



Telehealth

Can new Internet and computer technologies enhance access to healthcare?

Between appointments, a physician sits down at his computer, opens up a window on the Web, and discovers that one of his patients is concerned about weakness in her shoulder a few weeks after a shoulder replacement.

The surgeon quickly responds to the question by typing, "This is normal during the early stages of your recovery" into the patient's confidential E-Medicine Website. The patient checks her site a few minutes later and reads the doctor's reassurance.

This scenario might sound futuristic, but it is fast becoming reality in the Pacific Northwest. It is called telehealth: the process of facilitating healthcare using telecommunications and Internet technology.

One new telehealth program, called E-Medicine, is currently under development at the University of Washington. Another program, Telepartners, is already available to every school in Washington State, from kindergarten to college.

Telehealth used to be known as telemedicine, but the name has evolved to include consultations with specialists in many fields, including psychologists and speech therapists, among others.

Faculty at the University of Washington, including Yongmin Kim, professor and chair of the bioengineering department, have been researching and

developing information networking systems and have developed the new E-medicine initiative. It is part of a larger program called Distributed Diagnosis and Home Healthcare (D2H2). The purpose of the E-medicine program is to provide patients and physicians with a means



Yongmin Kim, professor and chair of the University of Washington bioengineering department.

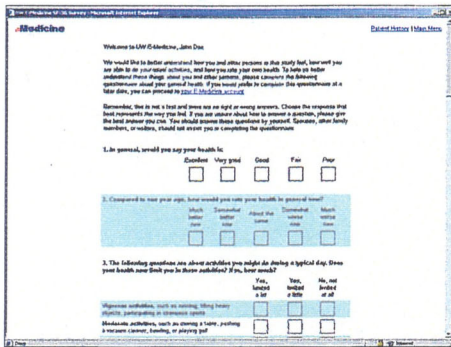
to communicate more efficiently by using the Web instead of some in-person meetings.

The E-Medicine program involves a secure Web site in which patients' medical records are maintained. Since medical records are on the Web, they are accessible by both patients and physicians. This strategy allows a patient to ask the physician questions or voice concerns without making a trip into the clinic. The physician can then respond at the next convenient time

*Thermopolis, Wyoming,
one of the sites participating
in the rural telemedicine
network project.*

Photo: Doug Plummer

by Jennifer O'Neil



Frederick A. Matsen, chair of orthopaedics and sports medicine at the UW, feels a sense of comfort knowing that his patients can reach him 24 hours a day by leaving a message for him on the E-Medicine site. "I can just pour a cup of coffee, read through these messages and give a short or long answer depending on the circumstances," he notes.

Matsen also believes the office becomes much more efficient because he is only seeing in person the patients that need to be seen in person. "I feel bad when patients have to come to my office and then wait because some unexpected problem came up," he says. It is a waste of the patients' time to make a trip to the office for a five-minute consultation when many of the questions can be easily answered by communicating through the site.

Since the patient can control who will have access to the site, the patient can give any physician access to his or her medical records. This capability could be quite helpful if the patient gets sick on vacation and needs to see a local physician. It also simplifies the process of consultations by physicians to other physicians or specialists.

Another possibility in the future is the placement of prescriptions on the site, so the patient could have the prescription filled by any pharmacist just by allowing limited access to the site.

The E-Medicine Web site contains browser extensions, which allow the patient to upload multimedia information, such as a video of a patient's range of motion. In addition, a dermatologist could examine images and videos of an infected area without requiring the patient to make the often-inconvenient trip into the clinic.

