

## Telemedicine for Children With Disabilities

Dennis C. Harper  
*Department of Pediatrics  
Center for Disabilities and Development  
Carver College of Medicine  
University of Iowa Hospitals and Clinics*

We evaluated the efficacy of team-to-team interdisciplinary telemedicine evaluations for children with special needs in rural Iowa. A real-time cable system was connected to two public school sites and a small regional hospital from the hospital-based Center for Disabilities and Development. Results from the treatment and control groups suggest that the telemedicine group (parents) reported consultations at least as effective as parents who received on-site evaluations. Providers (multiple professionals) were equally positive about the evaluations. Data suggest that the telemedicine evaluations were viewed as good as face-to-face consultations. Significant cost savings occurred.

Children with special needs present a complex array of health care requirements that remain throughout their life span. These needs include chronic health disabilities (diabetes, epilepsy, cystic fibrosis), developmental and behavioral disorders (cerebral palsy, spina bifida, attention deficit hyperactivity disorder, mental retardation, autism), and traumatic injuries (traumatic brain injury, spinal cord injury). These conditions can and often do have a major impact on the daily functioning of each child. Families travel substantial distances to obtain services from an interdisciplinary team of pediatric experts. Usually a group of professionals relate and consult with local professionals to facilitate treatment recommendations.

Traditional service models include the child and family visiting multiple individuals in different clinics or teams of professionals in clinics and the communication of information in a standard written report, whenever it arrives. Much time, energy, often great distances, costs, long waits for appointments, and late communications characterize these traditional evaluation and treatment service systems (Glueckauf, 2002). Care coordination between providers and the local schools following evaluations is often the major challenge. These systems of care are frequently overburdened, difficult to access, and costly for parents. One parent consumer noted, "We are still going through the same thing as parents did 30 years ago ... there is all this new technology. ... If we had telemedicine none of this would happen" (Wheeler, 1998, p. 16).

It is not surprising that telemedicine would be considered for providing multi-specialty health care services for children with special needs. As early as the 1990s, professionals in rural New York (Wheeler, 1998) and rural Georgia (Karp et al., 2000) began offering multidisciplinary services to children with special health care needs at remote locations from hospital settings. Remote health care may be an important part of the future for much of rural America (Antezana, 1997) for at least some aspects of coordinated care. The Specialized Interdisciplinary Consultation Telemedicine Project provides an 8-year history of consultation services for children with complex neurodevelopmental disorders in rural Iowa communities, particularly in their school environments. This specialized interdisciplinary team consultation service for children with chronic health and developmental disorders is presently ongoing, with all disciplines participating. This clinical service is unique in that an interdisciplinary team of professionals at both sites (hospital and remote) completes the evaluations with parents and children present. This team-to-team consultation permits comprehensive parent and professional dialogue, professionally guided evaluation procedures, real-time discussion of evaluation results, treatment recommendations, and coordination of care (Harper, 2001b).

This National Library of Medicine project utilized three studio sites in southwestern rural Iowa, approximately 100 miles from University Hospitals in Iowa City, Iowa, with a population base of 75,000 families. The three sites (two in educational settings, one in a small regional hospital) had studios with push-to-talk microphones, Sony large-screen monitors, and ceiling-mounted cameras or Sony handheld cameras. Real-time communication was achieved by using Iowa's Communication Network, a DS3 fiber optic cable network linking 99 counties to 840 sites throughout Iowa located in hospitals, schools, and select public buildings. This project is unique in that the evaluation of these consultation services focused on parents and professional consumers located in these rural Iowa communities. The study answered two questions: Are telemedicine consultations viewed as effective as "face-to-face" consultations by parents and providers, and will rural patients, families, and providers be satisfied with telemedicine consultations? The study's

contribution to literature is its emphasis on evaluating the efficacy of the telemedicine medium for coordinated, team-to-team based care. Presently we are unaware of data evaluating the efficacy of interdisciplinary pediatric specialized consultations using a telemedicine strategy dealing with rural settings.

## THE IOWA TELEMEDICINE EXPERIENCE

Iowa is a rural state of approximately 3 million residents with an estimated 70,000 children who have a variety of developmental disabilities. Parents and professionals often travel long distances to Iowa's tertiary center, the Center for Disabilities and Development (CDD), for evaluation and treatment of children who exhibit complex health care concerns. The location for the specialized consultation telemedicine service is the CDD (formerly University Hospital School), which is a specialized rehabilitation hospital and outpatient clinic and is part of the medical complex of the University of Iowa Hospitals and Clinics, providing treatment and evaluation for people with chronic health care concerns and disabilities. The CDD has 235 faculty and staff providing a wide range of services for children and youth with neurodevelopmental disorders.

