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Editor

Handbook of Evidence-Based Practices in Intellectual and Developmental Disabilities

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Telehealth

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Introduction

According to the Institute of Medicine (2012), telehealth is, in part, the provision of healthcare via the use of electronic and telecommunication technologies. For applied behavior analysts (herein referred to as behavior consultants), telehealth provides for substantially increased opportunities to deliver effective and empirically validated procedures to clients, the client's family, and other care providers. As one example, Wacker (2013) presented a case example, Jace (described later in this chapter), of how telehealth can be conducted in the homes of young children with autism spectrum disorders. During this talk at the annual conference of the Association for Behavior Analysis International, videos showing the child and his mother working together on a behavior treatment plan were presented. The videos first showed the child completing a task demand that involved putting blocks in a bucket. His mother sat near him on the couch and gave directions and prompts as needed. After he completed the task, he requested a play break with his mother by pressing a microswitch that when pressed activated a prerecorded message. The child and mother repeated this play-work routine several times, while the mother appeared to be talking to herself. However, the camera then zoomed in on the fireplace, which was across the room from the couch. A laptop was sitting open on the mantle, and on the screen of the laptop was the live image of a behavioral consultant who was coaching the mother through the procedures and providing feedback and praise. Thus, via telehealth, this mother had her own private consultation from a highly skilled behavior consultant

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regarding the behavior management program she was conducting with her child. This occurred in her home without either her or the behavior consultant having to travel, which in turn, substantially reduced the amount of generalization that was needed for her to implement the program since she was already conducting the program in her home.

This example shows how we have incorporated telehealth into our outpatient clinical and research programs at the Center for Disabilities and Development (CDD), The University of Iowa Children's Hospital. In this chapter, we provide a brief history of the evolution of our services. We first describe our outpatient clinic, the biobehavioral service (BBS), including a description of in vivo in-home coaching delivered to families. We next describe how we utilized telehealth to provide applied behavior analytic services in both clinic and home settings, and how other disciplines and other highly trained behavior consultants have used telehealth to deliver services. We conclude the chapter with step-by-step recommendations for using telehealth as part of a clinical practice.

History of Outpatient and Community-Based Behavioral Assessment and Treatment Programs

Our telehealth program is a part of the services we provide through the BBS outpatient clinic (Northup et al., 1991). This clinic was developed in the mid 1980s to provide functional analyses (FAs; Iwata, Dorsey, Slifer, Bauman, & Richman, 1994) and reinforcement-based treatments to individuals with developmental disabilities who engaged in severe problem behavior such as self-injury or aggression. A large focus of the clinic has always been consulting with families and other care providers. However, the distance that many of the families had to travel made it difficult to provide the intensity of individualized coaching that some parents needed to effectively manage problem behavior in their homes. In addition, parents frequently had to wait for 3 or more months to be seen in the clinic as the demand for behavioral services in Iowa continued to exceed the availability of those services (Wacker et al., 2013b). This was especially distressing with very young children whose self-injury or other severe problem behavior was just emerging. To complicate matters further, practitioners with skills in applied behavior analysis have historically been located mostly in a few of the university or urban areas of the state, leaving many families without the behavior analysis services they needed for their child. In response to these challenges, we sought to extend the clinic model through the delivery of in vivo in-home and telehealth-based services to assessment and treatment of severe problem behavior.

Home-Based Services

Beginning in the early 1990s, we received funding from the National Institute of Child Health and Human Development (Wacker & Berg, 1992) to work with parents in their homes to conduct FAs of their young (up to 6 years of age) children's problem behavior and to then implement functional communication training (FCT; Carr & Durand, 1985) to reduce problem behavior in their homes. During this project, behavior consultants drove to the families' homes and coached the parents during weekly 1-h sessions to conduct the assessment and treatment procedures. All of the children had developmental disabilities and most had problem behavior maintained by negative reinforcement. Harding, Wacker, Berg, Lee, and Dolezal (2009) provided a summary and case example of the specific FCT procedures used by the parents. In general, treatment consisted of two steps: (a) the child was given a direction by the parent to complete a small task such as to stack blocks or to point to a picture in a book, and (b) after the task was completed, a communication card and/or device such as a microswitch was presented to the child, who could then request an enriched break to play. Thus, task completion produced the card/device from the parent, and touching the card/device produced an enriched break to play with the parent.

The initial results of this project (Wacker et al., 1998) showed that parents could conduct these assessment and treatment procedures with good success when they received on-site and real-time coaching from a skilled behavior consultant.

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The majority of the children participating in the project showed at least an 80 % decrease in their problem behavior within a few months and the rated acceptability (Reimers, Wacker, Cooper, & DeRaad, 1992) of the procedures by the parents was very high. Even greater reductions in problem behavior occurred in subsequent projects (Wacker, Berg, & Harding, 1996, 2000), and positive findings of the generalization (Berg, Wacker, Harding, Ganzer, & Barretto, 2007) and maintenance (Wacker et al., 2011) achieved with this in vivo in-home coaching model further convinced us that an in-home approach to assessment and treatment, with every session conducted by parents, could be highly successful with real-time coaching occurring as the parents conducted the sessions. However, there were two major problems with this approach if conducted as a service delivery program. First, it was limited to families living within a 100-mile radius of the clinic (Wacker et al., 2013a). Thus, unless a large increase in behavior consultants became available very quickly in local geographic areas, many families who lived outside of this radius would remain unable to access these types of services for managing their child's behavior at home. Second, in-home services were expensive to provide, primarily due to the travel time of the behavior consultant, and insurance reimbursement was often too low to allow clinicians to provide necessary ongoing services. Therefore, a more efficient approach to providing these services was required. The emergence of telehealth technology offered the opportunity to address some of the delivery barriers associated with both the clinic and in vivo in-home approaches.

Telehealth-Based Services

As summarized by Lee et al. (2015), the University of Iowa Hospitals and Clinics have been providing limited telehealth services since the mid 1990s. Behavior consultants began providing telehealth consultation to local pediatricians and school teams in 1996, when the University of Iowa's National Laboratory for the Study of Rural Telemedicine received a grant from the US National Library of Medicine (Kienzle, 2000). Part of this grant was used to fund projects that evaluated the effectiveness of telehealth, and BBS staff received one of those projects. Most of this project was devoted strictly to consultation, meaning that school or healthcare teams reviewed cases with BBS staff and then implemented the procedures locally without real-time guidance from the behavior consultants.

Barretto, Wacker, Harding, Lee, and Berg (2006) extended the procedures when they showed that FAs could be conducted effectively via telehealth. The telehealth system utilized an existing secure, fiber optic cable system, which connected the CDD to high schools, hospitals, and other government agencies in Iowa. Barretto et al. (2006) conducted FAs with two children, one in a school by a school team and one in a department of human services office by a foster parent and a physical therapist. There was no easy way to communicate between the sites, and so the local professionals and parent conducted a phone call with BBS staff prior to the assessment, and BBS staff held up signs indicating what should occur next and/or breaks were taken so that further discussion could occur by phone. Despite these major limitations, social functions were identified for both children. These results were replicated with other children in other locations with positive results occurring most of the time. Thus, rather than simply consulting on a case, the behavior consultants were able to observe the care provider conducting sessions with the child and to provide feedback as soon as it was needed.

These successful clinical demonstrations led Wacker et al. (2013a, 2013b) to further evaluate the efficacy of conducting both FAs and FCT via telehealth through a grant funded by the National Institute of Mental Health (Lindgren & Wacker, 2009). In this funded project, behavior consultants at the CDD coached parents to conduct FAs and FCT in regional pediatric clinics located near their homes (but over 200 miles, on average, from the CDD). These clinics were connected to the CDD via a secured videoconferencing system. They used this system to conduct the exact same FA and FCT procedures as had been conducted in the in-home project (FA plus 2-step FCT program) with 20 young chil-

dren diagnosed with autism spectrum disorder. Social functions were identified for 18 of the 20 children. In a subsequent study, 17 children (13 from the original group plus four additional children) received FCT. Problem behavior was reduced by an average of 93.5 %. This reduction in problem behavior was equivalent to that achieved in the in vivo in-home project (or from our CDD clinic studies; Asmus et al., 2004), but was much less costly and much more convenient for the participating families.

Although telehealth delivery was more convenient for clinicians and for families living substantial distances from our clinic in Iowa City, families still needed to drive an average of 15 miles to the regional pediatric clinics, and they still needed to generalize the procedures to their homes. Given the positive outcomes achieved by parents both in their homes with in vivo coaching and in regional pediatric clinics with remote real-time coaching, Lindgren and Wacker (2011) conducted these exact same procedures via telehealth directly in the homes of the children and their families using Skype™. We are currently in the last year of this project, and the behavioral results to date have been equivalent to those obtained in the previous projects. Social functions have been identified for most children's problem behavior, treatment results for most children show at least 90 % reduction in problem behavior, and the parents can implement the procedures with good fidelity (Suess, Romani, et al., 2014), even though all coaching is conducted via telehealth and there is the possibility of equipment problems (Lee et al., 2015) and other concerns (Suess, Kopelman, et al., 2014) that can affect the fidelity of the procedures. Parent ratings of acceptability have remained very high throughout all of the telehealth projects.

In the following sections, we describe both the in-clinic and in-home telehealth procedures we conducted through our clinic and funded projects. Most of our programs are currently funded through grants, but we are gradually beginning to integrate the use of telehealth into our BBS clinic. We do not anticipate that telehealth will replace in vivo (home and clinic) programs, but we do anticipate that telehealth will be increasingly used to augment our other clinical and research programs. In our view, the question is not whether we will be using telehealth in the future, but rather how to identify the conditions under which it can be best used.

Description of Treatment or Training Approach

Clinic-to-Clinic Telehealth Model

Model Description

The clinic-to-clinic project (Lindgren & Wacker, 2009) was the team's first large-scale attempt to replicate the procedures (FA plus FCT) first conducted in vivo in the family's home (Wacker et al., 1998, 2011) through telehealth. Therefore, the procedures used during this project (Wacker et al., 2013a, 2013b) were conducted as similarly as possible to the procedures from the in-home project. Participants were young children ages 2–6 years who were diagnosed with autism spectrum disorder and who engaged in problem behavior. Behavior consultants were located at the CDD (host site) and parents, their child, and a parent assistant were located at one of five participating regional pediatric clinics (remote site) located within 50 miles of the family's home. The regional pediatric clinic site and the CDD site were connected through a secure videoconferencing system. Assessment and treatment procedures were conducted during 1-h weekly consultations by the children's parents with live coaching from the behavior consultants.

