_____
Child participant:	_____
Parent participant:	_____
Date:	_____

CIRCLE THE APPROPRIATE NUMBER

STRONGLY DISAGREE	1
DISAGREE	2
NOT SURE	3
AGREE	4
STRONGLY AGREE	5

<p>1) As a therapist, I felt comfortable during the tele-intervention session.</p> <p>2) I found tele-intervention to be a beneficial experience of early intervention service delivery to the caregiver and his/her child.</p> <p>3) I found the tele-intervention session to facilitate meaningful communication interaction between the caregiver and his/her child.</p> <p>4) I would like to continue to provide intervention to this child and caregiver through tele-intervention methods.</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">1</td> <td style="width: 20%;">2</td> <td style="width: 20%;">3</td> <td style="width: 20%;">4</td> <td style="width: 20%;">5</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> </table>	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
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1	2	3	4	5																	
1	2	3	4	5																	



5) State a reason for your answer in question number 4.	<hr/> <hr/>
6) Were any difficulties experienced during the tele-intervention session?	<hr/> <hr/>

Appendix P: Clinician overall perceptions questionnaire

Final questionnaire for therapist/clinician

<u>Final Therapist/Clinician Questionnaire</u>	
Clinician:	_____
Child participant:	_____
Parent participant:	_____
Date:	_____

Please mark the appropriate block with an X

1.) Based on your experience thus far, do you think tele-intervention could be used with the same success as conventional intervention?

YES NO NOT SURE

2.) Please elaborate on the answer selected in question 1:

3.) In what instances do you feel tele-intervention may be effective/beneficial?

4.) In what instances do you feel tele-intervention might not be effective/beneficial?

Appendix Q: Parents' and clinician's answers to questionnaires and coding of answers

Codes for questionnaires

ParentCon1				
ParentCon2				
ParentCon3				
ParentCon4				
ParentIele1				
ParentIele2				
ParentIele3				
ParentIele4				
ParentFinal		1 Yes	2 No	3 Not sure
ClinCon1				
ClinCon2				
ClinCon3				
ClinCon4				
ClinIele1				
ClinIele2				
ClinIele3				
ClinIele4				
ClinFinal		1 Yes	2 No	3 Not sure
Tech1	1 Desktop PC	2 Laptop	3 Tablet	4 PC & Laptop
5 PC & Tablet	6 Laptop & Tablet	/ PC & Laptop & Tablet		
Tech2	1 Desktop PC	2 Laptop	3 Tablet	4 PC & Laptop
5 PC & Tablet	6 Laptop & Tablet			
Tech3	1 Desktop PC	2 Laptop	3 Tablet	4 PC & Laptop
5 PC & Tablet	6 Laptop & Tablet			
Tech4	1 Yes	2 No		
Tech5	1 Yes	2 No		
Tech6	1 Yes	2 No		
Tech7	1 ADSL	2 Wireless	3 Both	
Tech8	1 - 384kbps	2 - 512kbps	3 - 1mbps	4 - 4mbps and above
	5 - n.a.			
Tech9	1 Edge	2 3G	3 HSPA	4 4G (LTE)
5 iBurst Wireless		6 Other	/ n.a.	
Tech10	0 n.a.	1 Vodacom	2 MIN	3 CellC
	4 Virgin Mobile	5 Telkom Mobile	6 Other (Outside SA)	
	/ Vodacom & Telkom Mobile			
Tech11	1 Uncapped	2 Fixed per-month data bundle		



Tech12	0 n.a. 3 more than 5GB	1 Less than 1GB	2 Between 1 and 5 GB
tech13	1 Yes	2 No	
tech14	1 Yes	2 No	
tech15	0 n.a.	1 Yes	2 Somewhat 3 Not at all
tech16	1 Yes	2 No	
tech17	1 Yes	2 No	
tech18	0 n.a.	1 Yes	2 Somewhat 3 Not at all
tech19	1 Yes	2 No	
tech20	1 Yes	2 Maybe	3 No

