

PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Using Telemedicine to Improve the Care Delivered to Sexually Abused Children in Rural, Underserved Hospitals

Kristen J. MacLeod, James P. Marciniak, Cathy Boyle, Sheridan Miyamoto, Robert J.
Dimand and Kristen K. Rogers
Pediatrics 2009;123;223
DOI: 10.1542/peds.2007-1921

The online version of this article, along with updated information and services, is
located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/123/1/223.full.html>

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2009 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



Using Telemedicine to Improve the Care Delivered to Sexually Abused Children in Rural, Underserved Hospitals

Kristen J. MacLeod, MD^a, James P. Marcin, MD, MPH^b, Cathy Boyle, MS^a, Sheridan Miyamoto, MS^a, Robert J. Dimand, MD^c,
Kristen K. Rogers, PhD^a

^aDepartment of Pediatrics, CAARE Center, Children's Hospital, ^bSection of Critical Care, Department of Pediatrics, University of California, Davis, California; ^cDepartment of Pediatrics, Children's Hospital Central California, Madera, California

The authors have indicated they have no relationships relevant to this article to disclose.

What's Known on This Subject

Telemedicine is increasingly accepted as a way to provide subspecialty care, including child abuse care, in rural communities. No current published research has examined the potential clinical benefits of using real-time telemedicine during pediatric sexual assault examinations.

What This Study Adds

We investigated the use of telemedicine to assess and improve the quality of care for rural pediatric sexual assault victims. We examined the impact of real-time telemedicine on the quality of examinations provided to these victims.

ABSTRACT

OBJECTIVE. We used live telemedicine consultations to assist remote providers in the examination of sexually assaulted children presenting to rural, underserved hospitals. We hypothesized that telemedicine would increase the ability of the rural provider to perform a complete and accurate sexual assault examination.

PATIENTS AND METHODS. Child abuse experts from a university children's hospital provided 24/7 live telemedicine consultations to clinicians at 2 rural, underserved hospitals. Consultations consisted of videoconferencing to assist in the examination and interpretation of findings during live examinations. Consecutive female patients <18 years of age presenting to the 2 participating hospitals were included. We developed and used an instrument to assess the quality of care and the interventions provided via telemedicine as it related to patient history, physical examination, colposcopic and manual manipulation techniques, interpretation of findings, and treatment plans for victims of child sexual abuse.

RESULTS. Data from 42 live telemedicine consultations were analyzed. The mean duration of the consultations was 71 minutes (range: 25–210 minutes). The consultations resulted in changes in interview methods (47%), the use of the multimethod examination technique (86%), and the use of adjunct techniques (40%). There were 9 acute sexual assault telemedicine consults that resulted in changes to the collection of forensic evidence (89%). Rankings of practitioners' skills and the telemedicine consult effectiveness were high, with the majority of cases scoring ≥ 5 on a 7-point Likert scale.

CONCLUSIONS. The use of telemedicine to assist in the examination of sexually assaulted children presenting to underserved, rural communities results in significant changes in the methods of examination and evidence collection. It is possible that this model of care results in increased quality of care and appropriate forensic evidence collection. *Pediatrics* 2009;123:223–228

www.pediatrics.org/cgi/doi/10.1542/peds.2007-1921

doi:10.1542/peds.2007-1921

Key Words

telehealth, child sexual abuse, nonaccidental trauma, quality of care, telemedicine

Abbreviations

CAARE—Child and Adolescent Abuse Resource and Evaluation
UC—University of California
HPSA—health professional shortage area
ED—emergency department

Accepted for publication Apr 17, 2008

Address correspondence to Kristen K. Rogers, PhD, University of California, Davis, School of Medicine, Department of Pediatrics, Children's Hospital, 2516 Stockton Blvd, Sacramento, CA 95817. E-mail: kristen.rogers@ucdmc.ucdavis.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275). Copyright © 2009 by the American Academy of Pediatrics

