Two Year Results of a Pilot Study Delivering Speech Therapy to Students in a Rural Oklahoma School via Telemedicine

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Abstract

Schools in the United States are required to supply specific specialty services such as speech, occupational and physical therapy under the Individuals with Disabilities Education Act (IDEA). Because of their geographic locations and sparse populations, many rural communities do not have these specialties. The alternative of traveling to metropolitan areas where these services are more readily available is hard on the children and their families.

INTEGRIS Health and the Hugo Public Schools collaborated in a two-year speech teletherapy pilot study to test speech therapy services delivered over two-way, interactive videoconferencing. The effectiveness and satisfaction of this mode of delivery was measured. A comparison of lost therapy time due to technical difficulties was also made.

Steps taken to develop and implement the school teletherapy program, outline of a typical session, perceptions of rural administration, clinical outcomes, lessons learned and future applications will be discussed.

1. Introduction

More than 51 million Americans live in areas classified by the U.S. Office of Management and Budget (OMB) as non-metropolitan. They comprise one-fifth of the U.S. population. There are more scattered populations and smaller number of providers in rural and frontier areas. Rural populations frequently have difficulty accessing adequate health care [1]. The lack of adequate numbers of practitioners in rural areas can pose a significant challenge to rural communities. The need in rural areas for specialty services is high, yet rural residents often go without these services. Although 20 percent of the population lives in rural areas, less than 11 percent of the nation’s physicians are practicing in non-metropolitan areas [2]. Specialty services are even more limited than primary care and are not always available for more atypical medical cases. Geographic and financial barriers pose a threat to the provision of specialty care services for the rural population.

Rehabilitative and specialty services often are sparse and fragmented in rural areas. Populations in some of the rural communities fluctuate dramatically contingent upon recreational seasons and agriculture. When populations expand, demands for services also increase, including special services for individuals with disabilities. At other times, an individual may be the only one in the entire county with a specific medical condition and resultant physical or cognitive impairment.

Individuals with Disabilities Education Act (IDEA) was passed by Congress in 1990 to assure that all children with disabilities receive a free, appropriate, public education which emphasizes special education and related services designed to meet their unique needs. All states accept federal funding for special education, so must abide by this law. The local education agency or school system is responsible for identifying, locating and evaluating all children who require special education services. Once the evaluation has been conducted an Individualized Education Program (IEP) must be developed by the school system and the parents. This education plan must be reviewed annually or more often if requested by the parents.

Since IDEA was implemented, schools have been mandated to supply specific specialty services such as speech, occupational and physical therapy. Because of their geographic locations and sparse populations, many rural communities do not have allied health specialties. It is often a struggle for school administrators to secure these marginal services, and some rural schools may go for years without a speech language pathologist (SLP). Once an SLP is hired, the school stands a high chance of losing the newly hired professional to a metropolitan area where the caseload is lighter, the pay better, and peer
support is available. One rural community offered over 43 percent higher wages than the state average and still had difficulty obtaining a speech pathologist.

Other rural communities face similar problems and are forced to stretch the limits of their personnel. One rural SLP has to travel half of the day in order to work with children at geographically distant sites. An SLP in another rural area has students with complex medical conditions and tried to solicit information from state universities only to find her calls unreturned and her questions unanswered.

One alternative to access specialty services is for the student to travel to a metropolitan area where these services are more readily available. This would incur additional costs to the school who has to pay for travel. This also would entail physical and financial stress on the children and their families, requiring lost work time and travel expenses. Children traveling such distances are more fatigued and are less attentive to therapy once they get to the metro area, which lessens the session’s effectiveness. Moving to a metro area where services are more readily available is another option. However, most of these families make a living in agriculture-related fields, which precludes relocation to a metropolitan location. The family ties and social support of a rural area are usually strong. Even if a family could move, the different culture of a metro area and lack of family/community support creates additional burdens on the family. Innovative alternatives need to be considered that are financially viable and produce positive outcomes.

