In 1994, Ohio University College of Osteopathic Medicine (OU-COM) and osteopathic medical educators forged a new partnership that changed the fundamental delivery of osteopathic undergraduate and graduate education across Ohio. This partnership resulted in the establishment of the Centers for Osteopathic Regional Education (CORE) system, which began operation in July 1995. The CORE design originally supported five regions throughout Ohio, drawing on the strengths of medical educators from OU-COM, 13 osteopathic training hospitals in Ohio, and three affiliated osteopathic medical schools. As one of the foundations to this new system, the Ohio osteopathic medical education community wanted to develop a system of education that would establish a continuum of education that integrated advanced communications technologies to provide continuity of programs in all hospitals. The concept of establishing a “virtual community” became paramount in reducing the barriers of time and geographic location previously experienced in the delivery of medical education. This effort involved multiple training sites and hundreds of faculty, support staff, and students in the CORE system. On January 1, 1996, the Ohio Osteopathic Network of Excellence (OhiONE) began operations at all 13 CORE hospitals, with the Ohio University College of Osteopathic Medicine as the primary hub site.

The OhiONE distance-learning network has two distinct yet complementary components: (1) the OhiONE videoconferencing network provides real-time synchronous programming, and (2) an asynchronous Internet-based delivery system called COREnet. The specific challenges of creating a telehealth system were development and implementation of a statewide technology-enhanced education network, use of distance learning and video conferencing, and issues in developing and maintaining a quality distance learning system.

**CORE Consortium**

Renamed the Centers for Osteopathic Research and Education (CORE) to highlight an institutional commitment to research, the consortium has become a national model for the delivery of medical education. Developed specifically to integrate osteopathic clerkship, internship, residency, and lifelong learning, this innovative consortium created a natural continuum of medical education. Currently, the CORE consists of 12 osteopathic training hospitals in Ohio; OU-COM; Ohio Northern College of Pharmacy; University of Findlay; the Veterans Administration Medical Center in Chillicothe, Ohio; Kirksville College of Osteopathic Medicine in Kirksville, Missouri; Des Moines University College of Osteopathic Medicine and Surgery at Des Moines, Iowa; and the University of Health Sciences College of Osteopathic Medicine at Kansas City, Missouri.

The CORE, recently streamlined to four regions statewide, employs full-time staff, including assistant deans, whose primary focus is medical education, as well as faculty coordinators and an administrative infrastructure that sets the CORE apart from other consortia. With residencies in multiple specialties, including extensive offerings in primary care, CORE gives trainees the widest offering of residency programs in the osteopathic profession. The CORE provides a vertically integrated system that blends together the basic sciences, clinical training, medical ethics, and osteopathic principles and practices, from predoctoral to postdoctoral training to lifelong learning. The CORE system is also horizontally integrated across residency programs within the same discipline. Each of seven residency program advisory committees uses live and distance learning techniques to deliver educational programs based on defined educational objectives. Currently, over 700 medical students, interns, and residents train in the CORE system.

State-of-the-art technology plays an integral role in the CORE’s infrastructure. In particular, two distance learning components, OhiONE and COREnet, place the latest high-tech learning equipment at the fingertips of students, interns, residents, faculty, and staff. The mission of the distance learning systems is to minimize the constraints of time and distance to enhance communication among students, interns, residents, faculty and staff to improve continuity and efficiency in educational programs. The CORE system accomplishes this by providing access for students, interns, and residents to electronic medical databases, multimedia learning resources, and broad access to the Internet and the World Wide Web. COREnet, a multimedia computer network, was created for students, interns, residents, faculty, and alumni. The system can be accessed from any of the...
CORE sites via a network system that provides access to electronic mail; multimedia learning modules, including tutorials and case simulations with digital images and heart and lung sounds; electronic clinical manuals; and medical databases housed in the OU-COM Learning Resource Center. All computers on the network also have access to OhiOLink, which provides the ability to search and borrow from more than five million titles in the statewide library system, as well as provides access to major national and international databases. COREnet also provides full access to the Internet, the worldwide computer network that includes thousands of medical education and clinical resources from major universities and hospitals, with OU-COM services provided by a World Wide Web server.