In this section we provide a step-by step description of the procedures used in this project and we highlight the modifications we made from the in-home in vivo model to the telehealth clinic-to-clinic model.

Step One: Determining Equipment Needs

The regional pediatric clinics had preexisting high speed internet and videoconferencing capabilities. As part of this project, the CDD had a four-station telehealth center that connected to the regional clinics by a firewall-protected virtual private network. Emblaze-VCON vPoint HD was

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Step Two: Initial Meetings

Parent Assistant Training

Parent assistants were hired to provide on-site support to the parents as needed during the telehealth consultations. The parent assistants' children received care at the clinics, but the parent assistants had not received specific training in behavior analysis prior to this project. Parent assistants were hired to work about 8-h per week.

The behavior consultants provided two, 1-h training presentations to the parent assistants. These presentations were done via telehealth and also served to train the parent assistants on the technology. One presentation reviewed the principles of behavior analysis, and the second one reviewed the specific procedures of the project (FA and FCT). The parent assistants received a manual that described the project's procedures and timelines in detail. The parent assistants had duties prior to, during, and after each telehealth visit. Prior to the visit, the parent assistants arranged the clinic room to ensure safety, made sure all materials needed for the session were available, and met remotely with the behavior consultant to review the plan for the visit. During the visit, they assisted the parent by continuing to make sure materials were available and preventing the children from eloping or climbing on the tables, and they assisted the behavior consultant with troubleshooting technology issues. After the visit, the parent assistant met with the behavior consultant to review the results from the visit and plan for the next visit.

Parent Training

Prior to beginning telehealth visits with the child, the behavior consultant met remotely with the parent for 1 h to provide training to the parent on the project's procedures. Parents also received a manual with descriptions of the procedures and were asked to read the procedures prior to implementing them. Parents were not expected to remember how to implement the procedures on their own as they received live coaching throughout the sessions in the same way as provided during the in vivo in-home project (Harding et al., 2009).

Initial Assessments

Three assessments (parent interview, daily behavior record, preference assessment) were conducted prior to beginning the FA and FCT. The purpose of these assessments was to obtain information about the child's target problem behavior (behavior of focus during the FA and FCT, which usually included self-injury, aggression, and/or property destruction), to develop hypotheses regarding the function of the target behavior, and to identify stimuli to utilize during the assessments. These three assessments were conducted during the first parent meeting and the first telehealth visit with the child.

Parent Interview

During the first parent meeting, in addition to reviewing the procedures, the behavior consultant interviewed the parent. During this interview, the parent was asked to describe the behaviors of concern and how these behaviors impacted their day-to-day lives. Based on this information, the team developed response definitions and gauged the severity of the child's target problem behavior. In addition, we asked the parents about the child's overall behavior and communication skills. This interview also provided the behavior consultant with important information on the parents' communication skills and overall comfort with the telehealth equipment.

Daily Behavior Record

The behavior consultant asked the parent to collect a daily behavior record of the target behaviors for 1-week until their next meeting. This assessment served two main purposes. First, it helped to develop hypotheses regarding the function of the child's problem behavior and therefore assisted in designing the FA conditions for that child. Second, it prompted parents to consider the function of their child's problem behavior.

Preference Assessment

The behavior consultant asked the parent about toys/activities the child liked, and the degree to which the child needed adult assistance to engage in those activities. An array of five to six of these activities was then used during a free operant preference assessment (Roane, Vollmer, Ringdahl, & Marcus, 1998) that was conducted during at least three, 5-min sessions. The highly preferred items were used during the free play and tangible conditions of the FA, and the less preferred activities were often used during the escape condition.

Step Three: Evaluation Procedures

Functional Analysis

Sessions during the FA were conducted similarly to those described in the in vivo in-home projects (Wacker et al., 1998, 2011), with a few procedural and logistical changes.

Before the Child Arrived

The behavior consultant initiated a telehealth call to the parent assistant 10–15 min prior to the parent and child arriving in the clinic. The behavior consultant then guided the parent assistant in ensuring the clinic space was safe and ready for conducting the sessions. The behavior consultant and parent assistant ensured that all materials needed for the sessions were available in the room except for ones the parent was bringing from home.

Coaching the Parent and Providing Feedback

The behavior consultant provided live coaching during the session to the parent as described in Harding et al. (2009). This included providing prompts such as when the parent should reinforce target behaviors and providing descriptive feedback regarding the fidelity of those procedures.

Conducting Sessions

One control (free play) and three test (social attention, escape, tangible) conditions were typically included in the FA (Wacker et al., 2013b). One difference in the FA procedures compared to the in vivo in-home project was that three to nine consecutive free play conditions were conducted initially to assist the child and parent to become comfortable with the telehealth technology and the clinical space. We continued to conduct free play sessions until zero or near zero occurrences of problem behavior occurred. For most children, three to four free play sessions were sufficient. After the test conditions were begun, the order of the sessions was counterbalanced. Inclusion in the project required that the child's problem behavior was maintained, at least in part, by social functions.

Functional Communication Training

Prior to beginning FCT, the behavior consultant, parent assistant, and the parent had a meeting to discuss the FCT procedures. FCT involved teaching the child to comply with a request (which increased via demand fading) and then mand for an enriched 1–2 min break. The parent was asked to practice FCT in his/her home daily for 10–15 min and report on the practice sessions to the behavior consultant at the beginning of the next telehealth appointment.

Benefits, Challenges, and Hints for Clinic-to-Clinic Telehealth

Benefits

The two primary benefits of conducting services via telehealth from clinic-to-clinic was that the vast majority of the children displayed at least a 90 % decrease in problem behavior, and parents rated the treatment as highly acceptable. Very few of these children could have been served in either our clinics or our in-home treatment project because of geographical constraints (e.g., distance, cost). Other benefits included:

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1. *Cost Effectiveness*. In comparison to the in vivo in-home project, the decreased travel time for behavior consultants resulted in an overall threefold reduction in the cost of delivering effective behavioral assessment and treatment to children who displayed problem behavior.
2. *Efficiency and Increased Access*. The decreased travel time to families' homes increased the efficiency of the behavior consultants. This resulted in their ability to see more children during the same period of time.

Challenges

Very few concerns arose during the implementation of the clinic-to-clinic telehealth project. However, as with any service delivery model, there are various potential problems and limitations to consider, including:

1. *Access*: Although the pediatric clinics were closer to the children's homes, the families still had to travel to the local clinic. The travel may pose obstacles for certain families and may therefore limit their ability to utilize this service. For example, families who did not own vehicles had to identify transportation on a weekly basis to the clinic, and families who had limited funds had difficulty paying up front for the gas money to come to the clinic. Additionally, families who had other children had to secure childcare for siblings or one of the parents had to stay home. These obstacles may result in session cancellations or the families' inability to participate in this service delivery model.
2. *Generalization*: Although the parent was coached to implement the intervention with good fidelity in clinic, they still needed to implement it in the natural setting (e.g., home, community) without support, which may result in treatment fidelity errors.

Hints

Throughout our experiences on this project, we identified several strategies and tips that were beneficial, could have been beneficial, or should have been considered when beginning the project. Based on these experiences, the following hints should be considered when developing a telehealth service.

1. *Immediate Feedback*: We used a real-time telehealth model in which the behavior consultant observed the parent as the parent was conducting a session with his/her child. This allowed for immediate feedback, which likely increased the overall fidelity of the procedures. If the telehealth sessions had instead been recorded and stored for later viewing by the behavior consultant, the delayed feedback may not have been as effective.
2. *Capability to Control Camera*: When conducting clinic-to-clinic telehealth, it is more likely that the technology connecting the clinical settings has higher capabilities than technology used in the home since it may be used by multiple providers, from different specialties, and for multiple clients. Enhanced technology comes with various benefits such as the remote capability to control the camera in the host location. When conducting behavioral assessment and intervention, this is a great benefit because the individuals at the remote site (e.g., parent, parent assistant) do not have to worry about the camera positioning and can focus on following the behavior consultant's directions. In addition, if the child moves away from the camera's view, the behavior consultant can easily track the child's movements.
3. *Number of Sessions per Visit*: Despite scheduling 1 h for each telehealth visit, we were able to conduct only three to six sessions (lasting 5 min each) per appointment. The lower than expected number of sessions was due to the need to touch base with parents and remind them of procedures at the beginning of the session, provide feedback to parents after the sessions, and prompt the parent assistant and parent to prepare for the next session.
4. *Child Sensitivity to Consultation*: Several of the children in our project were highly sensitive and responsive to the behavior consultant coaching his/her parent. Children who were vocal sometimes responded to behavior consultant inquiries and coaching (e.g., saying, "No" or engaging in problem behavior when the behav-

ior consultant instructed the parent to place a demand on his or her child even though the parent had not yet made the request). In these cases, we implemented various modifications such as using bug-in-the-ear systems, turning off the behavior consultant's camera, limiting the in-session coaching, and talking with the parent pre- and post-session by phone.

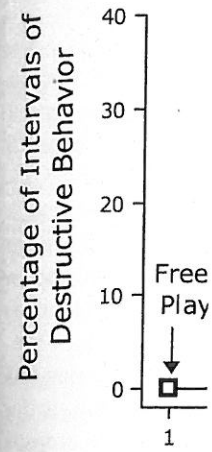
Case Examples The following two case examples (Mel and Newt) are representative of the procedures and results from our clinic-to-clinic telehealth project. Both children's demographic information and FCT data were included in summary tables in Wacker et al. (2013a).

Mel. Mel was a 30-month-old boy diagnosed with autism spectrum disorder, mixed-receptive-expressive language disorder, and developmental delay. His target problem behavior consisted of self-injurious behavior (e.g., head banging, hitting head with hard objects, hand biting), aggression (e.g., head butting), and property destruction (e.g., throwing items). Mel was nonvocal, and his communication consisted of walking toward the items he wanted (e.g., approaching mother's bag, walking toward door). Mel attended a preschool classroom for 3 h every day. Mel's father lived halfway between the CDD and the local pediatric clinic, and his mother lived approximately 88 miles away from the CDD and a few minutes from the local clinic where they received telehealth consultation. Mel and one or both of his parents attended weekly 1-h telehealth visits for approximately 4 months.