EACH YEAR IN the United States, there are ~900 000 victims of child abuse and neglect.¹ Of these children, ~10% are victims of sexual assault. Some of the highest rates of child abuse and neglect occur in rural areas,² where geographical barriers reduce access to the specialty services needed for pediatric victims of sexual assault. This is particularly true in California, where 13 of the most rural counties have the highest rates of child abuse and neglect referrals.³ This problem is compounded by the fact that hospitals in these rural areas have fewer resources and less experienced pediatric sexual assault examiners. Without access to appropriately trained staff, child sexual abuse victims may receive incomplete and inaccurate examinations, face unnecessary admission or transfer, and may not receive the quality of care that they deserve, putting them at risk for inadequate protection and continued abuse.

Telemedicine is increasingly accepted as a feasible solution to providing subspecialty care in rural communities.^{4–8} It addresses the problems of access to subspecialists and geographic isolation and allows specialists in pediatric sexual assault to be available anywhere. The most recently published data in 2000 identified 7 statewide telemedicine

networks.⁹ These networks have been used to assist rural practitioners by providing education, peer review, and forensic examination support. Current published research in the use of telemedicine for child abuse and neglect addresses programmatic issues,⁹⁻¹² satisfaction of telemedicine and quality of care,^{10,13,14} and telemedicine's role in rural provider education and support.^{12,14} The findings of Burton et al in Kentucky¹⁴ demonstrated a significant increase in the number of referrals and examinations for pediatric sexual assault in rural communities after the inception of their telemedicine program, suggesting that in the appropriate community, a telemedicine program can increase access to care.

Despite the publications on feasibility and programmatic issues, no current published research has examined the potential clinical benefits of using telemedicine during pediatric sexual assault examinations. Specifically, it is not known whether telemedicine can improve examination quality or an examiner's ability to accurately interpret findings during sexual assault examinations.

In 2003, the University of California Davis Child and Adolescent Abuse Resource and Evaluation (CAARE) Center partnered with the University of California (UC) Davis Center for Health and Technology in Sacramento to offer live telemedicine consult services to pediatric sexual assault providers in 2 rural California counties. Child sexual abuse experts based at the UC Davis CAARE Center provide live assistance with the history, examination, and interpretation of findings, as well as remote videoconference seminars offering education and training to rural the providers. Anticipated long-term benefits of the program include improved accuracy in interpretation of the findings, more forensically defensible examinations, increased opportunity for continuing education, and better support for rural examiners, thereby addressing disparities in child abuse health care access and quality.

The purpose of this project was to assess the ability of a child sexual assault telemedicine program to improve the completeness of the examination and accuracy of its findings when performed by rural pediatric sexual assault practitioners. This study investigated the efficacy of using the technology of telemedicine to assess and ultimately, improve the quality of care in rural hospitals whose examiners diagnose and treat victims of child abuse. We hypothesize that the telemedicine program (live consultations and ongoing videoconference education seminars) would increase the ability of the rural provider to perform a complete pediatric sexual assault examination and accurately interpret the clinical findings.

METHODS

We implemented a telemedicine program at 2 sites from which practitioners expressed interest in obtaining telemedicine consultations on child sexual abuse examinations. The first rural site was established in June 2003 at a hospital located in the city of Eureka in Humboldt County, Northern California. This facility is the county's contracted hospital for child sexual abuse examinations.

