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The use of Telemedicine in Pediatric Psychology: Research Review and Current Applications

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Pediatric psychology, as a profession, was first defined by Logan Wright in 1967 as “dealing primarily with children in a medical setting which is non-psychiatric in nature” [1]. Shortly thereafter in 1968 the Society of Pediatric Psychology was founded and eventually became an official section of the American Psychological Association [2]. The field is focused on addressing the psychological and behavioral issues of medically ill children and their families and caregivers. For example, pediatric psychologists often help children with cancer cope with their diagnosis, help children with diabetes manage their complicated treatment regimen, or help obese children and their families implement the treatment recommendations made by their primary care physicians.

Pediatric psychology has an impressive clinical and research history, especially given its relatively short existence. Empirically supported treatments in pediatric psychology have been established for Cystic Fibrosis, Diabetes, Asthma, Feeding Problems, Obesity, Sleep Problems, Encopresis, Enuresis, as well as many other childhood health issues (see [2] for a comprehensive review).

There is also a long history of the use of novel technologies in pediatric psychology [3]. From using electronic pill count bottles to track child adherence to pill taking regimens, to using bed alarms for night time enuresis, psychologists have relied on technology in their work with children who are ill. Much of the recent technology literature in pediatric

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psychology has focused on the use of internet and other web based technologies [4]. For example, March and colleagues reported on the efficacy of an internet-based cognitive behavioral therapy for childhood anxiety disorders, and Stinson and colleagues reviewed internet-based self-management treatments for children with health conditions (see [4] for a review).

The objective of the current paper is to thoroughly review the literature regarding telehealth (specifically defined as interactive televideo) in the field of pediatric psychology. More specifically, our review will examine the application of televideo or teleconferencing in various populations of children and adolescents with chronic illnesses. We will follow this review with our own clinical and research applications of telehealth to our work in pediatric psychology. Finally, our review will conclude with a summary of study findings and future directions in the field for clinicians and researchers alike.

Methods

Studies were included in our review of the literature if they: (1) consisted of telemedicine applications for presenting concerns, (2) focused on a chronic illness group of children and/or adolescents, and (3) included videoconferencing/teleconferencing as the method of remote intervention. Studies were excluded if they: (1) were conducted using telephone interactions only (i.e., without video), (2) utilized other technologies as a primary method for service delivery (i.e., web-based interventions), and (3) focused only on a specific psychological condition without a chronic illness specified.

The following represents a review of the studies that met inclusion/exclusion criteria. A total of nine studies are detailed, and are organized by the outcome measure of interest for each investigation; these outcomes are aggregated into three categories: (1) Feasibility/Cost-effectiveness (broadly defined), (2) Clinical Outcomes/Assessment, and (3) Patient Satisfaction. As an example, if the primary outcome focus of a particular study was the reduction of anxiety levels, it would be considered a study of clinical outcomes, which would fall within the second category mentioned above. Each study included, along with relevant study details, is presented in Table 1.

Feasibility/Cost-effectiveness

A common focus of investigations within the telemedicine literature is the feasibility/cost-effectiveness of intervention. A focus of this kind establishes the utility of an intervention in comparison to standard hospital care, suggesting that it may be viable for large scale use. As such, studies of feasibility/cost-effectiveness are often initial or pilot studies of a particular intervention that include several outcome measures of interest. Our review identified six studies that focused on feasibility and/or cost-effectiveness as an outcome measure.

In a recent investigation, Witmans and colleagues [5] reported on the delivery of pediatric sleep services using telemedicine technologies for the Pediatric TeleSleep program. This methodology of service delivery was proposed as a means of treating individuals in rural areas of Alberta, Canada referred by their pediatricians, family physicians, and child psychiatrists for sleep problems. The multidisciplinary team included a pediatric sleep specialist, a developmental pediatrician, a registered child psychologist, and a pediatric nurse serving 89 participants. Results suggest that patients saved significant amounts of money and time, and that the services were feasible for rural patients. The authors note that families were able to receive extensive services over a 2–3 day period, rather than make repeated visits to the specialty clinic requiring extensive travel each time.