### Location and Overview of the Program

In 1994, the National Library for the Study of Rural Telemedicine was established at the University of Iowa Hospitals and Clinics. This facility is a large, 800-bed, high-tech tertiary care hospital with 7,000 hospital professionals serving Iowa and the Midwest. This effort was supported by multiple grants from the National Library of Medicine, and its purpose was to evaluate health care delivery needs in a rural setting, develop technical approaches toward their solution, and test these applications in community settings. This cooperative National Library of Medicine project lasted 6 years and provided comprehensive telemedicine services with a major focus on evaluation of delivery systems. A complete report of this extensive project is available at <http://telemed.medicine.uiowa.edu>.

### Program Components

The National Library of Medicine project developed five major clinical telemedicine projects: (a) Pediatric Echo Network—a statewide Tele-echocardiographic consultation network; (b) Emergency Department Support for Vascular Ischemia—a Web-based consultation network for rapid diagnosis and treatment of acute cardiac and brain infarction; (c) Tele Psychiatry Consultation—a real-time, two-way video conferencing psychiatry service for rural clients; (d) Diabetes

Education—a computer, Web-based, and Web TV in-home consultation and management system for rural clients; and (e) Specialized Interdisciplinary Consultations—a real-time, two-way video conferencing service for children with special health and behavioral needs in rural Iowa communities (Harper, 2001a). These projects and the project investigators provided an amazing test bed of clinical applications of telemedicine research evaluating a wide range of clinical problems, populations, and technology.

## TELEMEDICINE ENCOUNTERS

### Overview of Scheduling and Procedures

Our hospital-based scheduling center and a local (distant site) predesignated coordinator scheduled children and families of the CDD telemedicine consultations cooperatively. On scheduling, the child and family as well as local professionals with a designated local coordinator provided a brief orientation concerning the planned telemedicine consultation with all the specialists at both sites. When the child and the family arrived at the telemedicine site, the coordinator or team leader of the distant site was responsible for reviewing procedures for the telemedicine conference and dealing with information related to confidentiality, parental consent, and specific session record keeping. The team leader acted as both case manager and facilitator for the telemedicine encounter.

## PROTOCOL DEVELOPMENT

A series of protocols for patient presentation and consultation was established prior to the encounters for each clinical area in the study. This cooperative and prior consultation became a fundamental aspect of ensuring successful telemedicine encounters. A general consultation protocol was developed collaboratively and covered the detailed etiquette of telemedicine encounters. This protocol was the guiding template for all evaluation sessions and was the basis for training new local providers prior to specific consultations. The general consultation protocol outlined the following: logistics for sessions, designated leadership, specific responsibilities of participants, processing of confidential releases and reports, summaries of clinical consultation, and follow-up arrangements.

In addition, four subspecialty protocols were developed collaboratively between the hospital (CDD) team and the distant-site team in rural Iowa. These protocols focused on children with severe behavior disorders; children with swallowing disorders (dysphagia); children needing assistive technology services; and children with specialized unmet health needs, primarily traumatic brain injury.

The protocols were prearranged with local professionals and defined specific aspects of assessment, data collection, and what needed to occur beforehand to make the encounter successful. Details are supplied at <http://telemmed.medicine.uiowa.edu>. Each of these clinical protocols included a review of the clinical referral questions from a consensus of parents and local professionals; a brief restatement of historical findings from prior evaluations when available; a prearranged sequence of steps and procedures to complete the evaluation (e.g., a standard medical examination by a local nurse guided by a physician at the CDD; predetermined interview-based questions and procedures for the child, parents, and often the local educator to be given by other examiners (including psychologists, speech therapists, physical therapists); a summative, interpretive, and interactive conference following a traditional case conference format; and a written report followed to all participants. Each of the subspecialty protocols and specific patient data were frequently reviewed by phone prior to the evaluation session by social work staff. Initially much effort with all local teams was focused on prearranged clinical plans for the evaluation session. Generally after one or two interactions (e.g., case consultations), the protocols were mutually finalized, and the sessions proceeded more efficiently over time.