This community hospital is located 300 miles northwest of the UC Davis Children's Hospital in Sacramento. The city of Eureka is a designated health professional shortage area (HPSA).¹⁵ The population of Eureka is ~26 128, and the population of Humboldt County is 126 518 (US Census Bureau, 2000). The number of child abuse referrals for Humboldt County in 2007 was 2408 or 86.3 per 1000 children 0 to 17 years old, compared with the California average of 49.2 per 1000.³

The second rural site was established in April 2005 at a hospital in the city of Clear Lake in Lake County, Northern California. This hospital is 120 miles northwest of the UC Davis Children's Hospital. The city of Clear Lake is also a designated HPSA,¹⁵ with a population of 13 132, and the population of the surrounding Lake County is 58 309 (US Census Bureau, 2000). The number of child abuse referrals for Lake County in 2007 was 1070 or 82.2 per 1000 children 0 to 17 years old compared with the California average of 49.2 per 1000.³

Telemedicine Program

The clinicians at the rural sites included a mix of registered nurses, doctors, physician assistants, and nurse practitioners. All rural practitioners were relatively inexperienced at performing pediatric sexual assault examinations, although there was some variation. None of the rural practitioners had formal subspecialist training in child abuse and neglect. All clinicians participated in a standardized 3-day Pediatric Sexual Assault Training sponsored by the UC Davis California Medical Training Center. The telemedicine connections link the 2 rural hospitals' emergency departments (EDs), where the child sexual abuse examinations occur, to the UC Davis CAARE Center, as well as to the homes of 2 UC Davis CAARE Center examiners. Children brought to these rural EDs for suspected sexual assault can be connected, via 24-hour pager and live telemedicine, to child abuse experts at the UC Davis CAARE Center or at the examiners' homes for after-hour examinations.

The telemedicine equipment used at each site consists of a Tandberg 880 videoconferencing unit that is connected by using 3 Integrated Services Digital Network lines (384 kilobits per second transmission rate). The telecommunications connection provides live, interactive video and audio that are secure and encrypted for purposes of confidentiality. Digital images obtained during the sexual assault examination are recorded using a Sony DXC-390 3-charge-coupled device Digital Color Video Camera (Tokyo, Japan) fixed to an elbow piece on the colposcope. This camera provides for high definition, up to 10 times zoom, in addition to the colposcope zoom to best visualize injuries in and around the genitalia. With a switch box, the Tandberg videoconferencing unit can be used to communicate to the patient and providers for full view by the UC Davis CAARE Center staff. The entire encounter can be recorded with an in-line DVD recorder, including the colposcope-digital video examination and videoconference interview.

During the consultation, the child, parent or guardian, and the rural provider participate in the entire telemedicine encounter. The UC Davis CAARE Center staff

has full views of both the room and the colposcopic images. The participants at the rural sites have full view of the UC Davis CAARE Center staff as they consult with the examination. The live consults consist of the practitioners providing real-time guidance as the rural provider conducts the examination. Injuries were categorized as “acute” if they occurred in <48 hours and “nonacute” if they occurred >48 hours at the time of the examination. To assess the duration of the examinations, start times and finish times were recorded.

Measuring Quality of Care

We developed a survey instrument to capture data during live consultations. The survey instrument was developed by a panel of 2 nurse practitioners and 1 doctor before the start of the study. The remote examinations were scored by the UC Davis CAARE Center staff conducting the examination on whether the telemedicine consultation resulted in changes in the following variables: (1) initial history and data gathering, which includes (a) forensic interviewing methods, (b) medical history, (c) recent and past abuse history, and (d) the recording of abusive acts (eg, penetration, oral copulation, digital insertion); (2) use of the multimethod examination technique, which includes positioning of the patient in (a) supine separation, (b) supine traction, (c) prone knee-chest, and (d) any other manual manipulation deemed necessary to expose injuries; (3) use of adjunct techniques, which includes (a) saline/water, (b) moistened swab, (c) catheter, and (d) toluidine blue dye; and (4) forensic evidence collection (in acute assault cases only), which includes (a) use of the Woods Lamp, which shines florescent light to detect foreign secretions, (b) vulvar/vaginal secretion and culture collection, and (c) victim’s pubic or perpetrator hair collection. The UCD CAARE Center staff scored “yes” or “no” to each of these questions as to whether these recommendations resulted in changes in the rural practitioner’s examination during the telemedicine consultation. The UC Davis CAARE Center staff scored the following variables on a 7-point Likert scale (1 = not very effective to 7 = very effective): (1) remote examiner’s interaction with the patient; (2) the skills of the remote examiner; (3) remote examiner’s comfort and expertise with the colposcope; (4) the overall quality of the examination; and (5) the effectiveness of the telemedicine consult.