Clawson and colleagues [6] evaluated a telemedicine intervention for complex pediatric feeding disorders that was designed to provide families with more immediate remote access to the Pediatric feeding disorders program at Children's Hospital in Richmond, VA. Results from this evaluation indicated that costs were reduced dramatically (by \$900) for the 15 participating families. Such savings made the difference between access and no access to these services for many families.

McCrossan and colleagues [7] evaluated the feasibility of a telemedicine intervention to provide support for families with children diagnosed with congenital heart disease following the transition from hospital to home. Sixty-six children ages 1 month to 3 years participated in the evaluation, and results suggested the certain videoconferencing connections (i.e., Integrated Services Digital Network [ISDN] 6 and Asymmetric Digital Subscriber Line [ADSL]) were more effective and feasible for quality service than connections over cable modems or PTSTN systems.

Fiadjoe and colleagues [8] demonstrated the feasibility of utilizing telemedicine consultation for anesthesia in two pediatric liver transplants (two boys, 16 months and 4 years of age). Results indicated that consultation for these services was feasible when utilizing effective and reliable interactive televideo equipment.

Marcin and colleagues [9] reported on the use of telemedicine to provide critical care consultations to pediatric trauma patients admitted to remote intensive care units. Thirty-nine consultations were conducted with 17 patients (mean age of 5.5 years), and results suggested that the telemedicine consultations were feasible for a variety of critical care incidents. This study was the first effort of its kind to provide consultation services with a rural trauma center intensive care unit, and feasibility was inferred through the accuracy of clinical data recorded and the ability to delegate tasks.

Bensink and colleagues [10] conducted a pilot study to investigate the feasibility of telemedicine support for families with a child diagnosed with cancer. The multidisciplinary telemedicine team provided services for eight families, including assessment of symptoms, review of blood test results, supporting symptom management, and providing counseling and educational services. Researchers concluded that the intervention was feasible, considering that usual hospital services were easily administered when provided with the necessary technology and families saved significant travel costs for each hospital service provided.

Clinical Outcomes/Assessment

Another primary focus of many telemedicine interventions is clinical outcomes and/or assessment of patients. For instance, Marks and colleagues [11] conducted assessments to determine the prevalence of overweight and obesity status in children and adolescents presenting to a psychiatric telemedicine clinic from rural areas of California. Of the 121 children and adolescents who met study criteria, 23% were overweight and 32% were obese. In addition, obese children were more likely to have conduct disorder than underweight or normal weight children.

Morgan and colleagues [12] conducted a randomized trial comparing the effectiveness of telemedicine with videoconferencing versus telephone consultation alone, to reduce the anxiety levels of 27 parents/families following hospital visits for children with congenital heart disease. Results indicated that telemedicine with videoconferencing reduced parental anxiety levels following a hospital stay significantly more than telephone consultation alone. In addition, videoconferencing provided for more accurate clinical assessment and observation of relevant patient information.

Shaikh and colleagues [13] evaluated the effectiveness of telemedicine consultations for pediatric obesity diagnosis, diagnosis changes/additions, and treatment outcomes. Patients consisted of 139 children and adolescents living in rural California. Results indicated that changes or additions were made to 77.8% of patients' diagnoses and 79.8% of patients' diagnostic evaluations. Further, 80.7% of patients that were seen more than once showed improvement in clinical outcomes.

Finally, Clawson and colleagues [6] found similar support for improvements in clinical outcomes as a result of their intervention. More specifically, 50% of the initial consultations resulted in recommendations that facilitated local treatment for children. The authors attributed other successes to the telemedicine intervention, stating that many children showed improvement in areas such as the age appropriateness of their eating, their range of acceptable foods, and increased swallowing ability.

Patient/Provider Satisfaction

Finally, patient and/or provider satisfaction represented an important outcome of interest in many of the studies. For example, Marcin and colleagues [9] asked parents, physicians, nurses, and/or respiratory therapists participating in the telemedicine consultations to complete satisfaction surveys immediately following the consultations. Overall, results suggest that parents were satisfied with services provided (mean of 3.8 on a 5-point scale), and that physicians and nurses were similarly content with the consultation structure (overall satisfaction over 4.5 on a 5-point scale for both groups).