Caregiver Questionnaires Answers To Open Ended Questions

Caregiver Participant	CQ Conventional Intervention Question 5: "State the reason for your answer in question number 4."	CQ Conventional Intervention Question 6: "Were any difficulties experienced during the conventional intervention session?"	CQ Tele-intervention Question 5: "State a reason for your answer in question number 4."	CQ Tele-intervention Question 6: "Were any difficulties experienced during the tele-intervention session?"	Final Caregiver Questionnaire Question 2: "Please elaborate on the answer selected in question 1"	Final Caregiver Questionnaire Question 3: "In what instances do you feel tele-intervention may be effective/beneficial?"	Final Caregiver Questionnaire Question 4: "In what instances do you feel tele-intervention might not be effective/beneficial?"
1	"It's what we know now."	"None"	"More comfortable at home in own environment"	"line dropped 1 time"	"Staying in own comfort zone @ home & less traveling"	"If moving to area where there are no therapists"	"I can't think of one."
2	"Geen afleiding v. ander kinderstydens sessie."	"n.a."	"Internet service not sufficient"	"Yes – the busy environment @ home made the session almost impossible."	"Ane was glad nie gemaklik met tele-intervention nie. Isabel maak ook diesessie baie moeilik. Internet swak beeld."	"Tele-intervention sal voordelig wees vir kinders wat ver v. d. terapeut bly."	"Die tele-intervention is moeilik vir familie met ander kleiner kinders. Dit was moeilik aangesien dit die eerste keer was, sou moontlik makliker gewees het met 'n volgende sessie."
3	"Face to face therapy remains the best method of intervention. Where this is not available, tele-intervention is second best choice/option and offers a suitable alternative to traditional therapy."	"None"	"We are moving to Namibia and would like to continue with Brenda."	"No"	"Face-to-face therapy remains the best means of intervention as it allows for transmission of subtle cues that may not be visible or apparent in a tele-intervention. As such a tele-intervention remains a viable second option in my opinion and should not replace conventional therapy where latter is available."	"Where geographical constraints limit the possibility of having regular conventional sessions. E.g. if the child lives in another city of country."	"In cases where conventional therapy is available. During assessments. Where there are behavioural differences in the child between conventional + tele-intervention."
4	"My child seems more comfortable in her own surroundings, but I feel she also enjoys going to Brenda"	"No"	"My child reacts better in her own surroundings, however I was not sure that I know exactly what I did was correct."	"No"	"I feel that the child will still benefit from the session in the same way. As the parent, I feel we would benefit with a bit of training first."	"If you really can't get to a therapist. Parents should get an explanation of what kind of questions to ask beforehand, just to put us at ease that we are on the right path."	"If the parent does not know what to do exactly. If the child doesn't feel relaxed in front of the laptop."
5	"We live in another province so this would be"	Khensani wasn't too focused on the	"We live very far so the tele-intervention would be"	"Khensani was too fascinated with the"	"Technology is very advanced now and a"	"If possible we could do it maybe twice a"	"Where we don't have the necessary material"

	convenient for us" (?)	camera so it was easier for her to do her session."	ideal for us."	tele-intervention (screen) and lost a bit of focus on the actual lesson."	great part of our daily lives. So this tele-intervention would be a success. And we still see Brenda on the screen so it wouldn't be difficult to proceed with our normal sessions."	week. It would save us a lot of time traveling from Witbank to Pta."	to conduct the session."
6	"Works better for me."	"None."	"Would enable add-on therapy sessions whilst residing in Vereeniging."	"Frustrated with constant loss of signal"	"Too many external factors consuming valuable time, such as loss of signal, power outages etc. With conventional intervention you have her attention 100%"	"E.g. We are moving to Vereeniging soon. I would make use of 'add-on' sessions so that I don't have to drive to Pretoria more than once a week."	"Constant interruption of signal and power as we experienced during our Skype session. Facilities/resources play a role as well. Doing a session on an 11 inch screen is not effective at all."
7	"Chloe is used to conventional therapy"	"Didn't have hearing aids, hearing in left ear deteriorated, waiting for BAHA"	"More used to face-to-face therapy"	"Technical issues – battled to download Skype; struggled with angle of laptop (physical set-up)"	"Could be beneficial for clients who are too far away from therapist"	"Could be beneficial for clients who are too far away from therapist"	"If close to therapist, then conventional therapy is the most optimal option"
8	"Having Brenda one on one present gives me confidence with giving Mia 'therapy'"	"No."	"Convenient for our family with small children."	"No."	"Therapist constantly present for your guidance and support."	"Saves a lot of time."	"If there's a technical issue re internet connection."
9	"It gives me as parent guidance on what to focus on with my child."	"No"	"My child tends to react more comfortably in his own environment"	"Sometimes delays (technical issues)"	"Technical issues might prevent having meaningful sessions. Might not have equipment/toys needed unless given by therapist before the session (e.g. certain animal toys)"	"Definitely gives child opportunity to be in his own environment, do not need to get used to therapist and environment."	"Child might be distracted easily with his own toys he wants to play with instead of paying attention to session."
10	"Alegra's speech and language is not on par yet."	"No, not from my side."	"I'm not sure that its better than the one-on-one session in Brenda's office"	"No"	"I have not had enough experience in such sessions."	"If the child is sick or away from hometown."	"When it will cancel out one-on-one sessions in Brenda's office."