Patient Population

Data were collected for consecutive pediatric sexual assault patients (<18 years of age) presenting to the rural EDs when telemedicine consultations were requested. Although there were no exclusion criteria, consultations were not requested on all patients who received a pediatric sexual assault examination at the rural EDs. Telemedicine consultations were obtained at the discretion of the rural practitioner. The data collection for this study began in February 2005 and was completed in November 2007.

TABLE 1 Characteristics of 42 Children Receiving Remote Telemedicine Consultation

Characteristic	Description
Age (N = 39)	
Range	7 mo–17 y
Mean	7 y
Median	6 y
Mode	4
Exam type (N = 39), n (%)	
Acute	9 (23)
Nonacute	30 (77)
Exam duration (N = 37), min	
Mean	71.0
Median	60.0
Range	25–210
Gender (N = 42), n (%)	
Female	41 (98)

Statistics and Protection of Human Subjects

Descriptive statistics were used to report the demographic and survey data. Median and mean scores from a 7-point Likert scale were reported to evaluate the performance of the rural practitioners and the effectiveness of the telemedicine consult.

This project was originally designed as a quality assurance telemedicine program that provided live consultations to rural practitioners examining child victims of sexual abuse. UCD Institutional Review Board approval was obtained to analyze the retrospective data that were collected under standard operating procedure. All consultations were conducted live and recorded on DVD for the quality assurance feedback process. The ability of the child abuse experts to not only view the examination process but to listen to the consult was critical in providing instantaneous guidance.

Use and storage of images is the standard of care in the field of child abuse and neglect. Telemedicine introduces just 2 changes. The images are moving images rather than still images, and there is a potential introduction of sound on the recordings. To protect the children’s identity in this project, no sound was recorded on the DVDs. No names, birth dates, medical chart numbers, or other identifiers were provided during the consults or recorded on the DVDs. The DVDs were stored in the same secure manner as the centers’ still photographs. We labeled the DVDs with the time, date, and place of examination. In cases where multiple siblings were seen in succession on the same day, the DVD was also labeled with the patient’s initials to avoid confusion.

RESULTS

As shown in Table 1, we collected data on 1 male and 41 female patients over the 33-month study period at the 2 rural sites: 23 (55%) cases from Eureka in Humboldt County, and 19 (45%) cases from Clear Lake in Lake County. The age of the 39 children on whom we were able to obtain an age was 7 months to 17 years, with a mean of 7, a median of 6, and a mode of 4 years. In 3 cases, the child abuse experts and remote examiners were unable to determine whether the injuries were acute or nonacute. Of

TABLE 2 Changes in Examination as a Result of Telemedicine

Consultation	
Type of Change	Change, n (%)
Collection of forensic evidence (N = 9)	8 (89)
Gathering historical information (N = 42)	15 (36)
Interview methods	7 (47)
Medical history interview	10 (67)
Abuse history interview	8 (53)
Use of the multimethod technique (N = 35)	30 (86)
Separation	6 (20)
Traction	16 (53)
Knee-chest	16 (53)
"Other" techniques	3 (10)
Use of adjunct techniques (N = 38)	15 (40)
Saline	9 (60)
Moistened swabs	3 (20)
Catheter	3 (20)
Toluidine blue dye	1 (7)

the 39 children we were able to gather this information on, 30 (77%) were nonacute and 9 (23%) were acute. We were able to obtain data on examination duration in 37 (88%) of 42 cases. Duration of the examinations ranged from 25 to 210 minutes in length, with a median time of 60 minutes and a mean time of 71 minutes.