Similarly, Bensink and colleagues [10] reported that all families expressed satisfaction with the telemedicine service provided. Further, Witmans and colleagues [5] found that a majority (94%) of participants felt that telehealth provided easier access to specialized services, and 94% felt as though the service was satisfactory overall. Also, 94% stated that they would use TeleSleep services in the future if needed.

Lastly, Clawson and colleagues [6] reported high levels of patient satisfaction within a pediatric feeding disorders intervention. Participants were asked to rate their overall satisfaction with the services, their comfort using the services, and the clarity of communication. Satisfaction on each of these three domains was high (4.4, 4, and 3.8 on a 5-point scale, respectively). Moreover, participants were asked to report the likelihood that they would use the telemedicine services again, and all 15 participating families stated that they would use the services again if needed.

Current Clinical Applications

Because research on the use of interactive televideo in pediatric psychology is still rather new, it is important to also consider current clinical applications. The University of Kansas Medical Center, our own facility, has a nationally known Center for Telemedicine and Telehealth. As such, our institution has a strong program using interactive televideo in pediatric psychology. In the current section we will describe our own clinical use of telemedicine in pediatric psychology focusing on individual therapy, multidisciplinary teams, and groups – all delivered via interactive televideo.

Individual Therapy

For several years, pediatric psychologists at our institution have provided outpatient services via telemedicine. Our telemedicine clinics are broad in scope, encompassing not only children affected by medical illness, but also more traditional psychological disorders (e.g.,

anxiety, depression, Attention Deficit Hyperactivity Disorder). We have also utilized telemedicine for follow-up services for outreach clinics we offer throughout the state.

Technology—The technology for telemedicine services at our institution has evolved over time. As high-speed internet connections have become feasible in Kansas, the program has shifted to the more cost effective and accessible internet protocols (IP). Videoconferencing equipment is selected based on privacy needs and encryption utilized. The provider is able to access videoconferencing from telemedicine specific rooms or from smaller units in his/her own office. The cost of this videoconferencing system is several hundred to several thousand dollars depending on setting, including the videoconferencing unit and software, video monitor, PC, and/or cart. In addition, the distant site pays costs associated with the high speed connectivity/IP connection as well as their own equipment.

The main advantages of the office telemedicine units are convenience and efficiency. The provider can sit in his/her own office, have access to email and other electronic documents, and reduce the transition time between patients. In terms of efficiency, if a patient is late, does not show for the appointment, or if there is an open slot in the provider's schedule, the provider can remain productive with other tasks.

Referral—At our institution, referrals for telemedicine services come from a variety of sources, including schools, other mental health professionals, and medical providers (both internal and external). The University of Kansas Medical Center also operates several Area Health Education Centers (AHEC) throughout the state that are hubs for referrals to telemedicine clinics.

When a referral is received at our Center for Telemedicine and Telehealth, an intake packet is sent out to the family for completion prior to the first appointment. This packet includes an intake form for the family as well as narrative reports by family and school about the concerns they have regarding the child. Broad-band measures of behavioral and emotional functioning (e.g., Behavioral Assessment System for Children [BASC], Child Behavior Checklist [CBCL]) are also completed by parents and teachers prior to the first appointment. Additionally, families are asked to send past medical records, evaluations, and school records. All of this information is available to the clinician prior to the first appointment.

Referral questions in our telemedicine clinics tend to be similar to face-to-face outpatient clinics. In addition to common outpatient presenting problems (e.g., ADHD, depression, anxiety, disruptive behavior disorders), clinicians also frequently provide a range of mental health interventions for children and their families coping with physical illness and a variety of medical stressors. This population includes children and families who are coping with a recent diagnosis of a chronic/terminal illness, acute illness, difficulties with medical adherence, poor pain management, preparing for medical procedures, and managing pain and anxiety after medical procedures.