### TEAM-TO-TEAM CONSULTATION

As noted, this project was based on an interdisciplinary delivery model that focused on collaboration between teams of professionals assisting children and their families. The team-to-team effort was not contrasted with a single discipline approach; this was not feasible. The model of delivery enabled many unplanned opportunities. Care coordination was enhanced because a majority of local providers were involved in the case consultation. Parents frequently felt empowered by participating in the evaluation and in the discussion of recommendations with all providers present. The team-to-team process enabled sharing of expertise among all, mutually enhancing professionals' skill levels. Finally, the respective teams at the CDD and local professionals developed an increased sense of familiarity and personal rapport. A formal process evaluation was not conducted but based on the anecdotal comments, these aforementioned benefits were clearly noted (Harper, 2002).

### CONSULTATION SERVICE FLOW CHART

The schematic in Figure 1 shows the process of telemedicine consultation. This figure depicts the multiple steps of the teleconsultation process. We acknowledged that not all requests for this teleconsultation process were suitable; as we dialogued

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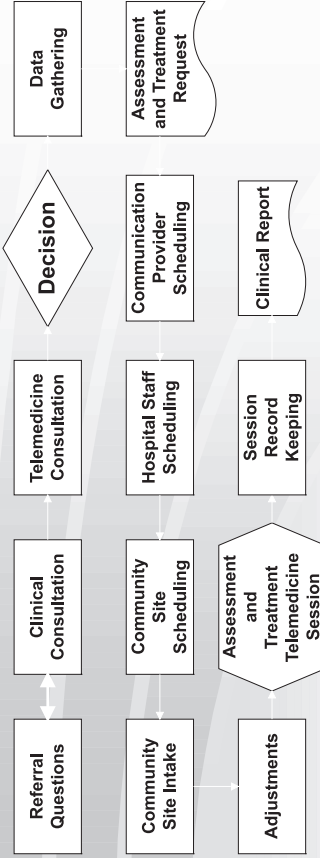


FIGURE 1 The process of telemedicine consultations.

with local referrants, the needs of children may change. Consequently, we developed a series of steps to review referrals, verify status, and ensure availability of local professionals at both sites. This process was completed by scheduling personnel and increased our general success in delivering what was needed. Data gathering and the clinical report became two crucial steps in this process. As with any evaluation, there was a need for specific clinical data, and this need is more significant when using a long-distance care system. Rather important, the need for a timely and concise clinical summary (hard copy) ensured a record of the session and was provided to parents and providers within an average of 5 days from the session.

### EVALUATION OF PATIENT AND CAREGIVER AND PROFESSIONAL SATISFACTION

A comprehensive patient and professional satisfaction survey (available from the author) was developed cooperatively and administered by the Iowa Institute for Social Sciences, an independent social science consulting firm at the University of Iowa. This phone-based survey consisted of 55 items for each parent and professional area and reviewed multiple areas of patient and professional satisfaction with the telemedicine encounter. For professionals, questions focused on the quality of information using the telemedicine venue in comparison to traditional face-to-face on-site evaluations or consultations. Multiple response scales were used (Likert and specific categories) in the survey.

Content of the specific questions focused on parents' satisfaction with multiple aspects of telemedicine sessions; cost reduction; whether telemedicine was as good as face-to-face evaluations; and technical quality of the telemedicine sessions, professionals' satisfaction with the telemedicine session from a diagnostic or evaluation perspective, whether it was as good as face-to-face consultation, telemedical quality, and time savings. The interview took 30 to 45 min.

Treatment groups consisted of parents/caregivers and professionals who participated in telemedicine encounters, whereas control groups consisted of parents/caregivers and professionals who had no experience with telemedicine encounters but had prior clinical experience with the CDD treatment system. Selecting an appropriate control group for this study was viewed as an important goal. The primary goal of the study was to evaluate the vehicle of telemedicine—that is, can we offer a service “as good as face to face” in the opinion of parents and providers. We used the center's patients as the group who had received prior interdisciplinary service on-site and carefully matched this group to those who participated in the telemedicine project. Groups were matched for age, gender, socioeconomic status, and problem type, not diagnosis per se. We were interested in a functional comparison of referrals. Exclusive diagnostic comparison was not viewed as relevant to the use of our services model or the efficacy of telemedicine evaluations.