Clinician Questionnaires Answers To Open Ended Questions

Therapist Participant	TQ Conventional Intervention Question 5: "State the reason for your answer in question number 4."	TQ Conventional Intervention Question 6: "Were any difficulties experienced during the conventional intervention session?"	TQ Tele-intervention Question 5: "State a reason for your answer in question number 4."	TQ Tele-intervention Question 6: "Were any difficulties experienced during the tele-intervention session?"	Final Therapist Questionnaire Question 2: "Please elaborate on the answer selected in question 1"	Final Therapist Questionnaire Question 3: "In what instances do you feel tele-intervention may be effective/beneficial?"	Final Therapist Questionnaire Question 4: "In what instances do you feel tele-intervention might not be effective/beneficial?"
1	"Easy family to work with, could work either way with them."	"None"	"Mother and son comfortable with the technology and Mom's skills base good"	"...dropped once during the session. But quickly re-established connection."	"From the pilot, it would appear it could be a valuable method of service delivery to parents away from the centre/therapy base."	"More regular follow-up with 'out-of-towners"	"Inexperienced parents might be a challenge."
2	"Anè does better face-to-face; but who knows if it may improve with Skype."	"None."	"Could continue but would need to plan sessions very carefully to include sibling."	"Difficulties experienced with sibling present and the quality of the transmission."	"It would appear it could be a valuable method of service delivery to parents away from the centre/therapy base."	"More regular follow-up with 'out-of-towners"	"Inexperienced parents might be a challenge."
3	"This family is so much further along in the process, either Skype or conventional could work."	"None."	"Easy family to work with. Both mom and daughter relaxed with the technology and mom's skill level makes it easy."	"Close to 8a.m. we began experiencing signal issues."	"Both methods proving to work."	"More regular follow-up with 'out-of-towners"	"Inexperienced parents might be a challenge."
4	"Kiana is easy-going + enjoys the interaction."	"none as such – just technical difficulties with the recording"	"Kiana was much more vocal and demonstrated much better quality language and interaction in the safety of her home."	"None."	"In this particular case, the child demonstrated a higher quality interaction + better language skills in the safety of her home, with her family around."	"More regular follow-up with 'out-of-towners"	"Inexperienced parents might be a challenge."
5	"Mother was more comfortable"	"None."	"Would probably need a few sessions before one could really get a therapeutic session going with this child."	"Signal a little poor, but did not lose contact."	"it would appear it could be a valuable method of service delivery to parents away from the centre/therapy base."	"More regular follow-up with 'out-of-towners"	"Inexperienced parents might be a challenge."
6	"Easy child to work with, parents engage easily"	"None."	"Require a more stable connection so as not to stress/frustrate the parent."	"Many, many technical difficulties, kept losing video on one or both sides."	"This child responds as well and is comfortable with technology."	"Will be moving away in the course of 2015; this could save the family much travelling and petrol costs."	"Inexperienced parents might be a challenge."
7	"Easy family to work with"	"None"	"Chloe was a little shy; would need to get used to"	"none"	"it would appear it could be a valuable method of"	"More regular follow-up with 'out-of-	"Inexperienced parents might be a

			this type of therapy'		service delivery to parents away from the centre/therapy base."	towners"	challenge."
8	"Mia can be a little distractible in conventional setting."	"None."	"Mia was much less distractible at home; saw more skills demonstrated than seen in conventional therapy."	"None"	"it would appear it could be a valuable method of service delivery to parents away from the centre/therapy base."	"I am continually amazed at how well most children respond to technology, considering this is the first time for many."	"Inexperienced parents might be a challenge."
9	"Luan is beginning to understand how session works, and is engaging more"	"None"	"Sou eintlik met hierdie kind eerdervia tele-intervensie wou werk – hy was baie meer rustig by sy eie huis."	"Een tegniese 'issues', anders goed verloop."	"it would appear it could be a valuable method of service delivery to parents away from the centre/therapy base."	"This child much more trusting in his own home; more comfortable engaging with mom."	"Inexperienced parents might be a challenge."
10	"Currently important for building a relationship"	"None"	"Alegra much more comfortable in her home environment."	"Delayed video transmission, but sound good."	"Once again for this child, she was much more comfortable at home than has been seen in her early sessions at the centre."	"More regular follow-up with 'out-of-towners"	"Inexperienced parents might be a challenge."