Telemedicine consultation resulted in changes to the pediatric sexual assault examinations, as shown in Table 2. In 15 (36%) of 42 cases, the telemedicine consult resulted in changes to initial history and data gathering. Of these 15 consults, 47% resulted in a change in interview methods; 67% resulted in a change in data collection for the medical history; and 53% resulted in a change in data collection regarding the child's past history of abuse. Only 1 consult led to a change in the recording of abusive acts.

In the 35 consults that employed the use of the multimethod technique, 30 (86%) resulted in changes or additions to the techniques used by the rural providers during the telemedicine consultation. Of the 30 consults where rural practitioners changed their approach to include techniques suggested by the child abuse experts at UC Davis, 20% added or changed the supine separation technique, 53% added or changed the supine traction technique, 53% added or changed the prone, knee-chest technique, and 10% added or changed other techniques such as further manual manipulation of the tissues during the examination.

In the 38 consults where the UC Davis staff provided consultation on the use of adjunct techniques, 15 (40%) consults resulted in the rural practitioners changing their examination methods to include the use of these adjunct techniques. Of these 15 consults, 60% added the use of saline to unfold hymenal tissues, 20% added the use of a moistened swab (Q-tip) to better visualize hymenal tissue, 20% added the use of a catheter to help visualize tissues, and 7% added the use of toluidine blue dye, which assists in the detection of injury.

There were 9 acute telemedicine sexual assault examinations performed in this study period. Of those, 8 (89%) resulted in changes to the methods of forensic

evidence collection. Of these 8 cases, 4 (50%) resulted in the use of the Woods Lamp, which through its florescent lighting, illuminates secretions for DNA testing, such as semen that may be on the child's body. In 6 (75%) cases, the rural practitioners were instructed to obtain secretions within and around the child's genitalia also for DNA testing. In addition, in 2 (25%) cases, UC Davis staff instructed the practitioners in the proper procedure for obtaining a reference hair sample to allow for DNA testing to distinguish between victim and perpetrator.

Of the 40 consults where we were able to assess the rural practitioner's skills in interacting with the patients, the majority of the examiners, 27 (68%), received a score of ≥ 6 (on the 7-point Likert scale described in the Methods section); 9 (23%) had a score of 5; and 4 (10%) scored at 3 or below. Of the 35 consults where we were able to assess for skill level of their examinations and techniques, 8 (23%) of the examiners were ranked at 6; 19 (54%) received a score of 5; and 8 (23%) had a ranking of ≤ 4 . The UC Davis staff was able to assess the rural practitioner's colposcopic technique in 34 consults, ranking 4 (12%) of the consults at 6; the majority, 20 (59%), at 5; and 10 (29%) at ≤ 4 . We assessed the overall quality of the examination in 34 consults and found that 8 (24%) were ranked at 6; the majority, 17 (50%), was ranked at 5; and 9 (27%) had a ranking of ≤ 4 . Finally, we scored the overall effectiveness or impact of telemedicine on the examination of 38 patients and found that 31 (82%) scored ≥ 5 , with the majority (71%) of 31 consults ranked at 7; and 7 (18%) cases scored ≤ 4 .

DISCUSSION

In this study of 42 telemedicine-assisted pediatric sexual assault examinations performed by rural providers, telemedicine had a positive impact on the completeness of the examination and the accuracy of its findings. The telemedicine consult directly resulted in changes in initial history and data gathering in 36% of cases, an increased use of the multimethod examination technique in 86% of cases, and increased use of appropriate adjunct techniques in 40% of cases. Appropriate use of these examination techniques has been shown in published literature to improve accurate identification of injuries in pediatric sexual assault.¹⁶ We found that in 8 of the 9 acute sexual abuse examinations, telemedicine consultation resulted in changes to evidence collection. Consulting clinicians generally rated rural practitioner examination skills and consult effectiveness high on the Likert scale. Poor image quality and difficulty in communicating with rural examiners in 2 cases resulted in the lowest overall effectiveness scores on the scale. There was unanimous agreement among the consulting providers that access to live telemedicine consults was important in all of the cases.