TABLE 1  
Child's Condition/Referral Need

	<i>Telemedicine</i>	<i>Control</i>
Age ( <i>M, SD</i> )	7.5 (5.4)	6.5 (3.7)
Referral question ( <i>n, %</i> )		
Special health care needs	23 (42.6%)	29 (58%)
Severe behavior disorder	11 (20.4%)	6 (12%)
Swallowing disorder	5 (9.0%)	6 (12%)
High need assistive technology	15 (28.0%)	9 (18%)
Total	54	50

### TREATMENT SAMPLE

The study treatment sample was obtained as a convenience sample based on local need and referral from the designated catchment area. The catchment area was selected as a rural and distant location (approximately 100 miles) from the CDD in Iowa City, Iowa, as the focus of the initial telemedicine proposal. The Area Education Agency 15 (a large, administrative, multicounty unit serving 3,575 children with disabilities) and the Ottumwa Regional Health Center 100 miles from the CDD served as target sites, providing services for approximately 70,000 predominantly rural residents in southeastern Iowa.

Four cohorts of children with specific preselected disabilities were included: (a) children with disabilities who had unmet health care needs (primarily brain injuries) and children with neuromuscular disorders; (b) children with developmental disorders and severe behavior disorders; (c) children with swallowing disorders; and (d) children who, because of their disabilities, had a need for assistive technology or augmentative communication assistance.

Study participants in the treatment group consisted primarily of parents of the children with disabilities and professionals providing services to these children in their respective rural community areas. Specific numbers of these families are noted in Table 1. The final treatment sample consisted of 54 treatment children and families and 50 control children and families.

### CONTROL SAMPLE

Controls consisted of two sample types: families who had a child with disabilities and had previous (nontelemedicine) contact with the CDD, and local providers who did not participate in this telemedicine project but who had previous contact with the CDD in referring specific patients. The family controls were selected based on



TABLE 2  
Participant Participation

	<i>Family Catchment</i>	<i>Family Control</i>	<i>Provider Catchment</i>	<i>Provider Control</i>	<i>Totals</i>
No. complete	54	50	135	36	275
No. callbacks	7	4	29	7	47
Not eligible	0	2	2	0	4
Problem no.	4	5	5	1	15
Refusal	0	1	0	1	2
Duplicate	0	2	0	0	2
Late enrollment	8	0	21	0	29
Total	73	64	192	45	374

*Note.* Family catchment = families in the treatment area who received telemedicine consultant; family control = families who did not receive consultation from telemedicine but did receive prior onsite services from the Center for Disabilities and Development; provider catchment = professionals in the treatment area who referred telemedicine patients in the current study; provider control = professionals who did not receive telemedicine consultations but did have prior consultation contacts with the Center for Disabilities and Development; complete = completed phone interviews; callbacks = repeated tries to reach with no success; not eligible = did not meet study criteria; problems = variety of concerns, unable to reach, incomplete, and so on; refusal = refused to participate; duplicate = repeated contacts in study group; late enrollment = recontacted after study date concluded.

child problem referrals, similar socioeconomic circumstances, and a location outside of the research catchment area. Although an attempt was made to match for both child problem and severity of disability, this proved formidable and generally unsuccessful. Controls were defined as parents who had prior contact (treatment or evaluation) with the CDD but no telemedicine experience. Professional controls were defined as those professionals (all types) who had made referrals to the CDD previously, were outside of the research catchment area, and had received consultation or evaluation reports on these patients and families.

Participation (patients and professional providers) is outlined in Table 2.

#### FAMILY AND PROVIDER INTERVIEWS OF TELEMEDICINE AND CONTROL DATA

The Iowa Institute for Social Sciences provided direct phone-based interviews (30 to 45 min) for all families and professionals involved in this study. One hundred participants (patients and families) were enrolled, 73 of whom agreed to participate in the final interviews, for a participation rate of 73%. Complete data were available on 54 patient families. The control group (family control) consisted of 64 families, 50 of which completed these interviews, for a participation rate of 78%.

Providers in the catchment (research-treatment) area consisted of 4 physicians, 4 nurses, 10 social workers, 33 educational specialists (psychologists, speech pathologists, educational consultants), and 84 others (teachers and service providers). Of the 192 available, 135 participated for a participation rate of 71%. Finally, provider controls consisted of 4 physicians, 2 nurses, 4 educational specialists (psychologists, speech pathologists, educational consultants), and 26 others (teachers and service providers). Of the 45 contacted, 36 agreed to interview, for a participation rate of 80%. This group (provider control) was the most difficult to recruit and obtain. We suspect most felt a limited basis for participating.