Consultation—For referring providers who want diagnostic clarification on one of their patients, we provide a 2–3 session consultation service via telemedicine. This service is very similar to more traditional outpatient services with the main difference being that no treatment is initiated. After the initial assessment is completed, a report is generated and sent to the referring provider who then continues with treatment. Our clinicians continue to be available, however, for additional consultation with providers throughout the state.

Treatment—Treatments in our telemedicine clinics are comparable to face-to-face treatments in outpatient clinics. In our pediatric psychology telemedicine clinics, common treatments include pain management, relaxation training, cognitive behavioral therapy

(CBT), and behavioral therapy. Anecdotally, we have found little difficulty applying these treatments effectively to the telemedicine modality. Most treatment difficulties typically arise as a result of technological problems (e.g., lag in audio feed, disrupted connection, etc.), which occur only infrequently.

It should be noted that some clinicians find that it is more difficult for them to implement certain therapies over telemedicine than it is face to face. For example play therapy with a young child may be challenging due to the providers lack of proximity to the play materials. Or, some providers may find exposure therapies challenging, again, since the provider is not in the same location. When interventions are judged to be critical in the successful treatment of the child, attempts are made to identify a provider in the area that can provide the necessary interventions or that can work collaboratively with one of our providers via telemedicine.

Additionally, there are some populations that respond less favorably to treatment via telemedicine. Children who are very young tend to have difficulty adapting to telemedicine interactions. They may exhibit confusion over talking with someone on a television/computer screen and are, not surprisingly, less engaged in the therapy process. Children with developmental disorders may also be less likely to understand and engage in the telemedicine process, although we have found this is not necessarily the case. When working with these populations, we have found it helpful to focus on behavioral management training with the parents/caregivers when that is indicated. Attempts are then made to locate a provider that could deliver other services face-to-face.

Billing—Billing for telemedicine services at our institution is completed by our billing department. Individual and family therapy are the most common billing codes used by our clinicians. Reimbursement for telemedicine services varies by state and by billing code, but there is a general trend for more comprehensive coverage for these services [14]. Centers for Medicaid and Medicare Services provides a list of CPT codes covered via TeleMedicine that many providers and intuitions find helpful (www.cms.gov/Telemedicine/). In Kansas, we have also secured grant funding to cover reimbursement for some services that are not covered by certain patients' insurance, but in some instances this is not possible.

Multidisciplinary Depression Clinic

The multidisciplinary depression clinic is a telemedicine clinic for children and adolescents whose primary presenting problem is depression. Providers are a pediatric psychologist and pediatric psychiatrist.

Referral—The referral process for the multidisciplinary depression clinic is similar to the process described above for the individual therapy telemedicine clinics. Referrals come locally and throughout the state from schools, pediatricians' offices, and mental health providers. Families are asked to send all relevant materials (e.g., testing records, medical records, etc.) and are sent an intake packet as described above for completion prior to their first appointment.

Consultation—The first phase of the multidisciplinary depression clinic is consultation and assessment. This occurs with both the psychologist and psychiatrist in session with the child and family. At this time, a diagnostic interview is conducted, relevant history is gathered, and other tests are ordered (e.g., rating scales, labs, etc.). At the second session, the psychologist and psychiatrist review test results with the child and family and discuss treatment options.

Treatment—Once treatment is initiated, the structure of the clinic changes to most effectively meet the needs of the child and family. If pharmacological treatment is recommended, the treating psychiatrist will meet in separate telemedicine sessions with the child and family to initiate and monitor medication. If psychological treatment is recommended, the treating psychologist will initiate empirically-supported treatment (typically CBT in our clinics) via telemedicine. Where both pharmacologic and psychological treatments are recommended, the treating psychologist and psychiatrist will continue to collaborate closely during treatment, even though they are not meeting together with the child and family for ongoing telemedicine sessions. This is typically done through regular email and telephone conversations.

Clinicians involved in these multidisciplinary depression clinics report high levels of satisfaction with the structure and functioning of the clinics. Some of the benefits they report are a succinct evaluation process, increased communication and collaboration with other providers, and being able to observe and learn from other providers.