2. School speech teletherapy pre-pilot

Speech Therapy primarily involves the use of interactive speaking and visual cues for a therapist in order to assess and guide a student. Two-way interactive video conferencing has been used in Nebraska to deliver speech therapy to patients who had difficulty speaking subsequent to a stroke. This brought specialty consultation and treatment to stroke patients who otherwise would not have access to such care.

Expanding on this idea, it was decided to evaluate if telemedicine could be an effective intervention for students needing speech therapy in a rural Oklahoma school. Assessing this approach needed to be done cautiously to ensure the students were receiving proper services by being able to interact effectively with the therapist over video conferencing.

3. Developing the pre-pilot. Relationship building and education

A pre-pilot was chosen as the first step to determine if telemedicine could be a viable option for delivering speech therapy without a large amount of money and time being expended. It was also important to assure all the major stakeholders— including the therapists, administrators, parents, and students themselves— were comfortable and supportive of this intervention tool. Despite the best plans, technological and logistical problems can occur, and it was best to try to eliminate any unforeseen problems while still in a pre-pilot program. In order to eliminate as many extraneous variables as possible, the rural school would need to have an established relationship to the metro hospital whose infrastructure would support the teletherapy, and carry the project to the next stage should the pre-pilot be successful.

3.1. Geographical location and population served

Choctaw County is located in the far southeast corner of Oklahoma on the Texas border and near the Arkansas border. The population of Choctaw County is 15,302. Hugo, the largest town with 5,978 residents, is in Choctaw County. The statistics are staggering with the poverty level being 49.3 percent. Child poverty is 44.21 percent with 80 percent of the children on the school lunch program. Choctaw County is both a full Medically Underserved Area (MUA) and Health Professional Shortage Area (HPSA).

INTEGRIS Rural Telemedicine, INTEGRIS Jim Thorpe Rehabilitation Center (IJTRC), and Choctaw Memorial Hospital had a long-standing affiliation, which was an advantage for a pre-pilot. Likewise, the rural hospital and the Hugo Public Schools served the same community and had a strong alliance. All four entities collaborated in the speech teletherapy pre-pilot for four weeks in the spring of 1999. Choctaw Memorial Hospital was part of the INTEGRIS Health System, a not-for-profit healthcare system based in Oklahoma, under INTEGRIS Rural Facilities.

2.3. School telespeech pre-pilot technology

The pre-pilot was conducted at the Choctaw Memorial Hospital and bridged to Southwest Medical Center of which IJTRC is part. The connection was bridged through INTEGRIS Baptist Medical Center (IBMC), which is the core of the INTEGRIS Health system. Choctaw Memorial Hospital utilized a H.320 videoconference unit connected via dedicated T1 to the video bridge at IBMC.

Data and video services are distributed across the INTEGRIS Wide Area Network (WAN), that provides connections to over 60 locations throughout the state, and access to specific extranets throughout the nation. The INTEGRIS WAN core is a Newbridge 3645 carrier grade
switch. This hardware provides INTEGRIS with the capability to port voice, video and data over various bandwidths to remote locations. This site also houses a VTEL/EZENIA 320 standard based video bridge capable of direct video connections to INTEGRIS facilities, as well as an EZENIA 320/323 gateway/gatekeeper. The gateway enables H.320 or H.323 connectivity throughout the network and beyond. An Ascend inverse multiplexer connected to an Integrated Services Digital Network (ISDN) Primary Rate Interface gives the system the capability to connect both nationally and internationally.

2.4. Pre-pilot interventions

INTEGRIS Rural Facilities was awarded a federal Rural Telemedicine grant from the Office for the Advancement of Telemedicine (OAT) under the Human Resource and Services Administration (HRSA). This grant supplied the necessary seed money and project oversight to help develop, oversee, and evaluate the pre-pilot results. IJTRC, also part of the INTEGRIS system, employed board certified SLPs that could supply the needed services.