OhiONE comprises an interactive compressed videoconferencing and data network that uses dedicated T1 connections accessed through the State of Ohio Multi-Agency Communication System (SOMACS). COREnet, the multimedia computer network, shares the T1 service with videoconferencing, using half of the T1 communication line for computer-based on-line services. The other half of the T1 is devoted to videoconferencing. OhiONE uses the SOMACS T1 broadband service to directly connect to a Telesis 200EX Access Switch, which provides point-to-point dial-up video services and video bridging. Advanced multipoint services are provided via an Accord MGC-100 (MGC, Multipoint, Gateway, and Control), one of the most advanced Multi-Agency Communication Systems available today. The MGC-100's architecture connects to any collaborative networks deployed today and is designed to incorporate future standards and networks. This architecture offers a wide range of capacities in video teleconferencing, be it a dedicated suite, classroom, or desktop implementation. More than just a multipoint controller, it acts as a transcoder, permitting H.320 and H.323 calls to be combined in any combination of protocols or line speeds from 56kbps to T1 bandwidth. Cisco routers are deployed for data traffic and quality of service management.

OhiONE also provides dial-out video connection to the public switched network. Polycom videoconferencing systems and a Microsoft Windows-compatible computer equip the end user sites. A site license arrangement between Microsoft and Ohio University, with availability to CORE members and students, provides messaging and productivity tools as well as access to Microsoft Word for word processing, Excel for spreadsheets, and PowerPoint for presentations. In addition, Microsoft Office Outlook client is used for messaging and scheduling. The Exchange mail server allows users to have controlled public folders within electronic mail and to share schedule and meeting information. Web site development using FrontPage by faculty and staff is also encouraged. Software design, coding, and implementation are executed in a Microsoft Visual Studio/Windows NT environment. Specifically, Microsoft Windows NT servers provide network services in the form of authentication and shares. Data storage is in Visual Fox Pro (VFP) database containers or "dbf" tables. Applications are being revised to implement a three-tier architecture in which the system would move to a Microsoft SQL data store, VFP business objects, and the appropriate user interface of either a robust client or a Web client.

Developing Resources
Funding the statewide network has truly been a shared partnership. The executive director submits a budget annually to the CORE finance committee. The budget includes all costs associated with operating OhiONE and COREnet, including service contracts, replacement equipment, T1 cost, and other operating expenses like office supplies, travel, and continuing education for staff. The total cost, approximately $350,000 annually, is divided equally by each consortium member. The total cost to each member, about $25,000 annually, includes technical support; unlimited videoconferencing access to any member in the network including multipoint participation; and high-speed Internet access.

Staffing of the system consists of an executive director, a distance learning coordinator, a senior network engineer, and a systems support technician. The college is also responsible for support services provided by the manager of network and data services. This position maintains responsibility for application development and supervises the senior network engineer, who manages the servers.

OhiONE Utilization
OhiONE has shown extensive growth in usage over its 5-year history. In the 2000-2001 calendar year, the system programming consisted of 708 hours of programming—a 29% increase over the 1999-2000 total (502 hours). The 2000-2001 OhiONE videoconferencing system usage consisted of various educational programming (41%), administrative applications (29%), and telemedicine (30%).

Educational programming using the OhiONE network is extensive and provided to interns, residents, faculty, and practicing physicians at the 12 participating CORE hospitals and educational partners. Programming topics include educational days for all specialties, grand rounds, specialty programs in research, ethics, managed care, educational methods, and basic science, as well as special guest lectures by notable experts on various issues. Administrative uses include monthly meetings for directors of medical education, physician advisory council meetings, human resource and public relations meetings, and various CORE planning committees. Management and administrative meetings have been particularly cost-effective with the CORE system, as the need for travel between sites has been either eliminated or significantly reduced.