During Mel's first telehealth appointment, the behavior consultant coached the parent to conduct three free play sessions, which also served as the stimulus preference assessment. Although Mel engaged with some toys, he persistently approached his diaper bag, which contained lollipops. Given the absence of consistent toy play, the lollipops were selected as Mel's highest preferred stimulus. Mel did not engage in target problem behavior during the initial three free play sessions. In addition, he did not attempt to approach the screen on which the behavior consultant's image was projected and did not seem to respond (e.g., move toward, look up) when the behavior consultant coached his parents. Therefore, the behavior consultant proceeded with the FA. During the next two, 1-h telehealth visits, the behavior consultant coached Mel's parents to conduct eight FA sessions within a multielement design. The sessions were 5 min in length and the order of the sessions was counterbalanced. The results of the FA, shown in Figure 22.1, identified that Mel's problem behavior was maintained by access to tangibles, specifically the lollipops that his parents carried in their bags. During FCT, Mel was required to walk to the work table when his parents showed him a work card, and to place his lollipop in an empty container called his "safe spot" (safe, meaning the lollipop would not be thrown away or taken by others). He then had to complete two requests (e.g., put blocks in a bucket) independently and without problem behavior prior to being able to mand by signing "more" for access to his lollipop. With one exception, Mel's target problem behavior decreased immediately and remained low during all sessions (Figure 22.2; FCT 2). The demand requirement was then increased to ten requests per session, and problem behavior remained low (Figure 22.2; FCT 10).

The main concern experienced with telehealth in this case was due to the severity of Mel's self-injurious behavior. His self-injury was severe and required that the behavior consultant prepare the parents and the parent assistant carefully to block and protect Mel from hurting himself. We have found that for children with more severe challenging behavior, it is imperative to prepare the parent and the parent assistant ahead of time to maintain the safety of all parties involved. During our clinic-to-clinic telehealth project, we did not have to terminate participation for any child due to severity of his/her challenging behavior.

Newt. Newt was a 36-month-old boy diagnosed with autism spectrum disorder whose target problem behavior was aggression (e.g., pushing, hitting), self-injurious behavior (e.g., head banging), and property destruction (e.g., swiping items, throwing items). Newt had limited functional communication and attended an early childhood special education preschool classroom. Newt and



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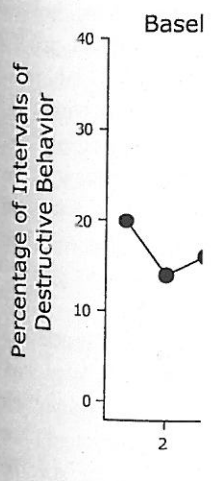

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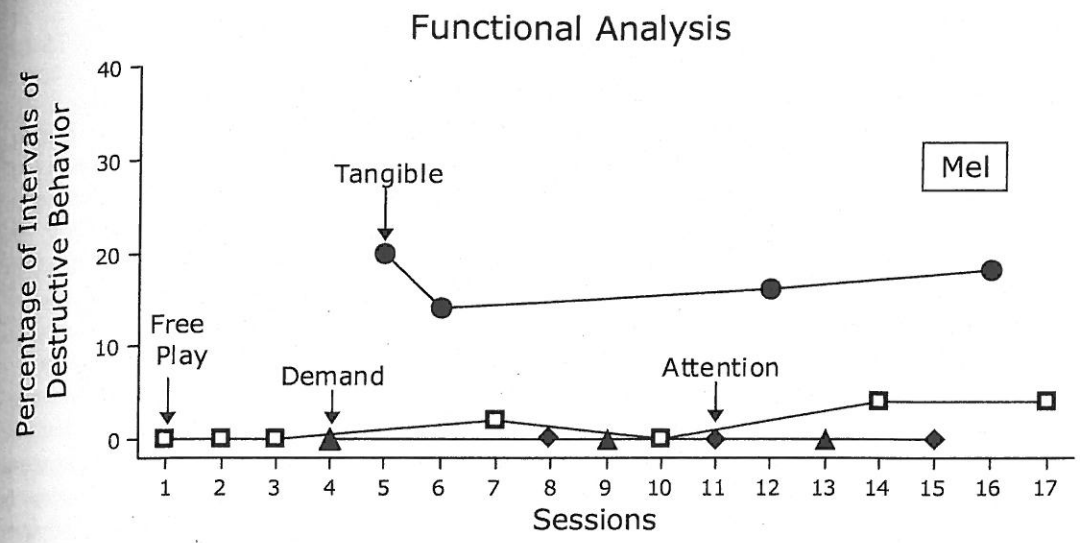

Fig. 22.1 Results of the functional analysis completed via telehealth with Mel during his enrollment in the clinic-to-clinic telehealth project

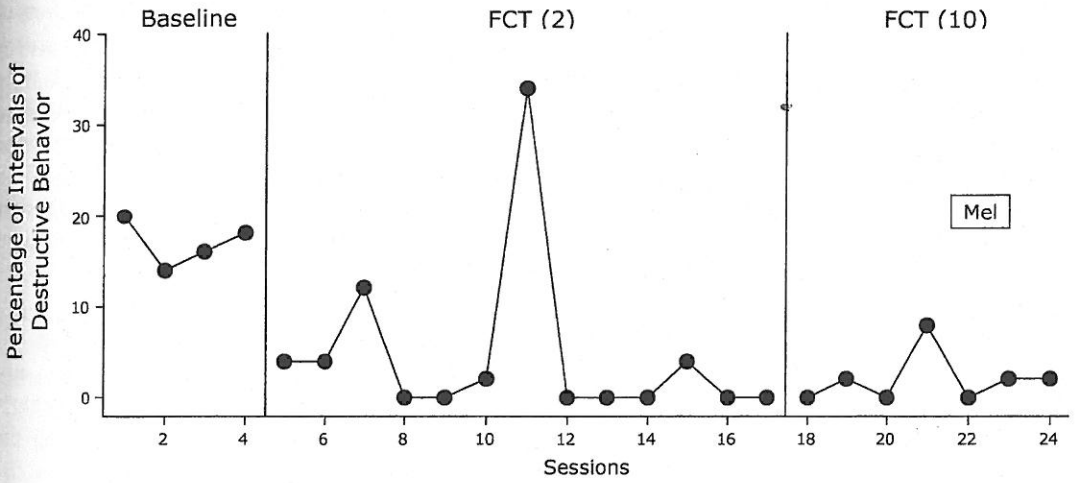

Fig. 22.2 Results of functional communication training conducted via telehealth with Mel during his enrollment in the clinic-to-clinic telehealth project

his family lived approximately 95 miles away from the CDD where the behavior consultants were located and approximately six miles from their local pediatric clinic where they received telehealth consultation. Newt and his mother attended weekly 1-h telehealth visits for approximately 4 months during the course of this project.

Newt was one of the last participants enrolled in the clinic-to-clinic telehealth study. Thus, the behavior consultant and parent assistant did not always have to call each other prior to Newt arriving in the clinic for the telehealth visits. During the first parent meeting, the parent assistant, Newt's mother, and the behavior consultant met to discuss the goals and procedures of the project, interview the parent, explain the daily behavior record, and ask about Newt's preferences. The parent assistant faxed the daily behavior record

forms to the behavior consultant for review prior to the next meeting. During Newt's first telehealth appointment, the behavior consultant coached the parent to conduct three free play sessions, which also served as the free operant stimulus preference assessment. Newt did not engage in problem behavior during these sessions, seemed comfortable in the environment, did not attempt to approach the screen, and did not seem sensitive to the behavior consultant coaching his mother.

During the next three 1-h telehealth visits, the behavior consultant coached Newt's mother to conduct 13 FA sessions within a multielement design. The parent responded very well to coaching. The only concern that occurred was during the escape condition, in which the behavior consultant had to remind the parent several times to make sure she had enough materials to complete the demand and to prevent Newt from having access to his preferred item before completing the tasks requested. The results of the FA showed that Newt's problem behavior was maintained by access to tangibles and escape from demands. FCT required Newt to walk to the work table and complete one demand (i.e., putting blocks inside a bucket) before being able to mand for an enriched break with his toys and parent attention. Newt manded by pressing a microswitch with a picture card attached to it. After an initial increase, Newt's problem behavior decreased to zero. The task demands were then increased to ten tasks per session, and problem behavior remained low.

The biggest problem we experienced with telehealth in this case was poor fidelity during demands. This mother needed the continued support of the parent assistant to conduct the FCT procedures with good fidelity.

As shown in these case examples, telehealth can serve as a very effective delivery system for behavioral assessment and treatment procedures. Although some problems with fidelity occurred, the parents were still able to achieve notable reductions in problem behavior. The biggest problem with conducting telehealth in regional pediatric clinics was that the families still needed to drive to a clinic and to generalize the procedures from the clinic setting to their homes.

Clinic-to-Home Telehealth Model

Model Description

The clinic-to-home project (Lindgren & Wacker, 2011) was initiated following the successful demonstration that parents can be coached remotely to conduct FA plus FCT in a clinic setting via telehealth. One of the primary objectives of the clinic-to-home telehealth project was to directly compare outcomes (e.g., reduction in problem behavior, cost, treatment acceptability) with the in vivo in-home and clinic-to-clinic telehealth models. The procedures used during this project (Suess, Romani, et al., 2014) were similar to those of the previously described projects (Wacker et al., 1998; 2013a, 2013b). Participants were young children ages 2–7 years who were diagnosed with autism spectrum disorder and who engaged in problem behavior. Behavior consultants were located at the CDD (host site), and parents conducted sessions in their homes (remote site). Assessment and treatment procedures were conducted during weekly 1-h telehealth visits by the children's parents with live, remote coaching from the behavior consultants. In this section, we provide a brief overview of the procedures used in this project with a focus on modifications needed to adapt the clinic-to-clinic telehealth model to the home setting.

Step One: Determining Equipment Needs

At the time of enrollment, our technology support staff contacted the parents to determine their equipment needs in order to participate in the project (refer to Lee et al., 2015, for specific equipment requirements). Parents were loaned a Windows-based laptop, webcam, and Ethernet cable if they did not already own the necessary equipment to participate. In order to meet each of the parents' equipment needs, we created an equipment lending pool from which the equipment was checked-out to the parents free of charge; the parents then returned the equipment at the end of their participation in the project. The laptops were equipped with Skype™ (video conferencing software) and Debut (video recording software). Internet service was also provided to

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the parents if they did not have broadband service or if the speed of the internet service was not sufficient for the telehealth visits (refer to Lee et al., 2015, for recommended internet requirements). Support for internet service was then discontinued when participation in the project ended.