Education prior to each stage of program development was essential to assure “buy-in” by key stakeholders, and commitment by all partners. The Hugo School system was familiar with interactive technology since they had utilized video technology in the classroom to “share” a language teacher for several years. This familiarity facilitated the pre-pilot.

School administrators were brought in from the beginning and played an instrumental role in educating the school board and community members regarding the potential of this application. Presentations were made to the school board members and to Oklahoma Healthcare Authority (the State Medicaid Agency which reimburses the schools for part of the services) prior to starting the project. An open house was given for potential participants in the program, their parents, teachers, school administrators, hospital and school board members to demonstrate how the technology worked.

2.5. Pre-pilot sessions

Once community orientation and informed consent procedures were completed, the five-week pre-pilot commenced using an intervention group of six students and a control group of three students. The intervention group consisted of three boys and three girls ranging in ages from three to nine. The control group consisted of one boy and two girls ranging in age from four to ten. The elementary aged student diagnoses ranged from mild to moderate articulation deficits. The pre-kindergarten group diagnoses included Cerebral palsy and Cleft Palate in addition to articulation disorders.

A hospital-based SLP from IJTRC conducted the interventions with the students. The students were transported to Choctaw Memorial Hospital in Hugo to use the video conferencing equipment (VTEL FRED H.320 unit) that was already in place. The hub SLP planned and conducted the sessions over the INTEGRIS video network using 384kbps on a dedicated T-1 line from Oklahoma City. Hugo is approximately 178 miles, or a four-hour drive, from Oklahoma City. The Hugo school SLP was present in the Hugo conference room for all therapy sessions. This served to assure that the student was receiving appropriate intervention, could understand what the hub SLP expected of them, and respond appropriately. The pre-pilot was treated as a research study with pre- and post-evaluations, outcomes, and cost analysis.

Additionally, the hub SLP provided consultation services to the SLP in Hugo before and through out the duration of the project. This added to the value of the relationship between a hub and spoke site.

2.6. Technical / logistical problems and corrections

The therapy sessions were conducted in an area adjoining the cafeteria with an accordion room divider, which decreased visual, but not audio, distractions. These distractions lessened the effectiveness of the therapy and could cause future confidentiality problems. This set-up was problematic and would need to be rectified for future projects. It was essential to have the sessions in a private area without extraneous disruptions.

2.7. Clinical outcomes

Due to the limited time frame and sample size of the pre-pilot, clinical outcome levels were not anticipated to show any major change. Organizers were pleasantly surprised to find that therapists and teachers saw improvement on the WeeFIM scores [3] in the cognitive domains of Social Interaction, Problem Solving and Memory after using teletherapy for only five weeks duration.

Pre- and post- testing measuring the cognition categories of comprehension, expression, social interaction, problem solving and memory was given to teachers, parents, and therapists. Significant improvements were reported in social interaction, problem solving and memory within the five-week pre-pilot period.
Students less than seven years of age were found to be less attentive to the speech therapy sessions; and as a result, it was decided to only include students seven years of age or older for the pilot study.

2.8. Satisfaction

A non-standardized customer survey tool was given to measure satisfaction. Satisfaction from this study was high from all parties; both in use of the telehealth technology and in functional outcome measures. Satisfaction was highest with parents and students. Teachers found that teletherapy was beneficial because there were many sets of eyes... not just one therapist. Through the use of two-way interactive video, multiple perspectives into the problems and treatment of each student was found. It was found that the older children, second grade and above, responded better to the video interaction. One older child in particular thought that he was on a television program and made tremendous improvement as he was doing his best, while receiving individual care.

Feedback from the project was favorable from the parents, students, therapists, and school administrators. The school board president informed his board that he was impressed when he saw a teletherapy session and that “through telemedicine, we are able to tap into the best of the best.”