## STATISTICAL COMPARISONS

Statistical analyses consisted of comparisons of multiple subgroups of participants on key interview comparison questions. Contrasts were made between telemedicine patient (families) and control (families), attitudes of telemedicine patient (families) on the telemedicine consultation sessions, and telemedicine provider group and provider control (nontelemedicine) group. Research analyses were completed with consultation and analyses from the Biostatistical Consulting Center of the University of Iowa. All analyses were completed by contrasting matching groups (treatment vs. control) using two statistical tests: Fisher's exact test and Wilcoxon rank sum test. Significance levels were set at  $p \leq .05$  in all instances.

### Telemedicine Patient Versus Control Group

Statistical comparisons evaluating the comparability of the telemedicine patient ( $n = 54$ ) versus control ( $n = 50$ ) were not significant on child's health or behavioral referral condition, times a child visited the local doctor in the past year, distance and travel time to the CDD, parent who attended consultations, age of the child, parent employment and educational status, age and race of parent, parental income, and gender of respondent. These comparisons suggest that the telemedicine patient (families) and patient control groups were likely comparable and that contrasting these groups on key telemedicine efficacy questions was possible.

Statistical contrast between the telemedicine patient and control patient groups revealed no significant differences on satisfaction with the most current visit, rated quality of care of the recent visit, amount of time spent with physicians and professionals, ease of appointment making, and rated quality of the professionals' concern during the evaluation. These aforementioned comparisons suggest that there were no significant differences reported between the telemedicine patients' contact versus the control patients' report of their on-site clinical contact.

Furthermore, regarding the quality of evaluations completed via telemedicine, including the quality of care, physician and professional time, ease of appointment making, and perceived physician and professional care delivered, was rated by the parents as equal to the quality of these indicators during face-to-face direct clinical consultation.

A group of 36 families completed telemedicine consultations and had at least one on-site contact prior to the telemedicine consultation. These telemedicine patients contrasted their pre- (onsite) and post- (off-site) opinions of their evaluation experiences. These on-site and off-site contrasts revealed no significant differences in the following: quality of on-site versus telemedicine consultation, amount of time with professionals, ease of appointment making, and perceived professional's concern during the evaluation. Statistical data for these comparisons are available from the author. Collectively these comparisons of parent's experience with their own prior on-site versus telemedicine consultation were all rated positively with face-to-face consultation at the CDD.

### Attitudes of the Telemedicine Group

Parents in the telemedicine group noted the following: Current view of telemedicine experience was the same or more positive, 98% (53/54); quality of care of the experience was good to excellent, 98% (53/54); quality of provider concern during consultation was good to excellent, 98% (53/54); and view following consultation was satisfied to very satisfied, 98% (53/54). Some parents (10–12%) reported technical problems during the telemedicine session, usually with poor audio and camera movement.

### Telemedicine Provider Versus Control Group Provider

Statistical comparisons evaluating the comparability of the telemedicine provider ( $n = 135$ ) versus the control group provider ( $n = 36$ ) did not reveal significant differences on the following: time in actual consultation, distance in local community from office to telemedicine site, times each provider referred patients to the center, ease of appointment making, satisfaction with recent consultation, rated provider concern in the evaluation, and satisfaction with referral access to the center. These aforementioned comparisons suggest no differences were reported in the interviews of these telemedicine versus control providers in rated satisfaction, quality of care received, professional time, provider concern, and satisfaction with access to referrals. Telemedicine consultations are rated as comparable to face-to-face consultations for the services provided in the opinion of the professionals surveyed.

## Comparison of Attitudes Among Providers on Their Satisfaction With the Telemedicine Consultation

The interview stated, "Thinking about your most recent telemedicine experience, on a scale of 1 to 5, 1 is strongly disagree and 5 is strongly agree, please tell me how much you agree or disagree with each of the following statements." Question 35 asked participants for their response to this statement: "The consultation would have been better if it had been conducted in person." We developed two groups from the response to the question based on this distribution: 1 and 2 (*disagree, in favor of telemedicine consultation*) ( $n = 66$ ), and 4 and 5 (*agree, in favor of in-person consultation*) ( $n = 41$ ). We then contrasted (on the basis of this dichotomy of in favor or not in favor) the sample responses based on these two new groups. Significant differences ( $p < .05$ ) in relation to this experimental dichotomy revealed the following findings. Those in favor of telemedicine for consultation (a) viewed appointment making as more positive, (b) participated more often in telemedicine consultations, (c) viewed access to high-quality care as an important issue, (d) viewed telemedicine as more positive with increasing contact experience, (e) reported that families are more positive about telemedicine than onsite, (f) were more comfortable with telemedicine, (g) reported that more communication is permitted, (h) reported that they see this as providing better care, (i) reported it as more positive because it permits productive use of time, (j) had received more training and were more positive, (k) reported telemedicine made it easier to provide care, and (l) recommended this service more when they were more positive. All data comparisons are available from the author.