After the parents received the equipment in the mail, a technology meeting was completed to ensure compatibility with the telehealth system being used at the CDD and to familiarize the parents with how to use Skype™ (Lee et al., 2015). The technology meeting was approximately 1 h and involved our technology support staff contacting the parents via telephone to provide initial instructions on how to operate the computer and ended by testing the Skype™ connection.

Step Two: Initial Meeting

The week following the technology meeting, the behavior consultant held a 1-h parent meeting via Skype™. The parent meeting began by the behavior consultant providing an overview of function-based assessment and treatment procedures used in the project (Suess, Romani, et al., 2014). The parents also received a manual describing the project's procedures. The behavior consultant then interviewed the parent to determine the current behaviors of concern. At the end of the parent meeting, the behavior consultant and parent determined the room in the home (e.g., bedroom, kitchen, family room) in which the FA and FCT were going to be conducted and set a day and time at which the subsequent telehealth visits would occur.

Step Three: Evaluation Procedures

Functional Analysis

Parents were coached to conduct the FA within a multielement design, and all test conditions were counterbalanced. Unlike in the clinic-to-clinic telehealth project, parent assistants were not present during the FA, and parents conducted all sessions without any "hands-on" support in their home. Prior to each weekly telehealth visit, the behavior consultant spent a few minutes talking with the parent about how the sessions would be conducted, making sure that appropriate materials were present, and that the room was set up to conduct the analysis. FA sessions were conducted very similarly to the clinic-to-clinic model, including the addition of extra free play sessions, conducted consecutively at the beginning of the FA, until near zero occurrences of problem behavior occurred. All FA sessions were recorded using Debut for subsequent data collection and analysis.

Functional Communication Training

Prior to beginning FCT, the behavior consultant and parent met to review the FCT procedures, which again involved teaching the child to comply with a request and to then mand for an enriched 1–2 min break. The parent was asked to practice the FCT in their homes daily for 10–15 min and to record their practice sessions using Debut on the laptop. The behavior consultant and the parent briefly discussed the prior week's practice sessions at the beginning of the next telehealth appointment.

Benefits, Challenges, and Hints for Clinic-to-Home Telehealth

Benefits

There appear to be several potential benefits to the delivery of in-home behavioral services via telehealth.

1. *Treatment Effectiveness*. Outcome data indicated that the mean reduction in problem behavior for participants in the clinic-to-home telehealth project was 97 %.
2. *Cost Effectiveness*. There was a significant decrease in average cost per child per week compared to in vivo delivery of behavioral services in the home.
3. *Accessibility, Convenience, and Productivity*. By eliminating both the need for consultants to travel to the home and for families to travel to a clinic, clinic-to-home telehealth resulted in increased accessibility and convenience compared to the traditional in-home project or the clinic-to-clinic telehealth project. The average distance from Iowa City for families in the clinic-to-home telehealth project was over 116 miles. By eliminating travel barriers, many families were able to participate in the telehealth project who would have been previously ineligible due to geographical con-

straints. Furthermore, because services were delivered in the home, families did not have to travel to a clinic for weekly sessions.

4. *Generalization*. Similar to the in vivo in-home model, the FA and FCT procedures were conducted by parents in their own homes. This greatly reduced the need for parents to generalize the procedures, and the consultants could observe any naturally occurring barriers (e.g., more than one family dog was in "time out" during sessions).
5. *Treatment Acceptability*. Parent ratings of treatment acceptability remained high. This suggests that, regardless of the specific delivery system utilized, most parents have found the FA plus FCT approach to treatment to be very acceptable.

Challenges

The following is a list of practical considerations for practitioners to consider with in-home telehealth service delivery based upon our experiences.

1. *Technical Challenges*: Use of telehealth technology resulted in occasional technical problems related to connectivity, hardware, and software that did not exist when behavioral consultants provided in vivo consultation in the home. In a few instances, sessions could not be conducted at the scheduled time or data were lost due to technical difficulties. See Lee et al. (2015) for additional information about the types of challenges encountered and for technical guidelines for practitioners interested in providing services via an in-home telehealth service delivery model.
2. *Implementation Considerations*: Prior to conducting FA plus FCT in the home, behavior consultants needed to consider several practical issues that could influence assessment and treatment outcomes. These included (a) equipment needs (e.g., Did the parent have internet service? Did they own a secure and reliable webcam and computer?), (b) the safety of the child and parent in the room where the evaluation was to be conducted (e.g., Was there furniture that could be knocked over? Were potentially dangerous materials present?), (c) whether target behaviors were observable via telehealth (e.g., What happened if the child moved around quickly or left a defined space?), (d) who would be involved in the telehealth sessions (e.g., If the participating child had siblings, would they be present in the room?), (e) how the child would respond to the equipment (e.g., Did a Bluetooth® device need to be used to provide bug-in-the-ear coaching to the parent? Were additional free play sessions needed to be conducted to help the child adjust to the camera?), (f) the severity of problem behavior (e.g., If a child engaged in severe problem behavior, would we reinforce less severe behaviors that were part of the same response class?), and (g) how coaching would be delivered (e.g., setting up time with the parent prior to conducting sessions to discuss procedures to provide feedback during sessions if fidelity errors were committed, and to review results at the conclusion of the sessions). See Suess, Romani, et al. (2014) for information about how parents were oriented to conduct in-home telehealth.
3. *Insurance Reimbursement*. The procedures described in this chapter were conducted as part of federally funded research projects. Although the results strongly indicate that telehealth is a feasible model for conducting behavioral assessment and treatment, variability currently exists with respect to insurance reimbursement for telehealth services and especially for in-home telehealth services.

Hints

The following is a list of hints to consider when developing a clinic-to-home telehealth service.

1. *Advanced Preparation*. As described above, there are several variables unique to telehealth delivery of behavioral services in the home compared to in vivo delivery that can influence outcomes. Although it is impossible to anticipate all variables in advance, we encourage practitioners to carefully consider and resolve likely challenges to minimize difficulties that occur during sessions. It was particularly important for the behavior consultants to have the ability to troubleshoot simple technology

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2. *Immediate Feedback*: Similar to the clinic-to-clinic model, immediate feedback was provided to parents across all sessions, which likely increased treatment fidelity. We recommend that behavioral consultants correct errors when they occur instead of waiting until after a video of the session has been observed.
3. *Information Technology (IT) Support*. Before beginning to deliver services through telehealth, it will be important to select appropriate equipment and to ensure that IT support will be available to address any connectivity, hardware, and software issues that arise as well as issues related to protection of privacy and data storage and retrieval.
4. *Number of Sessions per Visit*: Similar to clinic-to-clinic telehealth, we completed slightly fewer sessions per visit in the clinic-to-home telehealth project than in the in vivo in-home project. Time spent checking in with the parent at the beginning of the session, conducting additional free play sessions to help the child adjust to the telehealth equipment, reminding the parent of procedures prior to sessions, and providing feedback after the sessions all contributed to the greater amount of total time needed to complete the FA.
5. *Child Sensitivity to Consultation*: A few of the children were aware of and overly responsive to the behavior consultant coaching their parent via telehealth. Similar to the clinic-to-clinic telehealth project, we implemented modifications such as using Bluetooth® audio technology, turning off the behavior consultant's camera, limiting the live in-session coaching, and talking with the parent pre- and post-sessions on the phone.

Case Examples The following two case studies (Jace and Billy) describe procedures used during the clinic-to-home telehealth model. For Jace, the first case example, we emphasize the procedures conducted during the telehealth appointments. Jace's data were previously published in Suess, Romani, et al. (2014). For Billy, we emphasize the various challenges encountered and our solutions to address those challenges throughout our experiences with Billy and his mother.

Jace. Jace was a 31-month-old boy diagnosed with autism spectrum disorder and intellectual disability. Jace's mother conducted all telehealth sessions. Jace's home was located 3 miles from the CDD.

At the time of enrollment, the behavior consultant conducted a brief phone interview to determine his parents' equipment needs. Specific information was obtained regarding access to a computer, internet service, and other technology materials (e.g., webcams, Ethernet cables). This information was important to determine whether the equipment currently in the home would be sufficient for telehealth services.

After receiving the needed telehealth equipment, the behavior consultant held the technology meeting with the mother to orient her to Skype™ and other specific features of the computer (e.g., Internet Explorer). The behavior consultant also ensured that Skype™ was using the external webcam provided for her instead of the internal webcam on the computer to ensure the highest quality visual image. Finally, the behavior consultant helped the mother connect the Ethernet cable from the computer to the internet modem. Connecting the Ethernet cable proved difficult for her, even with descriptive feedback from the behavior consultant. Thus, the behavior consultant instructed her to move the external webcam so the behavior consultant could see the modem and computer to facilitate more specific support.

The purpose of the second telehealth visit was for the behavior consultant to deliver a didactic training during a 1-h meeting. The primary behavioral concerns were self-injurious behavior (e.g., head banging), aggression (e.g., pulling hair and biting), and property destruction (e.g., throwing items). Jace did not have an effective form of communication and only occasionally used gestures (e.g., pointing).

The FA began the following week. The behavior consultant began preparing for this visit (and all subsequent visits) about 10–15 min prior to the scheduled appointment time. During this setup period, the behavior consultant prepared notes to record general behavioral observations

during the visit and also logged onto Skype™ to check the internet connection and webcam. After establishing a connection, the behavior consultant guided the mother to make sure the living room was safe, to move some items (e.g., picture frames), and to create barriers to block Jace from running out of the living room and to prevent the family dog from entering the room.

A series of free play sessions were first conducted to evaluate Jace's level of reactivity with having the behavior consultant coach his mother via Skype™ and to conduct free operant preference assessments. Prior to the beginning of free play, and before each subsequent test condition of the FA, the behavior consultant provided a detailed vocal description of each test condition. For example, the behavior consultant described free play by saying something similar to, "During free play, allow Jace to play with his toys. Provide as much attention to him as you can and try to avoid making requests. Allow Jace to direct the play."