Given the lack of previous clinical research in this area of telemedicine, it is difficult to comment on the consistency of our findings. However, telemedicine is increasingly accepted as a feasible solution to providing pediatric subspecialty care in rural communities. It addresses the problems of access to subspecialists and geo-

graphic isolation, allowing pediatric subspecialists, such as our abuse experts to be available anywhere. As of the year 2000, telemedicine child abuse networks existed in 7 states.⁹ Telemedicine child abuse networks have been used to assist rural practitioners in provider education, peer review, and forensic examinations.⁹

Current published research in the use of telemedicine for child abuse and neglect cases focuses on several programmatic issues. Published criteria for a successful program include the necessity of good technical support, the commitment and training of the local provider, and the existence of a fundamental need for better quality or better access to care in the community.^{9,11,17} Needs assessments, challenges, and goals for the telemedicine child abuse programs have also been examined,⁹⁻¹² demonstrating that many of the common barriers to success can be as concrete as physical space limitations, equipment difficulties, insufficient number of cases, and lack of standardized equipment.

We encountered many of these issues in our study. Issues such as limited physical space and standardized equipment required diligent collaboration between the academic and rural sites. Our technical support team and medical staff invested a significant amount of effort and travel to address these problems, which can be both time-consuming and expensive. In our study period, there would often be up to a 6-week lapse between consults at our rural sites. Rural areas by definition have a sparse population, making it more difficult for rural examiners to maintain their skills.¹¹ The presence of telemedicine may decrease the impact of this problem in 2 ways. First, it is our hope that the presence of telemedicine will decrease the high staff turnover in this emotionally intense field, thereby leading to more experienced examiners over time. Second, as was apparent in Burton et al.'s 2002 Kentucky study,¹⁴ we expect to see a rapid increase in the number of child sexual abuse referrals and examinations in these rural counties with access to telemedicine.

In a 2000 survey of the then 7 existing statewide telemedicine programs, Nancy Kellogg and colleagues⁹ delineated a set of goals for the use of telemedicine in pediatric sexual assault. One of the most critical goals was the use of telemedicine as a method of peer review, with the aim of building diagnostic consensus in child sexual abuse cases. Other researchers have also emphasized the importance of telemedicine in provider education and peer support.^{12,14} Within the first year of our program's implementation, the rural pediatric sexual assault sites have joined our bimonthly case review conference via telemedicine. This allows the rural practitioners access to cases discussed not only among UC Davis examiners, but those from multiple institutions in Northern California. All practitioners are encouraged to submit interesting and difficult cases for discussion. The enthusiastic response to this child abuse case conference has led us to open the program up to all 16 of the UC Davis pediatric telemedicine sites in rural Northern California and Nevada. These additional sites are not involved in our pediatric sexual assault study, but are now benefiting from telemedicine access to multiple child

abuse experts in Northern California in the form of a case conference.

Another unanticipated benefit of the project involves the use of the telemedicine DVD as legal evidence. The DVD that is created at the rural site during the telemedicine consult provides an extremely clear and accurate representation of the examination findings. The DVD lends powerful, concrete support to the rural examiner's testimony. In fact, use of the DVD as courtroom evidence has led to plea bargain in several of our rural cases.* The changes to evidence collection that occurred in all 4 of the acute examinations cannot be over emphasized. Without forensically defensible evidence collection, perpetrators of these acts cannot be brought to justice.