2.9. Pre-pilot assessment and planning for pilot study

Discussions were conducted between stakeholders from both the rural and metro areas on the pre-pilot findings. Meetings were held between the metro and rural SLPs on: 1) how to conduct sessions; 2) strategies to incorporate a teacher’s aide; 2) the IEP process; and 4) selection of student candidates for the pilot program. The School principal worked with the Rural Telemedicine Project program and clinical directors on reimbursement, coding and logistics. The project technical director worked with the communications coordinator for the school on-line installation and technology selection.

3. School Speech Teletherapy Pilot Study

Favorable results from the pre-pilot led to an expanded pilot study in the Fall of 1999 as a collaboration between INTEGRIS Rural Telemedicine, IJTRC, and Hugo Public Schools. Sample size was increased to eleven students who were selected based on their Individual Educational Plan (IEP). The duration of the project was extended to a 30-week study. These eleven students were second grade or older, with either language or articulation deficits.
3.1. Pilot study education

A presentation was first made to the school board on the results of the pre-pilot program. Permission was given by the school board to expand the pre-pilot into a full pilot study for the next academic year (fall and spring semesters). The outcomes from the pre-pilot were favorable enough that all stakeholders were comfortable that a hub therapist could conduct sessions sufficiently without a spoke therapist being present. A teacher's aide was to be present at all times during the therapy sessions. A similar presentation was made to the Oklahoma State Licensure Board for Speech Language Pathology to inform them of speech/language studies occurring in the state. Finally, a presentation of the pre-pilot study was given to the Oklahoma HealthCare Authority on the outcomes of the pre-pilot, the satisfaction of all related participants, and the plans for the expanded pilot study.

3.2. Pilot study technology, Year One

The pre-pilot had been conducted between two health care sites that were part of the INTEGRIS video network. The next stage of the study was to have the services delivered to the school itself, which was not a part of the INTEGRIS video network. The decision was made to use the state’s educational network, OneNet, as the telecommunications carrier between IJTRC and Hugo Elementary School for several reasons. OneNet provides data and video connectivity to most schools in the state and the Hugo Public School System had other schools in the district already connected to OneNet. Additionally, the INTEGRIS video network was equipped with a T1 connection to the OneNet network. Lastly, contributing to this decision was the potential to replicate the program to other schools in the state at the conclusion of the successful pilot study.

ISM C and IJ TRC are located on the same campus in Southwest Oklahoma City. The INTEGRIS Baptist Medical Center campus is located on the north side of Oklahoma City. The two campuses are interconnected and services by a private municipal area network incorporating video, voice and data.

Services would be delivered directly from the INTEGRIS video network with an H.320 VTEL at INTEGRIS Southwest Medical Center in Oklahoma City bridged at IBMC to an H.320/323 gateway connected through the OneNet network to a PolyCom H.323 unit at Hugo Elementary School. Peripherals incorporated included an ELMO document camera to display instructional materials such as books and cards from Oklahoma City. An AMD 2500 camera would be utilized to transmit close-ups of students’ mouths from Hugo. Transmissions settings remained at 384kbps via the OneNet H.323 network and passing through a Gateway at IBMC to convert H.323 to H.320.
The H.323 PolyCom unit was installed at Hugo Elementary School in a room dedicated to telemedicine applications. The dedicated room was used to ensure confidentiality for patient intervention, and lessen the possibility of distractions during therapy sessions. The AMD 2500 general exam camera was installed as a second camera and found to be essential in several applications. This second camera allowed both the student and the therapist to see close-ups of the student’s mouth. The easy zoom feature of the AMD 2500 allowed the students to focus on their own mouth eliminating the need for the teacher aide to handle the equipment. The students enjoyed using this camera, and it served to increase active participation. At the hub site, an ELMO, or opaque projector, was added. This increased the abilities of the therapist to play word games and have children read from books used in therapy. The use of the ELMO enabled the therapist to break up the sessions and add variety to keep the student’s interest and increase the effectiveness of the sessions.

The pre-pilot had been conducted at ISMC in a conference room that was used for many other purposes. Though it worked for the limited time that was needed for the pre-pilot, it did not suffice to meet the 12 hours required for the pilot study. A new room was wired at IJTRC and a PolyCom, which had both H.320 and H.323 capabilities installed.