E-Medicine is still in its infancy and is currently undergoing testing in such cases as the post-operative care of shoulder surgery patients. After surgery, the physician

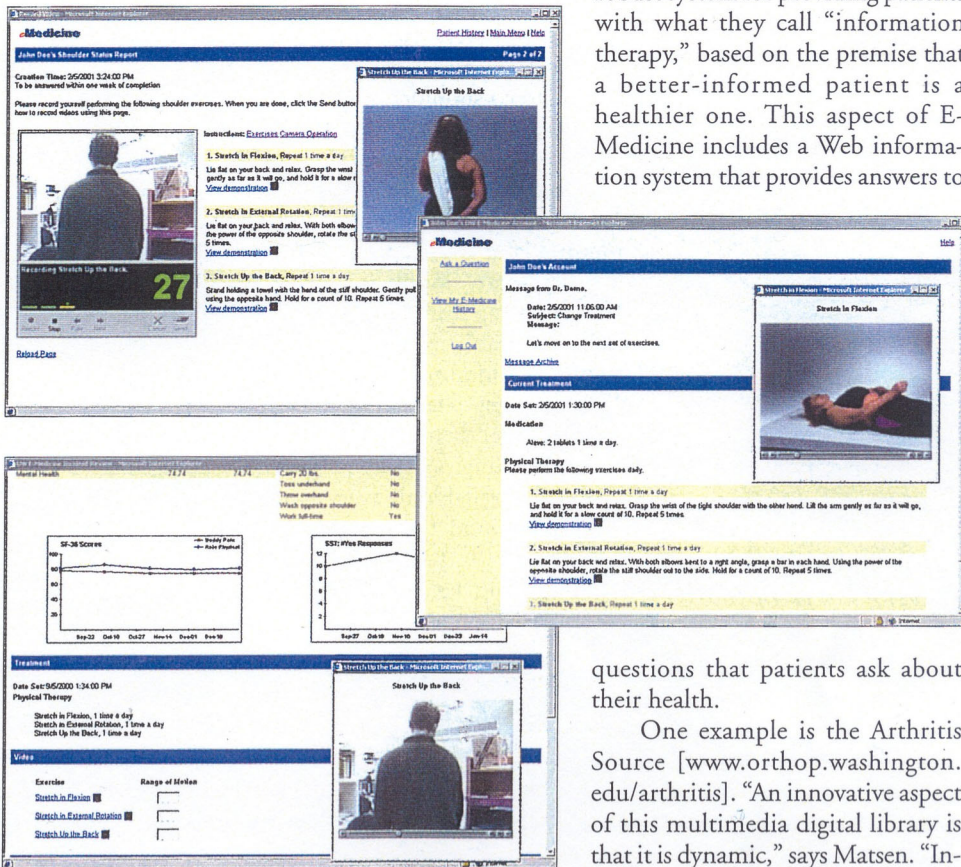
often gives specific exercises and instructions for the post-operative phase. By using the E-Medicine Web site, the patient can refer to the site to view videos demonstrating these exercises as often as needed. The patient can also use a simple mini-digital camera and simple software to capture a video of the range of motion of the shoulder and send it to the site, so the physician can view the progress directly.

An example of such a case is a young man, we'll call Joe, who was getting serious about weight lifting. The activity caused a stress fracture in his arm. A physician in his hometown treated him by inserting a rod in the arm bone to stabilize the fracture; however, the operation caused an infection. He

home, Joe sent video images of his arm each day to Matsen. Joe was able to ask the doctor questions without talking to him directly via long distance phone calls. After several months, Joe's arm was better and he was back in the gym.

Another UW initiative contributing to the realization of telehealth is the Program for Educational Transformation Through Technology (PETTT), funded by the University Initiatives Fund. "The goal of PETTT is generally to make it easier for teachers to teach, for learners to learn and to disseminate the educational efforts of the University far beyond its campus," says Matsen.