Primary limitations in this pilot study design include the lack of a control group, a limited number of consults, and the fact that the investigators were the experts responsible for assessing the quality of the examinations. Because the examinations are recorded without audio, only the experts conducting the examination were able to complete the survey instrument. This can obviously introduce bias; however, the examiners were actively trying not to inflate the frequency of changes; on the contrary, it was their opinion that they underscored the frequency of changes. The follow-up study to this project would provide a control group consisting of examinations performed by rural providers without the assistance of telemedicine, but with access to consults by mailing the charts and photographs to a consultant at the referral center. The inclusion of independent evaluators in such a study could address the subjective nature of the expert evaluations in this phase and provide a more accurate assessment of quality. Given that rural sites, by definition, have a lower population and fewer cases, the only way to greatly improve sample size will be to expand to more rural sites.

Rural provider satisfaction and assessment of the telemedicine program plays an essential role in the program's long-term success. Unfortunately, our field has not developed a consistent approach to address satisfaction. Provider and patient satisfaction have been explored from various angles by other child abuse researchers. Dissatisfaction for both client and provider most often stems from discomfort with complicated or faulty technology.^{10,13,14,18}

In terms of economic impact of the program, the 2 most costly aspects of a child abuse telemedicine program are the consultant's time and the acquisition and maintenance of the necessary technology. The question of cost-effectiveness remains difficult to answer in the field of telemedicine¹⁹ and has not been proven in telemedicine child abuse programs. In our case, the technology costs have been funded by a generous grant; however, consultant time is not currently reimbursed. As a major academic center, we currently consider the pediatric sexual assault telemedicine consults to be a part of our community service, but this will not be sustainable if

*There is no sound on the DVDs, just a picture. This helps maintain confidentiality and minimizes the possibility of conflicting statements in the practitioner's expert testimony.

the project continues to expand. At the time of Nancy Kellogg's 2000 survey of the existing state telemedicine networks, all of the networks were funded by grants. None of the programs used a fee for service reimbursement model. Ideally, the use of telemedicine over time would put the consultants out of business through rural provider education. Unfortunately, no evidence suggests that this will happen. We hope that telemedicine will lead to a significant increase in the quality of the law enforcement and legal cases for pediatric sexual assault victims. When this increased quality of care occurs, the rural counties may consider sponsoring a contract with our institution to reimburse the consultants for their time.

CONCLUSIONS

We found that child abuse clinicians in a tertiary care center can use telemedicine to effectively make positive changes in pediatric sexual assault examinations performed by rural providers. This has significant implications for improving the quality of care received by our youngest victims in rural, underserved areas. Future research will include experimental designs to confirm the effectiveness of telemedicine in pediatric sexual assault compared with traditional methods of consultation, such as telephone and mail. Additional important areas for additional investigation include a focus on patient and rural provider satisfaction in using telemedicine to assist in these examinations, financial sustainability of such programs, and benefits of reducing transport to tertiary care centers. The future success of such programs will be defined by our ability to improve the quality of the pediatric sexual assault examinations, ensure provider satisfaction, and create a technically and economically feasible program.

This project is the first, to our knowledge, to examine the impact of real-time telemedicine on the quality of examinations provided to rural pediatric sexual assault victims. It is our hope and belief that this pilot phase and subsequent controlled studies can assist other programs in determining the feasibility and utility of live telemedicine in pediatric sexual assault.

ACKNOWLEDGMENT

This work was supported by the Hearst Foundation.

REFERENCES

1. Gaudiosi JA. Child maltreatment. Available at: www.acf.hhs.gov/programs/cb/pubs/cm04. Accessed November 2, 2008
2. Menard KS, Ruback RB. Prevalence and processing of child