### 3.3. Typical sessions

Two half-hour therapy sessions were scheduled for each student on a weekly basis. All sessions were one-on-one rather than in a group setting. The teacher’s aide was responsible for transferring the students to the telemedicine room. The aide initiated the video connections and adjusted the peripherals as needed. The aide also was in charge of giving homework to the students that was faxed to the school by the therapist. Sessions were conducted for articulation and language disorders. Therapy was conducted in accordance to the Speech/Language Telemedicine protocols for the system.

The camera was focused to include the face of both the therapist and the child for the initial greeting that began each session. The previous lesson was reviewed with the student prior to beginning the new intervention. Articulation sessions continued with warm-up or oral motor exercises. Students often were instructed to observe the therapist, and other times were allowed to use the second camera to focus on their mouth. The teacher’s aide switched the view to picture in picture (PIP) with the large picture showing what was on the second camera. The child could see their own mouth in the large picture, but still see the therapist in the smaller picture so they could model after the therapist’s mouth movements.

A typical activity was an auditory discrimination exercise (for new sound) which was the second phase of the teletherapy session. The therapist switched the camera from her to the ELMO, so that the object laying on the ELMO could be seen on the monitor by both the child and the therapist. A book that included the sounds might be read at this point, or speech therapy cards showing pictures of items with targeted sounds such as items that began with “sl” or “r”.

Drills for target sounds were next. Games were often incorporated into this activity such as the Memory game, where the child could see overturned cards on the monitor. The child then selected two cards at a time and tried to select a match. If they correctly matched the cards, they had to use the item on the card in a sentence in order to have the cards taken off the board. This proved to be a very popular game with the children and helped keep their focus on the lesson.

Language Sessions proceeded in a similar fashion to articulation sessions, except that instead of sound exercises, the student focused on target language structure. Again, the ELMO proved very helpful as the therapist often worked with visual aides such as cards that a child had to put in order, or activities that required the student to follow instructions. With younger students, often toys are used for play therapy. The therapist and the student, in order to reinforce the child’s identification, association and understanding skills, used identical sets of toys during therapy. For example, the therapist might guide the child to manipulate times such as plastic farm animals in response to her instructions. A summary of what they had focused on during the session and an overview of the homework assignments was given to end the intervention.

### 3.4. Technical / logistical problems and corrections, Year One

Several technical difficulties were encountered in the first year of the pilot that led to an extensive period of problem isolation due to the diverse nature of the networks involved. Manifestations included tiling, freeze-frames and session disconnects. The problem source initially focused on hardware but after rigorous testing shifted to the carrier connections between Oklahoma City and Hugo. Engineers at INTEGRIS, Hugo Schools and OneNet eventually traced the problem to oversubscribed bandwidth on the H.323 connection to Hugo Elementary School. Data is delivered in short bursts, especially Internet traffic. The bursts create an environment for H. 323 video traffic to be preempted in deliver due to the “real
"time" nature of video. Without the introduction into a network of end-to-end constant bit rate delivery of H.323 traffic, i.e. Quality of Service, additional bandwidth offers a temporary reprieve. OneNet gave priority to adding bandwidth to Hugo but the benefits were not realized until late in the pilot program term.

3.5. Clinical Outcomes

- Pre- and post-testing was completed by teachers, parents and therapist using representative questions from the cognition categories of comprehension, expression, social interaction, problem solving and memory. Therapist noted significant improvements in all five domains. Teacher reported significant improvement in comprehension and memory. Parents indicated the greatest improvements in expression and problem solving.
- Two students achieved their IEP goals and discontinued speech therapy. One student moved to another town and did not complete the year pilot.