These aforementioned comparisons indicate that those who reported telemedicine as more favorable reported that it provided access to higher quality care, generated positive feedback from patients, had higher participation rates in telemedicine consultations, and was a productive use of their professional time (Harper, 2004). Those who were in favor of on-site evaluations indicated a clear preference for needing more specific evaluated child outcomes that could not be completed "long distance." These specifics related to needs for cognitive child assessment and more detailed and direct physician assessments. It was also noted by some providers that they did not favor the technology and it was not accessible to them.

## Attitudes of Telemedicine Provider Group Reported Toward Telemedicine Consultation Experience

Providers in the telemedicine group noted the following: access to high-quality care as a factor or major factor in use, 88% (97/111); use because of family finances as a factor or major factor, 53% (52/98); use because of time savings as a factor or major factor, 96% (105/110); and use because it provided better care:

agree to strongly agree, 81% (106/131). During consultation, between 8% and 12% of providers noted some difficulty with being able to communicate, hear others, and see others. These concerns centered on poor audio, camera movement, and general studio problems. Nevertheless, an overwhelming number (88%) of participants reported no difficulties in these areas.

## ECONOMIC ANALYSIS

The economic analysis was viewed as a major issue in the development of the telemedicine project. Two aspects were emphasized in this analysis: time costs and travel costs for professionals to come to the center. We also surveyed parents on the amount of out-of-pocket costs for travel to the center in Iowa City. The economic analysis focused on how telemedicine can reduce costs related to transportation and reduce time for professionals who provide care for children with disabilities.

### Travel Costs

Travel costs were estimated by calculating the distance and expected amount of time spent traveling between Iowa City and the referral community and then estimating the transportation cost and opportunity cost of time spent in transit. By estimating the travel and time costs that would have occurred in the absence of this telemedicine-based initiative, we were able to estimate the potential savings attributable to this approach. These costs involve cost of transportation and professional costs to participate in this consultation if it were held on-site in Iowa City at the CDD.

### Time Costs

Estimation of time costs proved a difficult task given the large variety of occupations represented in the sessions. The basic approach involved estimating the amount of time individuals would have spent traveling between the referral site and Iowa City and valuing this time based on the individual's estimated hourly compensation.

### Hourly Compensation Estimates

Session participants were not asked to report their earnings because of concern that doing so might lessen response rates. Moreover, the nationally representative compensation estimates we used enhance the generalizability of our estimates

beyond Iowa. Because these wages exclude employee benefits, we adjusted these mean wage estimates to account for an average benefit of 17% as recommended by the Centers for Disease Control for economic evaluation in health care.

To estimate earnings for family members and others for whom occupation data were not available, we used the median annual earnings for full-year, full-time workers ages 35 to 44 as published by the U.S. Bureau of the Census. Students, the children being evaluated, and siblings were excluded from the analyses.

### Mileage Costs

To estimate mileage costs, we assumed an average of three people per car would make the trip. We used the U.S. Internal Revenue Service mileage allowance of \$.325 per mile to estimate transportation costs.

### Results Costs

Data were obtained on 91 sessions over the period February 24, 1998, to July 8, 1999. Eight sessions, occurring primarily in the first 4 months of the evaluation, could not be evaluated because of incomplete data, resulting in 83 evaluable cases.

Telemedicine is a major cost saver to local families and local professionals. The average savings to the local district (professionals and parents) was \$971 per telemedicine session. This cost figure includes costs of on-site team consultation and travel by the team to the local community if the session was completed in person by the team. Average savings for parents in out-of-pocket costs (mileage and meals) was \$125 per session. We did not include missed work, which was common.

## DISCUSSION

This study evaluated the use of a particular type of telemedicine and system to deliver specialized interdisciplinary care to rural Iowa and focused on two questions: Are telemedicine consultations viewed as effective as face-to-face consultations by rural parents and providers, and will rural parents and providers be satisfied with telemedicine consultations?