Test conditions of the FA were then alternated with additional free play sessions, with problem behaviors occurring during the tangible and escape sessions. His mother frequently had to move closer to the computer in order to hear the behavior consultant delivering feedback, which in turn affected the procedural fidelity of the FA. Thus, the behavior consultant began using nonverbal modes of feedback. For example, if the behavior consultant was coaching the mother to deliver physical guidance, the behavior consultant modeled taking his own hand to complete the task. Other technology problems occurred intermittently during the FA, likely due to a slow or delayed internet connection. These problems occasionally required the mother to reestablish the Skype™ connection with the behavior consultant. Technology problems never precluded sessions from being conducted.

As described by Wacker et al. (2011) a brief extinction baseline was then conducted to measure the persistence of Jace's problem behaviors during extinction. During extinction sessions, his mother delivered instructions to him to complete tasks. Elevated levels of problem behavior were observed during the extinction baseline.

Following the extinction sessions, the behavior consultant prepared treatment materials, which included a microswitch and play and work picture cards, and sent these to the parent. At the next telehealth visit, the behavior consultant reviewed the treatment procedures with Jace's mother. For example, the behavior consultant coached her on how to replace the work materials with the microswitch after Jace complied with her instruction. This meeting ended after approximately 1 h.

FCT treatment began the following week. Jace's mother and the behavior consultant briefly reviewed the task analysis for Jace's FCT treatment before beginning sessions. At one point, Jace ran away from his desk and out of camera view. After that session, his mother and the behavior consultant were able to discuss environmental modifications (i.e., moving a chair in front of the entrance to the kitchen) to prevent similar situations from occurring. After consistently low levels of problem behavior occurred during the initial treatment sessions, we probed sessions at the terminal treatment goal of completing ten tasks in a 5-min session. Jace continued to engage in near zero levels of problem behavior. In comparison to baseline, Jace's problem behavior was reduced by 100 %.

Billy. Billy was a 61-month-old boy diagnosed with autism spectrum disorder. He also had an extensive medical history as he was born premature at 24 weeks. His home was located 78 miles from the CDD. Billy and his mother participated in the telehealth sessions. Problem behaviors targeted during the FA and FCT were self-injury (e.g., head hitting), aggression (e.g., hitting, kicking, scratching), and property destruction (e.g., throwing items). Billy communicated using phrase speech. Billy and his mother participated in weekly telehealth sessions for approximately 4 months.

We interviewed Billy's mother to determine her equipment needs. She had access to a desktop computer and had internet service established in the home. Her desktop computer was too old to use for the project. Thus, a laptop computer and other needed equipment (webcam and Ethernet cable) were shipped to her. The current internet service in the home was judged to be sufficient for telehealth. She did not know how to use a computer and expressed concern about her ability to use the computer. For this reason, we had her

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come to the CDD to have the initial technology meeting to show her how to turn the computer on and off, connect to the internet, and create a Skype™ account. To teach her how to use Skype™, our technology support staff called her at her home and gave her step-by-step directions over the phone on how to log on to Skype™ and connect with the behavior consultant. We had the mother practice logging on to Skype™ a few times before the first telehealth visit. When the telehealth visits began, the behavior consultant called her on the phone to help her make the Skype™ connection.

Following an interview, the living room was chosen for conducting the procedures because the computer could be connected directly to the cable modem, which provided the most optimal internet connection. The computer and webcam were placed on a chair near the open floor space in the living room, which allowed the behavior consultant to observe Billy playing with toys and completing task demands. His mother arranged for another adult to be in the home to watch the other children while she participated in the telehealth visits.

During the initial free play sessions of the FA, Billy seemed comfortable with the behavior consultant coaching his mother via Skype™ as he played appropriately with the toys and did not approach the computer screen. One problem that occurred during the attention condition involved Billy eloping from the living room when his mother diverted her attention. Given that the behavior consultant could not see Billy when he eloped from the room, the behavior consultant instructed his mother to neutrally guide Billy back to the living room. Billy continued to engage in elopement during the attention condition. Elopement was then added as a target problem behavior. Two technology problems also occurred during the FA. The first problem involved a delay between the audio and video feeds. When this problem occurred, the behavior consultant often continued conducting the sessions. However, on occasion the behavior consultant had to have Billy's mother restart Skype™ because the delay was too disruptive and was compromising the fidelity of the sessions. The second problem involved losing the Skype™ connection all together. When the connection was lost, the behavior consultant and mother reestablished the video call when the internet connection improved and resumed conducting the session. Similar technology problems were encountered throughout Billy's participation; however, these problems never precluded sessions from being conducted. A total of 15 sessions were conducted in the FA, and the results suggested that Billy's problem behavior was maintained by escaping demands and gaining access to toys and attention.

Prior to starting treatment, the behavior consultant held a brief meeting via Skype™ to explain the FA and extinction baseline results and to describe the FCT procedures to the mother. The materials (e.g., play and work picture cards) needed for treatment were then mailed to her. During the subsequent telehealth visit, the behavior consultant instructed her on how to set up play and work areas of the room prior to beginning FCT. During FCT, Billy was directed to complete a small amount of work and then to mand for a break to play with the toys. Demand fading was used to increase the work requirement to access reinforcement (i.e., completing two, four, or ten demands per 5-min session). During one of the initial treatment sessions, Billy eloped from the living room and hid in the kitchen pantry when he was directed to complete work. Given that an attention function was identified in the FA, the behavior consultant did not want the mother providing attention by following Billy into the kitchen. Therefore, the behavior consultant instructed her to stay in the living room, repeat the task directive, and provide high quality attention when Billy returned to the living room and sat in the work area. The behavior consultant also had the mother move to the opposite side of the work area in order to block Billy from eloping from the room during subsequent treatment sessions. In addition to managing elopement, there were times when the behavior consultant could not see Billy in the work area. To fix this problem, the behavior consultant had the mother relocate the computer and webcam so that the behavior consultant had a wider view of the living room. To help his mother be more organized and consequently implement the treatment procedures with better fidelity, the behavior consultant

provided vocal prompts (e.g., "Do you have your work and play picture cards ready?") for her to get her materials ready prior to the start of an FCT trial. FCT was implemented for 32 sessions across eight telehealth visits. Billy's problem behavior was reduced by 100 % by the end of treatment.

Outcome and Procedural Approach Summary

As summarized in Table 22.1, results from Mel, Newt, Jace, and Billy showed that problem behavior was maintained by positive reinforcement (Mel) or a combination of positive and negative reinforcement (Newt, Jace, and Billy), and was reduced by at least 76 % when FCT was implemented by the parent. Treatment acceptability remained high across parents and telehealth projects. These results are representative of the overall results obtained for the majority of children enrolled in both telehealth projects.

As displayed in Table 22.2, procedural components remained relatively similar across all of our service delivery models. Each model required slight modifications in the step-by-step process such as determining equipment needs for the in vivo in-home service versus the clinic-to-clinic or clinic-to-home service. In addition, several challenges were experienced with the telehealth models, which required the development of practical solutions. For example, at times a lot of coaching from the behavior consultant was needed to increase the parent's procedural fidelity or to modify the environment. Given that these challenges are likely to be inevitable when the behavior consultant cannot be physically present, effective solutions need to be carefully considered, developed, and implemented. These solutions can include actions such as having a support person (like a parent assistant) available to show the parent how to conduct a procedure, using visual cues that can be moved in front of the webcam to show the parent exactly what to do, and having a highly skilled behavior consultant coaching and modifying procedures at the moment problems arise. In addition, technical issues, insurance reimbursement issues, and generalization issues need to be considered when using telehealth as a service delivery model.

Regardless of whether behavior analytic services were directly delivered by a trained behavior consultant in the home or via telehealth in a clinic or home setting, clinically meaningful reductions in problem behavior were observed for the majority of children and parents' ratings of treatment acceptability were high. Other benefits as well as limitations were noted specifically for each model, such as

Table 22.1 A summary of assessment and treatment results for Mel, Newt, Jace, and Billy

	Assessment		Treatment					Time
Case examples	Identified FA function(s)	Mean % of problem behavior in baseline	Function(s) targeted for treatment	Mean % of problem behavior at the end of treatment	% Reduction in problem behavior	Number of visits during treatment	Final TARF rating (scale 1–7; 7 = highly acceptable)	Total length of time in project
Mel	Tangible	17 %	Tangible	1 %	92 %	6 visits	6.5	~4 months
Newt	Escape and tangible	14 %	Escape and Tangible	3 %	76 %	9 visits	7	~3 months
Jace	Escape and tangible	9 %	Escape and Tangible	0 %	100 %	4 visits	6	~3 months
Billy	Escape, tangible, and attention	36 %	Escape and Tangible	0 %	100 %	8 visits	5	~3 months

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Table 22.2 A summary of the procedural steps, benefits, challenges, and hints across service delivery models

	In vivo in-home model	Clinic-to-clinic model	Clinic-to-home model
Step 1: Determining equipment needs	• Recording devices: video cameras	• Equipment for both clinic sites: computers, webcams, headphones with microphones, video conferencing software, video recording software, Internet connection	• Equipment for both clinic and home sites: computers, webcams, headphones with microphones, video conferencing software, video recording software, Internet connection
		• Test runs of equipment and software	• Training on how to operate the equipment
Step 2: Initial meetings	• Parent interview	• Parent assistant training	• Parent training
	• Daily behavior record	• Parent training	• Determine location of sessions in home
	• Preference assessment	• Parent interview	• Parent interview
		• Daily behavior record	• Daily behavior record
		• Preference assessment	• Preference assessment
Step 3: Evaluation procedures	• Functional Analysis	• Functional Analysis	• Functional Analysis
	• Functional Communication Training	• Functional Communication Training	• Functional Communication Training
Benefits	• Decreases in problem behavior	• Decreases in problem behavior	• Decreases in problem behavior
	• High treatment acceptability	• High treatment acceptability	• High treatment acceptability
	• Naturalistic setting	• Cost effectiveness	• Cost effectiveness
		• Increased access and efficiency	• Increased accessibility, convenience, and productivity
			• Naturalistic setting
Challenges	• Access	• Access	• Technical challenges
		• Generalization of procedures	• Implementation considerations
			• Insurance reimbursement
Hints		• Immediate feedback	• Advanced preparation
		• Capability to control camera	• Immediate feedback
		• Number of sessions per visit	• IT support
		• Child sensitivity to consultation	• Number of sessions per visit
			• Child sensitivity to consultation

increased access and efficiency when using either telehealth model, decreased needs for training for generalization when using the in vivo in-home or clinic-to-home models, and the need for increased free play sessions when FAs were conducted via telehealth. These findings suggest that both in vivo and telehealth delivered services have merit for addressing challenging behaviors and that clinicians should consider multiple variables when determining which approach to utilize.