Multidisciplinary Obesity Clinic

The multidisciplinary obesity clinic is a telemedicine clinic for children and adolescents whose primary presenting problem is overweight or obesity. Providers are a pediatric dietitian, pediatric psychologist, and a physician or nurse practitioner.

Referral—Referrals come locally and throughout the state from schools, pediatricians' offices, and other health providers. Families are sent an intake packet for completion prior to their first appointment.

Consultation—The first phase of the multidisciplinary obesity clinic is consultation and assessment. This occurs with the entire team meeting with the child and family. At this time, a diagnostic interview is conducted, relevant history is gathered, and other tests are ordered (e.g., behavioral questionnaires, labs, etc.). At the second session, the team reviews their findings with the child and family and they discuss treatment options as a group.

Treatment—All providers see the child and family members at each visit simultaneously. They focus on goal setting, behavioral contingencies, and other behavioral topics while also delivering nutrition education and physical activity education. The team suggests these changes for the entire family, and encourages the target child to track their progress using paper and pencil tracking forms at home. These forms, if kept, are reviewed at each successive meeting, focusing on improving healthy behaviors over time. Providers report the main benefit of this type of clinic is being able to reach patients throughout the state who would not be able to travel to the tertiary medical center on a monthly basis.

Group Obesity Treatment

As part of a series of grants from the National Institutes of Health, our team delivers family based behavioral pediatric obesity treatment to groups throughout the state. These groups focus on behavioral, nutrition, and activity topics and are delivered via interactive televideo to rural elementary schools. Approximately 4–10 families participate in each group. The primary provider is a pediatric psychologist who delivers a manualized treatment program. The intervention lasts 8 months, with 8 hour long weekly meetings followed by 6 monthly meetings.

Referral—Elementary schools sign up for the program that is advertised via flyers, list serves, and professional talks in their area. Once a school signs up, children are referred to this program when their annual school Body Mass Index screening meets or exceeds the 85th

percentile for age/gender. Notes are sent home and interested parents complete an intake packet to enroll their child in the program.

Treatment—As described above the treatment lasts 8 months, with 8 hour long weekly meetings followed by 6 monthly meetings. The manualized treatment program includes the entire family and encourages all family members to improve their health habits no matter their current weight status. The manual focuses on dietary, activity, and behavioral topics such as decreasing sedentary activity, increasing moderate to vigorous physical activity, goal-setting, self-esteem, and behavioral parent training. The dietary intervention component is based upon the Stop Light Diet, the most well-validated diet for children developed by Dr. Len Epstein and his team [15]. Primary outcomes indicate that the telemedicine delivery is well received and that the intervention is effective.

Summary

Pediatric psychology represents the integration of psychological theories and applications for children and adolescents in the hospital setting. Moreover, research in this area has established empirically supported treatments in a variety of contexts, including Cystic Fibrosis, Diabetes, Obesity, and others. While such research has established the importance of the field in general, a number of areas within pediatric psychology remain to be studied in depth, and their applications described in detail. For example, research and reviews of clinical telemedicine applications for children and adolescents are currently in their early form. As evidence, this review represents the only review to date of telemedicine applications for children and adolescents diagnosed with a chronic illness.

A majority of research in this area has focused on three specific themes, which were subsequently used to guide the organization of studies for this review (i.e., Feasibility/Cost-effectiveness, Clinical Outcomes/Assessment, and Patient/Provider Satisfaction). Generally, results from the studies reviewed suggest that telemedicine services for children and adolescents with chronic illnesses are feasible, cost-effective, and satisfying to patients. Some studies also suggest that telemedicine interventions may provide similar clinical outcomes to those expected from in-person service delivery. The broader pediatric chronic illness and telemedicine literature may inform future pediatric psychology applications (see Myers, Palmer, & Geyer, this volume). Similarly, lessons learned from NICU telemedicine programs may encourage further pediatric psychology practice over televideo [16,17].