- sexual abuse: a multi-data-set analysis of urban and rural counties. *Law Hum Behav*. 2003;27(4):385-402
3. Needell B, Webster D, Armijo M, et al. Child Welfare Services Reports for California 2005. Available at: <http://cssr.berkeley.edu/CWSCMSreports>. Accessed November 2, 2008
4. Kon AA, Marcin JP. Using telemedicine to improve communication during pediatric resuscitations. *J Telemed Telecare*. 2005;11(5):261-264
5. Nesbitt TS, Marcin JP, Daschbach MM, Cole SL. Perceptions of local health care quality in 7 rural communities with telemedicine. *J Rural Health*. 2005;21(1):79-85
6. Marcin JP, Nesbitt TS, Kallas HJ, Struve SN, Traugott CA, Dimand RJ. Use of telemedicine to provide pediatric critical care inpatient consultations to underserved rural Northern California. *J Pediatr*. 2004;144(3):375-380
7. Robinson SS, Seale DE, Tiernan KM, Berg B. Use of telemedicine to follow special needs children. *Telemed J E Health*. 2003;9(1):57-61
8. Callahan CW, Malone F, Estroff D, Person DA. Effectiveness of an Internet-based store-and-forward telemedicine system for pediatric subspecialty consultation. *Arch Pediatr Adolesc Med*. 2005;159(4):389-393
9. Kellogg ND, Lamb JL, Lukefahr JL. The use of telemedicine in child sexual abuse evaluations. *Child Abuse Negl*. 2000;24(12):1601-1612
10. Inouye J, Cerny JE, Hollandsworth J, Ettipio A. Child abuse prevention program with POTS-based telehealth: a feasibility project. *Telemed J E Health*. 2001;7(4):325-332
11. Whitworth JM, Mullins HC, Morse K. Design and implementation of an urban/rural Telehealth Network for the Evaluation of Abused Children: implications for global primary care applications. *Stud Health Technol Inform*. 2001;84(pt 1):863-865
12. Block RW. Telemedicine and distance learning in the child abuse interview field. *APSAC Advisor*. 2001;13(2):8-9
13. Whitten P, Love B. Patient and provider satisfaction with the use of telemedicine: overview and rationale for cautious enthusiasm. *J Postgrad Med*. 2005;51(4):294-300
14. Burton DC, Stanley D, Ireson CL. Child advocacy outreach: using telehealth to expand child sexual abuse services in rural Kentucky. *J Telemed Telecare*. 2002;8(suppl 2):10-12
15. Health Resources and Services Administration Bureau of Health Professions Shortage Designation. Shortage Designation: HPSAs, MUAs & MUPs. Available at: <http://bhpr.hrsa.gov/shortage>. Accessed November 2, 2008
16. Boyle C, Miyamoto S, McCann J, Rogers K. Comparison of examination methods of the sexually abused female: a descriptive study. *Child Abuse Negl*. 2008;32(2):229-243
17. Muram D. The medical evaluation of sexually abused children. *J Pediatr Adolesc Gynecol*. 2003;16(1):5-14
18. Pammer W, Haney M, Lmhc N, et al. Use of telehealth technology to extend child protection team services. *Pediatrics*. 2001;108(3):584-590
19. Whitten PS, Mair FS, Haycox A, May CR, Williams TL, Hellmich S. Systematic review of cost effectiveness studies of telemedicine interventions. *BMJ*. 2002;324(7351):1434-1437

Using Telemedicine to Improve the Care Delivered to Sexually Abused Children in Rural, Underserved Hospitals

Kristen J. MacLeod, James P. Marcin, Cathy Boyle, Sheridan Miyamoto, Robert J. Dimand and Kristen K. Rogers

Pediatrics 2009;123:223

DOI: 10.1542/peds.2007-1921

Updated Information & Services	including high resolution figures, can be found at: http://pediatrics.aappublications.org/content/123/1/223.full.html
References	This article cites 16 articles, 3 of which can be accessed free at: http://pediatrics.aappublications.org/content/123/1/223.full.html#ref-list-1
Subspecialty Collections	This article, along with others on similar topics, appears in the following collection(s): Office Practice http://pediatrics.aappublications.org/cgi/collection/office_practice
Permissions & Licensing	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: http://pediatrics.aappublications.org/site/misc/Permissions.xhtml
Reprints	Information about ordering reprints can be found online: http://pediatrics.aappublications.org/site/misc/reprints.xhtml

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2009 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