Review of Approach and Research Illustrative of this Approach

Telehealth-based services have been provided in Iowa for the past 20 years, but it has only been within the last 10 years that our use of this technology has evolved from providing consultation to the delivery of behavior analytic assessments and treatments with real-time coaching from behavior consultants. Expanding how telehealth

is delivered has evolved in new and innovative ways. However, telehealth-based services have been available for at least 40 years (American Telemedicine Association, 2015) and were even predicted as early as 1925 by Hugo Gernsback, a radio and publishing pioneer (Novak, 2012).

In the scientific literature, peer-reviewed articles on telehealth appeared in 1975 (based on a literature search in the PsychINFO and ERIC databases using the search terms *telehealth* or *telemedicine* or *telemental health* or *telebehavioral health* across all domain categories including all text, author, title, subject terms, source, abstract, and ISSN). The appearance of peer-reviewed articles on telehealth in 1975 supports the American Telemedicine Association's claim that telehealth-based services have been present for at least 40 years. Our search yielded 3655 telehealth entries between the years 1975 and 2015. When narrowing this search, 86 % of those articles were published during the last 10 years (2005–2015), which is why telehealth "feels" new and innovative. Telehealth-based services cover all aspects of healthcare, ranging from general parent training (e.g., Wade, Oberjohn, Conaway, Osinska, & Bangert, 2011) to providing highly specific treatments such as imagery-based treatments for breast cancer survivors (e.g., Freeman et al., 2015). The connection from a telehealth-based center (host site) to a remote site has included settings such as other clinics (e.g., Southard, Neufeld, & Laws, 2014), schools (e.g., Reynolds & Maughan, 2015), and homes (e.g., DelliFraine & Dansky, 2008), with the location between these sites ranging from within the same facility (e.g., Machalicek, O'Reilly, Chan, Lang, et al., 2009) to extremely rural areas (e.g., Dailey & Stanfa-Brew, 2014). In the following sections, we describe applications of telehealth-based services in selected areas of healthcare to illustrate the range of research being conducted. We then describe current research using telehealth-based services within the field of applied behavior analysis outside of our current projects. Finally, we describe several current research and clinical applications of telehealth-based services in the field of applied behavior analysis, based on recent interviews we conducted with active researchers and practitioners.

Applications of Telehealth-Based Services Across Healthcare

Much of the current research in telehealth focuses on demonstration of the feasibility of service delivery in a particular field or using a particular method. For instance, several studies focused on the feasibility and accuracy of providing screening or consultation to patients who presented to a clinic with referral for specific concerns or for routine care. The concerns or care addressed in these studies varied across the healthcare field, and included mental health (Southard et al., 2014), ocular health (Maa, Evans, DeLaune, Patel, & Lynch, 2014), and speech, language, and hearing health (Ciccia, Whitford, Krumm, & McNeal, 2011). One selected study evaluated the effectiveness of providing an evidence-based parent training program via telehealth (Reese, Slone, Soares, & Sprang, 2012). Another selected publication discussed the benefits and limitations of utilizing telehealth with military personnel in need of care regarding mental health concerns while deployed in a combat environment (Dailey & Stanfa-Brew, 2014).

For those studies evaluating the feasibility and accuracy of providing screening or consultation via telehealth, results have been generally positive. For example, Southard et al. (2014) showed that for patients who presented to a rural hospital emergency room (ER) for various mental health concerns (e.g., attempted suicide, nonspecific pain) resulting in a mental health consultation, various dependent measures improved when telehealth was provided from a community mental health provider located 15–35 miles away from the rural ER. The specific benefits were: (a) the reduced amount of time from the ordered consult to consultation from the community mental health provider, (b) the reduced amount of time from the patient's arrival in the ER to consultation from the community mental health provider, and (c) the reduced length of the hospital stay from arrival to discharge. Similarly, National Public Radio (NPR) recently released a story (Feibel, 2015) about Houston firefighters connecting with doctors using a video chat application to assess the immediacy of a visit to the ER

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during 911 house calls. By connecting with doctors via telehealth, the medical concern could be assessed and triaged to the appropriate clinic such as an outpatient primary care clinic rather than the ER.

Ciccia et al. (2011) and Maa et al. (2014) have also evaluated the feasibility and accuracy of screening individuals for concerns related to their respective specialty fields when those screenings are conducted via telehealth. Ciccia et al. (2011) showed that speech, language, and hearing screening via telehealth for children up to 6 years old was feasible, reliable, and strongly supported by the families. Specifically, pure tone hearing screening, speech-language screening, and Distortion Product Otoacoustic Emissions (DPOAE) screening were found to be 100 % reliable across screenings administered in-person compared to those administered via videoconferencing. An additional screening, typanometry, was administered and shown to be 84 % reliable across the different modes of administration. Similarly, Maa et al. (2014) found a high correlation between face-to-face ocular exams and tele-eye exams for detecting common ocular diseases (i.e., cataract, macular degeneration, glaucoma) in elderly patients.

Another area of healthcare research has focused on the effectiveness of delivering evidence-based practices via telehealth. Reese et al. (2012) implemented the *Group Triple P Positive Parenting Program* (Turner, Dadds, & Sanders, 2002) via telehealth with low socioeconomic status families from the Appalachian region of Kentucky where children were experiencing behavioral, emotional, or family problems. Results showed that the children's externalizing behaviors decreased, the parent's distress levels decreased, and the parent's skills and self-efficacy increased, suggesting that this evidence-based group parenting program can be implemented successfully via telehealth.

Dailey and Stanfa-Brew (2014) discussed how a telehealth service delivery model was utilized in combat environments. They discussed that in combat environments, behavioral health officers or the patient have to travel across dangerous areas to receive service in person, and this travel is often time-consuming. By using telehealth to deliver services to military personnel, lengthy travel delays were avoided, physical security risks were mitigated, and experts were available for facilitating care for psychiatric emergencies more immediately.

Overall, the use of telehealth as a service delivery model throughout healthcare has been shown to be an effective and feasible option for providing a range of services to individuals and families with a variety of concerns.

Applications of Telehealth-Based Services Across Applied Behavior Analysis

The first generation of telehealth research in applied behavior analysis focused on two major themes: (a) the effectiveness and feasibility of behavior analytic procedures and outcomes (Machalicek, O'Reilly, Chan, Lang, et al., 2009; Wacker et al., 2013a, 2013b), and (b) delivery of consultation and training for service providers and parents in behavior analytic procedures (Fisher et al., 2014; Frieder, Peterson, Woodward, Crane, & Garner, 2009; Gibson, Pennington, Stenhoff, & Hopper, 2010; Hay-Hansson & Eldevik, 2013; Heitzman-Powell, Buzhardt, Rusinko, & Miller, 2014; Machalicek et al., 2010; Machalicek, O'Reilly, Chan, Rispoli, et al., 2009; Suess, Romani, et al., 2014). Studies on the effectiveness and feasibility of delivering behavior analysis via telehealth have demonstrated that behavior analytic procedures can successfully be implemented in real-time while expert practitioners are not physically present. For example, Machalicek, O'Reilly, Chan, Lang, et al. (2009) evaluated the effects of behavior intervention plans on challenging behavior that were developed based on the results of FAs conducted via telehealth and showed that challenging behavior decreased when that behavior intervention plan was implemented. These results suggested that the results of FAs obtained via telehealth can be just as useful for treatment development as the results obtained from FAs conducted in vivo.

Behavior analytic studies on the use of telehealth have often focused on consultation and

training with an emphasis on providing training in behavior analytic principles and procedures to service providers and parents. For example, Fisher et al. (2014) evaluated a 40-h online training program for behavioral technicians that included online modules and scripted role-plays. The online modules consisted of the participants accessing the material within each module and passing a multiple-choice quiz with 80 % accuracy prior to proceeding to the next module. Role-plays were situated at various points within the module training and consisted of opportunities to practice the skills covered in a particular module while receiving real-time coaching and feedback. Participants in this study were randomly assigned to an immediate treatment group or a wait-list control group. In this preliminary study, results showed that those receiving the online training program implemented the procedures correctly and mastered the majority of skills taught following the training, whereas little change occurred for those in the control group, suggesting that training provided through the use of telehealth technology can be effective. Similar results were obtained with parents in a study conducted by Heitzman-Powell et al. (2014), in which parents received online training and real-time coaching and feedback when implementing behavior analytic procedures with their children with autism spectrum disorder.

Other studies have focused on real-time coaching and feedback, either prior to or during the implementation of a behavior analytic assessment or intervention procedure. For example, Gibson et al. (2010) evaluated the effects of a behavioral treatment (FCT) on challenging behavior (elopement) displayed by a preschool-aged child with autism spectrum disorder, with all intervention training and consultation provided via telehealth prior to the implementation of the intervention. Specifically, the authors provided training via telehealth to the teachers and teacher assistants on how to implement the FCT procedures. Total training time was 45 min and consisted of the consultants modeling the FCT procedure, coaching the teachers and teacher assistants through a series of role-plays, and providing feedback. Following this training, the school personnel's implementation of the intervention was shown to occur with high fidelity, and the student's challenging behavior was shown to decrease.

Training has also been provided during the implementation of behavioral assessments and interventions. For example, Machalicek, O'Reilly, Chan, Rispoli, et al. (2009) and Machalicek et al. (2010) demonstrated that preservice teachers and licensed teachers implemented preference assessments and FAs, respectively, with accuracy when receiving real-time coaching and feedback via telehealth. Similarly, Hay-Hansson and Eldevik (2013) showed that real-time coaching and feedback via telehealth was effective when training service providers to conduct discrete trial training with children with autism spectrum disorder.