Data presented in this study based on rather extensive and comprehensive interviewing suggest that parents in the telemedicine group viewed these consultations as at least as effective as direct onsite evaluations. Furthermore, a subgroup of parents ( $n = 36$ ) who had both on-site and telemedicine experiences reported no significant differences in their ratings of these two evaluation experiences, which were both highly positive. Providers (multiple professionals) who participated in the telemedicine study and controls who received onsite consultations were equally

positive about the evaluation received. These data suggest that the telemedicine evaluations were generally rated and viewed as good as face-to-face consultations. Problems were noted with audio and video concerns by consumers (parents and providers) in about 12% of the sessions. Generally, 88% to 90% of the respondents who participated in the telemedicine sessions noted them as good to excellent.

Costs for such services (excluding equipment) revealed major savings to local school districts in professional time and travel. Parents on average had modest reductions in out-of-pocket costs but lesser missed work costs.

### FUTURE CHALLENGES FOR TELEMEDICINE

This study did not effectively evaluate in sufficient detail the particular types of clinical consultations (e.g., new evaluations, screening, care coordination, follow-up, and counseling) that were best suited to telemedicine in chronic health care. Initial screening evaluations and follow-up evaluations with chronic health care monitoring were very well suited to the existing telemedicine program both clinically and functionally. The telemedicine services most utilized by our group were follow-up and care coordination. Future directions require that we clarify the limits of telemedicine consultation for specific clinical disorders and types of treatment options (Bauer & Ringel, 1999). As an example, we need to explore how providing earlier or unlimited psychological treatment of anxiety disorders is maximized using the telemedicine format. Further, it would be useful to know if more frequent follow-up of initial diabetic education of adolescents was more effective using a telemedicine venue as compared to a face-to-face method.

Reimbursement from private insurance carriers remains slow but is beginning to support some of these services. Capitated contracts for specific services with specific agencies are working. The future success of such consultations is related to broader acceptance of these telemedicine services by parents, professionals, and the insurance industry (Bashshur, Sanders, & Shannon, 1997). Will telemedicine be a reimbursable service? Payment for service will slowly improve, according to a number of experts in the field (Tracy & Edison, 2004). We need to be aware of the national licensing and credentialing requirements in telemedicine practice. Most likely, large health care systems will utilize telemedicine for providing for select "managed" populations such as the military, correctional institutions, and other groups (Effertz, Beffort, Preston, Pullara, & Alverson, 2004).

Is telemedicine effective or efficacious as a clinical tool? Telemedicine in this study has demonstrated it was able to provide for a variety of diagnostic and treatment services, screening, counseling, psychosocial management, behavioral management, interviewing, and general follow-up. Considerable research needs to focus on identifying the types of clinical problems that are best suited to a

telemedicine service. Encouraging results are certainly emerging for helping chronically disabled populations and promoting ongoing health management (Nelson, 2004; Niederpruem et al., 2004).

Does telemedicine fit into my clinical day? This was a significant concern verbalized anecdotally in our study and remains the biggest challenge for most professionals: Can I adapt to something entirely different? Telemedicine systems are best offered as a part of a continuum of services within a clinical array as one method for some parts of delivery or health care assistance. Professionals repeatedly note that success of telemedicine systems is directly related to how easy they are to use and if they fit into clinical work patterns and client needs. This is fundamental and obvious but not easily accomplished for a multitude of reasons.

Providing some aspects of health care to people in more convenient locations has clear benefits for their health and quality of life. Economic benefits for consumers to improved access are a compelling reason to continue exploring telemedicine services. If one needs assistance and can get it quicker and easier, it is reasonable to do so in some situations. It is not always economical or the best thing to do just because it might be easier. We are not sure about the impact of such services and their overall efficacy on specific health problems. Telecommunications systems can assist problems of the underserved with better dispersion of specialists and assistance needed at the right time. The implementation of telemedicine will likely continue to be an uphill battle. The least of the difficulties noted by many authors is technology. Education, support, motivation, and training of providers are critical (Patterson & Shulman, 2004). A variety of political and social factors often stands in the way of moving to newer technologies. We need to be sensitive to those issues and seek solutions. An overall analysis suggests that telemedicine efforts do work in a number of respects. Complex technologies will continue to assist us in developing a better quality of life; however, our goal is to learn to manage them so that this does in fact happen.

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