Community Linkages
A primary community linkage has been established with the Southern Consortium for Children, a collaborative of four Alcohol, Drug Addiction and Mental Health Services (ADAMHS) boards that has been instrumental in bringing psychiatric services for children to ten Appalachian counties in southern Ohio. Approximately 7 years ago, brokering services equivalent to one full-time child...
psychiatrist into the local mental health provider agencies became the first step in meeting the need for children’s outpatient psychiatric services. Child psychiatry services were unavailable through the local agencies before that time. The Advanced Practice Nurse/Telemedicine Program was designed to further increase access to those services. The Health Resources and Services Administration (HRSA), Office of Rural Health Policy, Rural Outreach Program provided initial grant funding for the program, which covered seven of the ten counties served by the consortium. The Substance Abuse and Mental Health Services Administration (SAMHSA) provided additional funding in the second year to include the remaining three counties in the program. The program partners include the Southern Consortium for Children, Ohio University College of Osteopathic Medicine, local mental health agencies, and clinical mental health staff, including two psychiatrists and two advanced practice nurse practitioners. The current system consists of seven networked sites for videoconferencing.

The services provided through the program fall into two main categories: direct service and education/consultation. The direct services provided by the psychiatrist/nurse collaborative practices include psychiatric assessment of children and adolescents, prescription of medication, monitoring medication, and client and family education. Clients receiving direct services are children and adolescents between 4 and 18 years old, with most (65% to 75%) meeting Medicaid eligibility.

The Behavioral Pediatric Case Seminar Series makes up most of the education/consultation piece. Initiated in September 1998, each program in the series is a monthly hour-long presentation. Each program consists of a case study presented to a panel composed of a child psychiatrist, a clinical nurse specialist, and a psychologist. A panel review of the case is conducted, followed by questions from the audience. Each program is presented via video teleconference with seven sites currently participating across the ten-county region. The series began as a way to enhance communication between the child psychiatrists and pediatricians to facilitate referrals and to increase the appropriateness of referrals from pediatricians to the mental health system. Now physicians, nurses, psychologists, social workers, medical students, and school counselors (among others) attend the series. The disciplines presenting cases have been equally diverse, with consumers participating as well.

Videoconferencing has proven to be a powerful tool for education and consultation in this program. It has also been used extensively for administrative functions. However, the original intent of the program was and is to use videoconferencing technology to provide direct services to children. Ohio’s slow development of policies regarding reimbursement for clinical services delivered via videoconference remains one of two problems that have effectively prevented the use of the technology for direct service. The other factor has been the lack of funds to connect satellite clinics to parent clinics. The partners in this project are currently working to find additional funding to further enhance the system to provide additional telemedicine opportunities.

The Southeast Ohio Health Education Network (SOHEN), created in 1998, also acts as a community linkage. Funded by a grant from the United States Department of Agriculture, the SOHEN system links the CORE and OU-COM system to four regional county libraries in southern Ohio. Partners were chosen primarily to provide health education opportunities to geographically isolated areas. Public libraries made logical partners due to their accessibility and the comfort level associated to them by local community members. In addition, through the state library system, all local libraries in Ohio receive a T1 line connected to SOMACS for use as a computer information conduit, negating a long-term financial obligation to the partners.

The SOHEN system has been used to provide various health education programming to health professionals through the OU-COM Area Health Education Consortium (AHEC) office. In addition, it has been found that the partner libraries have used the system for other community applications, such as linking with various after-school and summer learning opportunities for children.

Summary

Developing the technical infrastructure for the OHONE network and COREnet provided only nominal challenges to building a statewide network. The single most important component to the success of this network was a small group of advocates at each hospital to champion the potential benefits of technology for delivering osteopathic medical education. These advocates included both faculty and key administrators in each institution that were responsible for building a comprehensive business plan for the hospital upper administration, including identification of the financial efficiencies of deploying distance learning technology. Identifying a stable financial coalition has been extremely important to reduce the reliance on soft monies from grants and special appropriations. Because distance learning presents a new paradigm for educational program delivery, faculty development and training are essential for acquiring new skills and proficiencies with the technology. Staff and students also benefit from comprehensive training programs and system utilization in support of garnering a more “student-centered” learning experience.

Once the base funding and primary goals and objectives of the program are addressed, then building strong community partners becomes key to developing a comprehensive telehealth network. In addition to providing supplemental funding opportunities, the expanded network of physicians, nurses, and other allied healthcare providers develops a virtual community based on common goals and mission. These virtual communities become possible only when relationships are forged by common purpose, traditional interpersonal relationships are built, and institutional cooperation exists. Technology can provide an extremely powerful tool if appropriate resources are available to support the faculty and students through established educational goals and objectives.