The overall findings of telehealth as a service delivery and training model for behavior analytic procedures are positive: it is both effective and feasible. Behavior analytic studies on telehealth have noted numerous benefits including (a) the effectiveness of this service delivery model in training direct service providers and parents (Fisher et al., 2014; Frieder et al., 2009; Gibson et al., 2010; Hay-Hansson & Eldevik, 2013; Heitzman-Powell et al., 2014; Machalicek et al., 2010; Machalicek, O'Reilly, Chan, Rispoli, et al., 2009), (b) an alternative method for providing supervision and training (Fisher et al., 2014; Hay-Hansson & Eldevik, 2013), (c) increased savings related to time and money for direct service providers, parents, and behavior analytic specialists (Fisher et al., 2014; Gibson et al., 2010), (d) increased access to service and specialist support (Gibson et al., 2010; Heitzman-Powell et al., 2014; Machalicek, O'Reilly, Chan, Lang, et al., 2009; Machalicek, O'Reilly, Chan, Rispoli, et al., 2009), (e) increased abilities of direct service providers and parents in implementing behavior analytic procedures (Frieder et al., 2009; Heitzman-Powell et al., 2014), and (f) decreased occurrence of observer effects (Gibson et al., 2010).

Although there are a number of benefits to providing behavior analytic services via telehealth, there are also many challenges that have been noted that need to be considered when developing or con-

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Current Research and Clinical Applications of Telehealth-Based Services in Applied Behavior Analysis

The initial behavior analytic studies on telehealth have demonstrated the effectiveness and feasibility of using telehealth to train service providers and parents to assess and treat a variety of target behaviors. This has led to an increased use of telehealth by behavior consultants, much of which is too new to be available in the published literature. For this reason, we contacted colleagues across several sites to determine the work that is currently being conducted using telehealth. The colleagues and sites contacted included Drs. Wayne Fisher and Kevin Luczynski at the University of Nebraska Medical Center's Munroe-Meyer Institute, Dr. Stephanie Peterson at Western Michigan University, Dr. Jennifer McComas at the University of Minnesota, and Dr. Nathan Call at the Marcus Autism Center and Emory University. We contacted these colleagues because their current work represents a range of services from research to clinical practice and focuses on the training and supervision of direct service providers or the provision of services by highly trained behavior consultants.

Drs. Fisher and Luczynski have extended their first generation research from evaluating the effects of a 40-h remote-training program for behavior technicians (Fisher et al., 2014) to evaluating the outcomes of early intervention programming for children with autism spectrum disorder that is delivered by newly trained behavior technicians throughout the state of Nebraska who receive real-time (synchronous) coaching and delayed (asynchronous) feedback via telehealth from certified behavior analysts (W. Fisher, personal communication, March 5, 2015; K. Luczynski, personal communication, March 20, 2015). Dr. Peterson is training community mental health agency staff across the state of Michigan to conduct behavioral assessments and treatments with children with an autism spectrum disorder who engage in problem behavior (S. Peterson, personal communication, March 9, 2015). This training consists of didactic training, behavioral skills training, and real-time coaching for six predetermined behavioral assessment and treatment skills. The telehealth evaluations being conducted by Drs. Fisher, Luczynski, and Peterson are funded by research programs from the Department of Defense (Drs. Fisher and Luczynski) and the Michigan Department of Health (Dr. Peterson).

Dr. McComas is conducting feasibility and effectiveness research with girls who have Rett Syndrome and engage in self-injury (J. McComas, personal communication, March 5, 2015). This population was chosen because the prevalence of this syndrome is rare, and providing services to these individuals in-person is often precluded because of the distance from service providers. Telehealth appears to be a viable option for providing services to a broader number of girls with this syndrome, and the effectiveness of this approach is currently being studied. Dr. Call is conducting a 10-week (2-h per week) clinical service funded by a contract from the Georgia

State Department of Behavioral Health in which highly trained behavior consultants coach care providers in real-time via telehealth regarding how to conduct behavioral assessment and treatment procedures with children who engage in severe problem behavior (N. Call, personal communication, March 18, 2015). This service is an extension to already established services at the Marcus Autism Center in which in-person behavioral assessments and treatments are conducted in the clinic, homes, and community. With the in-person services, travel is constrained to a 50-mile radius. Thus, telehealth appears to be a viable option for expanding these established services to individuals and families across the state of Georgia.

Across all of these research and clinical endeavors, results to-date have been positive for behavior analytic training and supervision of staff and care providers and for direct intervention provided via telehealth. Similarly, positive results have been achieved in other healthcare disciplines, with the combined results supporting the continued use and evaluation of telehealth services. Based on this review and our own results, we make the following practice recommendations.

Practice Recommendations

Although telehealth provides a variety of benefits including increased access and efficiency of services, it is our impression that telehealth may not be beneficial or best practice in all situations. For example, a few children in our clinic-to-home telehealth project engaged in a level of problem behavior that was deemed unsafe for remote evaluation and treatment. In these cases, the behavior consultants felt more comfortable providing the services in vivo where they could physically help control the situation. Thus, service provided via telehealth was discontinued, and in vivo services were initiated. Similarly, we have struggled to obtain satisfactory treatment results with children whose problem behavior is maintained by automatic reinforcement. To match children to the treatment most likely to be effective, we provide a step-by-step decision tree of issues to consider when choosing between service delivery models. If telehealth is the chosen service delivery model, we provide a step-by-step checklist of recommendations for practitioners to consider when determining the equipment needs, determining the initial setup of the service, and determining the service's procedures. These recommendations are based on the collective experiences from our projects, our colleague's publications and current projects, and the literature we have reviewed. In addition to our recommendations, we suggest that the reader also reference the American Telemedicine Association's guidelines for video-based online mental health services (2013) as they provide additional clinical, technical, and administrative guidelines.

Choosing Between Service Delivery Models

The selection of the most appropriate model of care can be facilitated by using a series of initial questions to ask when choosing between the in vivo (in-clinic or in-home), clinic-to-clinic, and clinic-to-home service delivery models. These questions are illustrated in Figure 22.3 to assist with decision-making.

1. Is the presenting problem one that can be assessed and treated safely via telehealth? For example, we frequently assess and treat severe forms of self-injury maintained by automatic reinforcement or conduct extinction procedures as part of a treatment package that may induce more severe forms of problem behavior. In these cases, judgment by a highly trained behavior consultant is required to maintain the safety of the child and care providers, as studies have not been conducted on the feasibility and effectiveness of providing service for these issues via telehealth.
2. Is accessibility to equipment and an internet connection with the remote site sufficient? Some families do not have access to equipment that is suitable for telehealth and some rural locations continue to have inadequate internet connections. Additionally, most

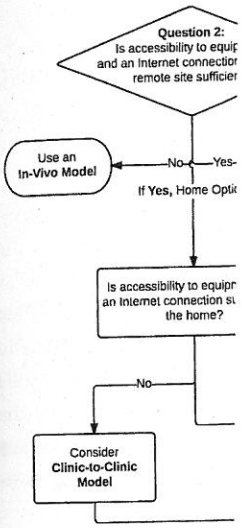

Fig. 22.3 A decision-ma

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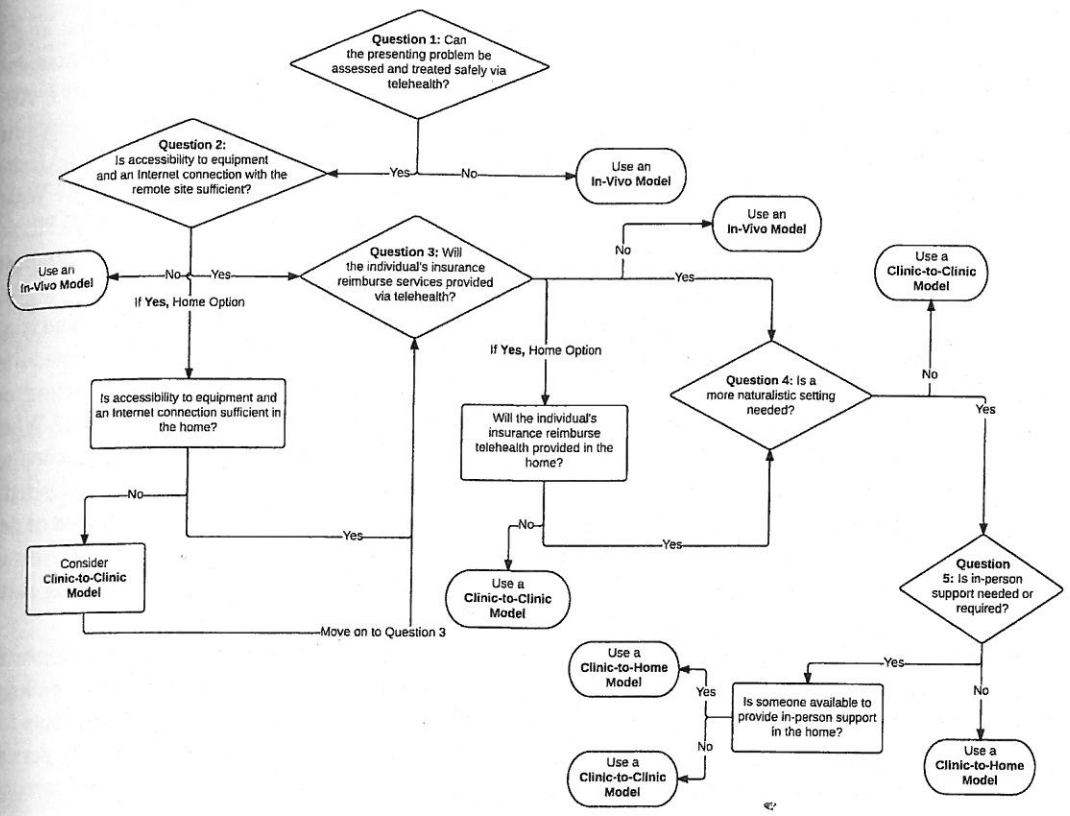

Fig. 22.3 A decision-making model for choosing between service delivery models

telehealth services do not have the capability of providing computer equipment or paying for internet service. For this reason, we are developing an equipment lending program within the CDD.

3. Will the individual's insurance reimburse for services provided via telehealth? Insurance reimbursement may depend on whether the telehealth setting is an approved site. Often, home settings are not considered approved sites. However, insurance reimbursement is continuously evolving so it is important to keep up to date on the current state of telehealth reimbursement.
4. Is conducting the assessment and treatment in a more naturalistic setting such as a home beneficial? One benefit of our in-home projects compared to the clinic projects was that parents did not have to generalize the treatment procedures to their home because they were already being trained within that environment on how to respond to their children's problem behavior.
5. Is in-person support needed or required? Is someone available to provide in-person support (e.g., direct service provider, family member, neighbor) in the home? In behavior analysis, some services such as discrete trial training include a direct service provider conducting the procedures in vivo, whereas other services such as assessments and treatments for problem behavior may only need someone to provide childcare to siblings. Additionally, in-person support may be beneficial for such situations as those described above, making telehealth a feasible option if problem behavior becomes severe and warrants additional in-person support.