In addition to a general description of the research to date on the subject, this review aimed to describe a number of telemedicine interventions for children and adolescents with a chronic illness that are currently being conducted our own academic medical center. This information may then provide insight into the various treatment modalities that can be used in the application telemedicine in the hospital setting (e.g., individual, multidisciplinary, and group interventions). Overall, the interventions described from our own experience suggest similar themes outlined by the studies reviewed above. Specifically, they suggest that telemedicine is a feasible and satisfactory way to provide most psychological treatments to children with chronic or acute illness and their families.

While establishing feasibility and cost-effectiveness is important, and a majority of studies reviewed assessed for these features, more thorough examinations of clinical outcomes should be incorporated in future telemedicine interventions. In this way, health professionals can ensure that the quality of service and outcomes in telemedicine interventions are similar to those expected with usual care, and will be more confident suggesting such services to patients and other providers. In addition, once these outcome studies do exist, meta-analyses

of this research base to establish quantitative inferences on the effectiveness of telemedicine interventions for children and adolescents with chronic illness will be very informative.

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Table 1

Studies included in review of the literature (presented in alphabetical order)

| Authors | Title | Subjects | Method of Intervention | Conclusions |
|--------------------------|---|--|--|--|
| Bensink, et al. (2008) | A pilot study of videotelephone-based support for newly diagnosed paediatric oncology patients and their families | 8 families with a child recently diagnosed pediatric oncology | Inertive televideo | Good patient satisfaction. Various data on cost and workflow |
| Clawson, et al. (2008) | Complex pediatric feeding disorders: Using teleconferencing technology to improve access to a treatment program | 15 children ages 8 months to 10 years old with Feeding Disorders | Interactive televideo | Vide Conferencing was effective in helping children and families and was cost-effective |
| Fiadjo, et al. (2009) | Telemedicine consultation and monitoring for pediatric liver transplant | 2 children ages 4 years old and 16 months old with liver failure | Interactive televideo | International videoconferencing consultations are feasible |
| Marcin, et al. (2004) | The use of telemedicine to provide pediatric critical care consultations to pediatric trauma patients admitted to a remove trauma intensive care unit: A preliminary report | 47 non-trauma, non-surgical related pediatric critical care acutely injured children | Interactive televideo | Patients who received consultations were younger and more severely injured; consultations via interactive televideo are feasible and result in high parent and provider satisfaction; Regional PICUs can consult with rural adult ICUs to care for children in a "highly satisfactory" manner per patients and rural providers |
| Marks, et al. (2009) | Weight status of children and adolescents in a telepsychiatry clinic | 121 individuals ages 4–21 who were pediatric psychiatry patients living in rural areas | Interactive televideo | 55% of patients overweight/obese, with bipolar and depressed children having highest rates of obesity |
| McCrossan, et al. (2007) | Assisting the transition from hospital to home for children with major congenital heart disease by telemedicine: A feasibility study and initial results | 66 children ages 1 month to 3 years with major CHD | Compared interactive televideo with telephone only | Feasibility established for videoconferencing with high-speed connections |
| Morgan, et al. (2008) | Home videoconferencing for patients with severe congenital heart disease following discharge | 27 families with children ages 0 to 25 months with pediatric congenital heart disease patients living in rural areas | Interactive televideo vs. phone | Vide Conferencing decreased parent anxiety significantly more than phone, and resulted in significantly greater clinical information |
| Shaikh, et al. (2007) | Clinical management and patient outcomes among children and adolescents receiving telemedicine consultations for obesity | 99 children and adolescents ages 1 to 17 years. Rural patients referred for obesity, morbid obesity, overweight or abnormal weight gain to a telemedicine weight management clinic | Interactive televideo | Consultations resulted in changes/additions to diagnoses 77.9% of the time; Repeated consultations led to improved health behaviors, and for 43.6% of patients, weight maintenance or weight loss |
| Witmans, et al. (2008) | Delivery of pediatric sleep services via telehealth: The Alberta Experience and lessons learned | 89 children ages 1 to 18 with sleep disorders | Telephone and interactive televideo | 94% of patients were satisfied with the service and would use it again. Saves money. Reaches rural populations |

Note. Studies reviewed used various terms when referring to videoconferencing, but were labeled interactive televideo in this review for the sake of clarity.