3.6. Satisfaction

Student satisfaction with Speech Teletherapy (selected items from a non-standardized consumer satisfaction tool) averaged 4.88 on a scale from 1 (least satisfied) to 5 (greatest satisfaction). The range was from 4.6 to 5 with a mode of 5. Therapist satisfaction from two therapists was measured in January and March using approximately the same questions as the students were given. Impressions with telemedicine varied. The greatest source of dissatisfaction was generated by the technical problems that occurred in March due to network over-subscription. Satisfaction was high with parents and school administrators, despite technical difficulties. The superintendent of the Hugo Independent School District summed up her support by saying, “This program has the potential to open up a whole new avenue of health care in rural Oklahoma.”

4. Pilot Study, Year Two

Year One of the pilot was assessed for clinical outcomes, satisfaction, and technical problems. Though clinical outcomes and parent satisfaction was still high; concerns that the students weren’t getting all their therapy due to technical problems led to changes in transmission. In addition, the reimbursement contract was changed to reflect the possibility of services not being rendered due to technical problems.
4.1. Logistics, Year Two

The telemedicine equipment at IJTRC was moved to another room, as teletherapy became part of a different department in the system. The same equipment was used, so no change in quality was detected. Part of the same students that participated in Year One was included in Year Two. Those who were not continued had met their therapy goals in Year One, moved from Hugo, or had a schedule conflict and could not receive therapy in the time allotted.

4.2. Technology, Year Two

OneNet is introducing improvements and adaptations to adjust to the demands the school systems are placing on the network with a commitment to implement Quality of Service technology to prioritize the delivery of H.323 video. Due to the scope of implementation on a statewide network, the modifications required would not be completed by the time the second year of the pilot began. In order to insure a stable H.323 environment and good quality video it was necessary to use a dedicated T1 line through a commercial telecommunications carrier, Sprint, in order to assure high quality video at the beginning of the school year. OneNet has been utilized recently for other video connections with satisfactory results. The Hugo Elementary connection will be revisited when the contract for connectivity is up.

5. Lessons Learned

During the two years of the pilot study the students received individual one-hour speech therapy interventions for 30 weeks, resulting in almost a thousand virtual visits. Clinical outcomes, cost effectiveness and satisfaction of therapists and students with the telemedicine sessions were measured.

5.1. Clinical Outcomes

The INTEGRIS Rural Telemedicine project addresses this in two ways: children’s special health care needs are addressed primarily through the schools. In addition to addressing the physical and medical needs of the children, counseling services to help these children develop a positive attitude and self-esteem were available. The availability of services will also help to increase the proportion of children and youth with disabilities that spend at least 80 percent of their time in regular education programs.

The use of both high-end and low-end technologies also can be used for consultation, education, and social support for those with conditions like development disorders or acquired neurological impairments.

6. Future applications

The pilot study has proved that telecommunications can be used to effectively deliver speech therapy – both articulation and language interventions – to students in rural schools. This was echoed in a Report to the American Speech-Language-Hearing Association Executive Board. The Issues in Credentialing Team for that organization stated that it believed “that the remote delivery of audiology and speech-language pathology services through technology (telehealth) abs the potential to become a more widely used mode of clinical service delivery and a rapidly expanding marketplace niche for our professions.”

Future studies will include additional schools, rural initially then possibly metro, for speech pathology. Additional services, such as physical therapy, occupational therapy and behavior modification are being explored. The use of technology via analog phone lines has been used in homes following neuro-insult. The quality of analog phone line video, if at least 20 frames/sec, is sufficient to consider its usage in schools that do not have a sufficient number of students, or the school budget to warrant, the more expensive T1 line leases. This is being considered especially in the case of one rural school giving services to another school in its local calling range.

All changes will be done incrementally, and in research format, at INTEGRIS to ensure optimal outcomes, acceptance by stakeholders, and replicability nationally. Finally, a manual and an instructive short course on how to most effectively use telehealth for therapy will be developed for other therapists. INTEGRIS Health is continuing its innovative initiatives “to find a better solution” to delivering cost effective, specialized healthcare to communities in Oklahoma. This study demonstrated how telehealth is helping to bring Oklahoma into the new millennium on the cutting edge of special service delivery.

7. References