Step-by-Step Checklist of Recommendations for Practitioners

After determining that telehealth service delivery is most appropriate, several steps warrant consideration when developing the service. Within these steps, we provide areas for consideration and additional tips or questions to ask when developing a telehealth service. This checklist is summarized in Table 22.3. Specifics of these recommendations will depend upon the type of service provided via telehealth. For example, if only face-to-face consultation is provided, a wide-angle camera is not necessary. In contrast, a wide-angle camera is necessary for services that attempt to capture large motor movements such as a child running around a room.

Step One: Determining Equipment Needs

Consider what equipment is needed to achieve adequate audio and video quality for both telehealth sites (host site and remote site). Is the remote site required to have equipment (e.g., computer, tablet, smartphone) or will the host site maintain an equipment lending library? Are Ethernet cables needed? Are external webcams or wireless cameras needed? Is Bluetooth® technology needed for audio communication? What videoconferencing software will be used? Please see Lee et al. (2015) for specific equipment recommendations.

1. Consider what internet service plans and connections are needed. Is the remote site required to have an internet connection or will the host site pay for the service? What are the optimal bandwidth speeds needed to obtain the audio and video quality desired? This is likely to depend on the purpose of the telehealth service (e.g., consultation versus assessment) and the videoconferencing software being used.
2. Familiarity with the equipment and programs is needed to troubleshoot general technology problems with the audio and video inputs for both telehealth sites. Is an IT support person needed? IT support will likely be needed

Table 22.3 A checklist of recommendations for practitioners when developing a telehealth service

Steps	Consideration	Additional tips/questions
Determining Equipment Needs	1. Equipment needs to achieve adequate audio and video quality for both sites	• Is the remote site required to have equipment or will the host site provide it?
		• Are Ethernet cables needed?
		• Are external webcams or wireless cameras needed?
		• Is Bluetooth® technology needed?
		• What videoconferencing software will be used?
	2. Internet service plans and connections needed	• Is the remote site required to have an Internet connection?
		• What are the optimal bandwidth speeds for the desired audio and video quality?
	3. Familiarity with the equipment and programs to troubleshoot general technology problems	• Is an IT support person needed?
	4. Other issues related to equipment	• Does the equipment and software programs need to maintain confidentiality?
		• Is recording software needed to capture the telehealth session?
		• Does the service provider need the ability to move the camera remotely?
		• Will firewall systems block the connection?
		• Is overall cost a concern?

(continued)

Steps	Consider
Determining the Initial Setup of Telehealth Service	1. Initia meet to us troub initia the e
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Determining the Telehealth Service's Procedures	1. Prepa
	2. Startii
	3. Proce a visit
	4. Proce conclu
	5. Follow

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Steps	Consideration	Additional tips/questions
Determining the Initial Setup of Telehealth Service	1. Initial technology meeting to learn how to use, test, and troubleshoot any initial problems with the equipment	• Are task analyses of how to connect with the host telehealth site necessary?
	2. Logistics of providing telehealth	• What room will be used for the telehealth visits?
		• Does the room chosen, maintain safety of all individuals present?
		• Does the room chosen provide enough space for the purpose of the telehealth visits?
		• Docs the room chosen provide sufficient Internet connection?
		• Does the room chosen provide access to or limit materials?
		• Can the room be used consistently for telehealth visits?
		• Is there a place in the room for the equipment for maximum viewing abilities?
	3. Who will be involved in visits	• Can the same person be available for weekly visits?
		• Is a support person needed to run interference with siblings, etc.?
		• Is a support person needed during the procedures?
	4. Meeting prior to beginning procedures to set up room and orient to the service	• What needs to be removed (i.e., dangerous items), setup (i.e., play and work areas)?
		• Where should the webcam be placed webcam to obtain the best view of the room?
		• What general procedures should be discussed for subsequent telehealth visits?
	5. Developing a plan for connecting	• Who should initiate the telehealth contact?
		• What are the procedures and who is responsible if the telehealth contact is not made?
		• What procedures should occur when the Internet connection is lost during a visit?
	6. Benefits of an initial in-person meeting	
Determining the Telehealth Service's Procedures	1. Preparing for a visit	• What abilities does the practitioner need to successfully conduct telehhealth visits?
		• What data collection procedures need to be conducted?
		• What are the goals of the visit?
		• How many sessions need to be conducted?
		• What types of conditions need to be conducted?
		• What materials does the practitioner need?
		• What precautionary measures need to be considered?
		• What termination criteria need to be developed?
	2. Starting a visit	• Docs check-in with the individual need to occur?
	3. Procedures during a visit	• Describe general procedures to the parents prior to the start of each session.
		• Try to avoid deviating from the protocol or procedures while conducting sessions.
		• Keep calm if technology problems arise during the telehealth visit.
		• Provide the individual with immediate praise and feedback during sessions.
		• Provide more detailed feedback at the end of the sessions.
		• Be one step ahead of the individuals during the session.
	4. Procedures at the conclusion of a visit	• At the end of the telehealth visit, briefly review results, describe what to expect in subsequent visits, and describe any homework needed.
	5. Follow-up procedures	• Send an e-mail with updates on results and reminders of upcoming visits

when initially starting the telehealth service and for troubleshooting more significant technology problems.

3. Consider other issues related to the equipment. Do the equipment and software programs need to maintain confidentiality to comply with HIPAA and FERPA compliance rules? Is recording software needed to capture the telehealth session? Does the service provider need the ability to move the camera remotely? Will firewall systems block or slow the connection? Is overall cost a concern?

Step Two: Determining the Initial Setup of Telehealth Service

Several recommendations are provided when initially setting up a telehealth service. Many of these recommendations can be combined into one or two meetings with participants at the remote site.

1. Consider having an initial technology meeting with the individual to help them learn how to use, test, and troubleshoot any problems with the equipment. Are task analyses of how to connect with the host telehealth site necessary?
2. Consider the logistics for providing the telehealth service to the remote site. What room will be used for the telehealth visits? When working with children, it is often helpful to have a room that can be closed to prevent the child from eloping from the room. Other specific questions to consider include the following. Does the room chosen maintain safety of all individuals present? Does the room provide enough space for the purpose of the telehealth visits? Does the room provide sufficient internet connection speeds to support optimal audio and video streams? Does the room provide access to materials needed for the visits, and limit access to materials in need of restriction? Can the room be used consistently for telehealth visits? Is there a place in the room for the equipment to be placed to maximize viewing capabilities?
3. Consider who will be involved in the telehealth visits. Can the same person be available for weekly visits? Is a support person needed to supervise siblings, etc.? Is a support person needed during the procedures?
4. Consider having a meeting with the individual to set up the room and orient them to the telehealth service. What needs to be removed (i.e., dangerous items) and set up (i.e., play and work areas)? Where should the webcam be placed to obtain the best view of the room? What general procedures (e.g., expectations, individual roles) should be discussed for subsequent telehealth visits?
5. Develop a plan with the individual regarding the telehealth connection. Who should initiate the telehealth contact? What are the procedures and who is responsible if the telehealth contact is not made within a specified time period? What procedures should occur when the internet connection is lost during the telehealth visits? It is often helpful to exchange phone numbers so that both parties can communicate with each other in case technology problems arise at the start of the telehealth visit or if the internet connection is lost and cannot be re-established while conducting telehealth sessions.
6. Consider whether an initial in-person meeting is beneficial.

Step Three: Determining the Telehealth Service Procedures

1. Consider the necessary steps for preparing for a telehealth visit. This preparation is very important for making the telehealth visit go smoothly. What abilities does the practitioner need to possess to conduct telehealth visits successfully? What data collection procedures (e.g., live recording, recorded and scored later) need to be conducted? What are the goals of the visit? Specifically, how many sessions need to be conducted? What types of conditions need to be conducted? What materials does the practitioner need? What precautionary measures need to be considered? What termination criteria need to be developed?
2. Consider the procedures conducted at the start of a telehealth visit. Does check-in with the individual need to occur? Check-in may consist

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of asking about how things have been going since the last visit, summarizing the results to date, and summarizing the objectives for the visit. This may be beneficial in building rapport with an individual, especially if an in-person introduction did not occur.

3. Consider the procedures to be conducted during the telehealth visit. Describe general procedures to the participants prior to the start of each session so they understand what they need to do. The directions should be simple and clear for parents to understand. Avoid using jargon. Try to avoid deviating from the protocol or procedures while conducting sessions. Making several procedural changes during the telehealth visits will likely make the visit seem more chaotic. Keep calm if technology problems arise during the telehealth visit. Make the decision if the session will continue despite the technology problems, or if the session needs to be stopped to address the technology problem before continuing on with the visit. Provide the individual with immediate praise and corrective feedback during the sessions. These phrases should be brief to avoid disrupting the parents from conducting the procedures. Provide more detailed feedback at the end of the sessions to help parents learn how to implement the procedures differently in subsequent sessions. Be one step ahead of the individuals during the session. This may involve giving warnings about upcoming procedures, helping them keep track of where the materials are placed in the room, and instructing on where to position themselves and the child.
4. Consider the procedures conducted at the conclusion of the visit. At the end of the telehealth visit, briefly review results from the current visit, describe what the parents should expect to do in the subsequent visit, and describe any homework that needs to be completed prior to the next visit.
5. Consider the follow-up procedures. For example, an email may be sent with an update on the results to date and a reminder of the date and time of the upcoming visit.

Summary

Telehealth can be an effective service delivery model for a variety of concerns that traditionally have been addressed in-person by professionals in their clinic offices or classrooms. Telehealth provides an alternative to this in-person model with the greatest benefits including increased access and efficiency and decreased costs. Although telehealth can be effective and feasible, it is unlikely that telehealth will replace traditional in-person models. Rather, telehealth can serve as a supplement to traditional service models or as an alternative service option when both traditional and telehealth models are equally effective. Given that these models are all reasonable options for delivery of behavioral services, it becomes imperative that practitioners weigh the benefits and challenges when choosing a service delivery model. Similarly, it is important for researchers to continue evaluating the conditions under which telehealth is most effective in order to inform clinical decision-making in practice.

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