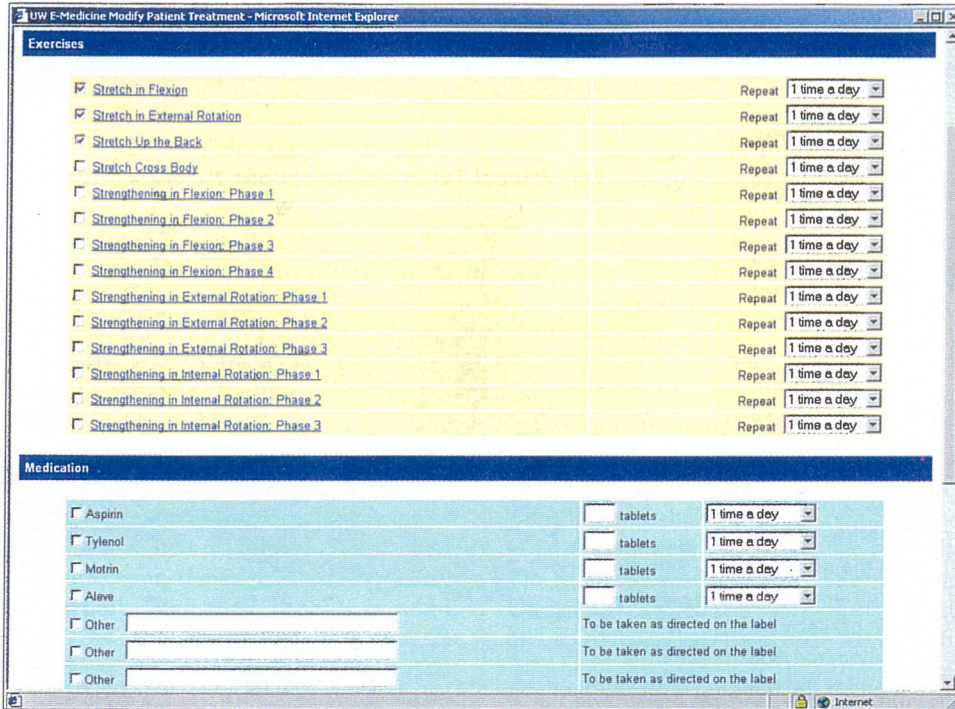
PETTT researchers have developed a robust system for providing patients with what they call "information therapy," based on the premise that a better-informed patient is a healthier one. This aspect of E-Medicine includes a Web information system that provides answers to



came to the UW, where Matsen treated him for the infection and the fracture. But Matsen knew he would need to see Joe nearly every day to properly care for him. Since Joe's hometown was far away from the UW, it would be too costly for Joe to stay in a hotel near the hospital. So Dr. Matsen set him up on the E-Medicine program and loaned him a laptop with a camera on the top of it. Once

questions that patients ask about their health.

One example is the Arthritis Source [www.orthop.washington.edu/arthritis]. "An innovative aspect of this multimedia digital library is that it is dynamic," says Matsen. "Individuals have the opportunity to pose questions of the system. If the answer cannot be found, the faculty of the UW receive the question, establish the best answer, and add this information to the Arthritis Source so that the next time the question is asked, the answer will be right there, anytime, for individuals anywhere. The Arthritis Foundation Hotline is now using the Arthritis Source so that they can better in-



form their callers. Now over 3,000 individuals are using the Arthritis Source each day.”

Matsen points out that UW faculty in medical education, diabetes self-management, medical centers information systems, and the UW Physicians Network have come together to establish an “E-Group” to pursue opportunities as well as grant and commercial funding for their shared interest in using technology to improve the health of the public through enhanced access to expert information.

“While the opportunities are growing, the cost of providing this type of access is diminishing due to the most rapid progress in connectivity for everyone through the Internet,” says Matsen. Furthermore, the technology needed for E-Medicine may be the same as that used for popular consumer electronic devices such as high-definition TV. Even with the current excitement surrounding E-Medicine, it likely will be some time before this approach becomes routine. Several questions remain to be addressed—including the issues involved with physicians practicing outside their own state, clarifying malpractice boundaries, and ensuring patients’ privacy.

“As with the revolution in understanding the human chromosome, this application of technology to health care brings up some important questions,” Matsen notes.

“For example, does communication with patients in a state other than Washington constitute practice in that state so that licensure would be required? Where should the record of these interactions be hosted and how is access to this information controlled? How would the E-medicine system relate to other medical records regarding the patient?” he asks.

In spite of these challenges, plans are in the works for the addition of browser extensions to E-Medicine systems that will allow external sensors to upload data such as blood glucose level and digital stethoscope audio data. Another possibility is the addition of home ultrasound devices, which would enable patients to send medical images to the physician through the E-Medicine site—possibly even allowing an obstetrician, for example, to monitor fetal health remotely.

Another example of telehealth is the University of Washington’s Telepartners program, a videoconferencing out-

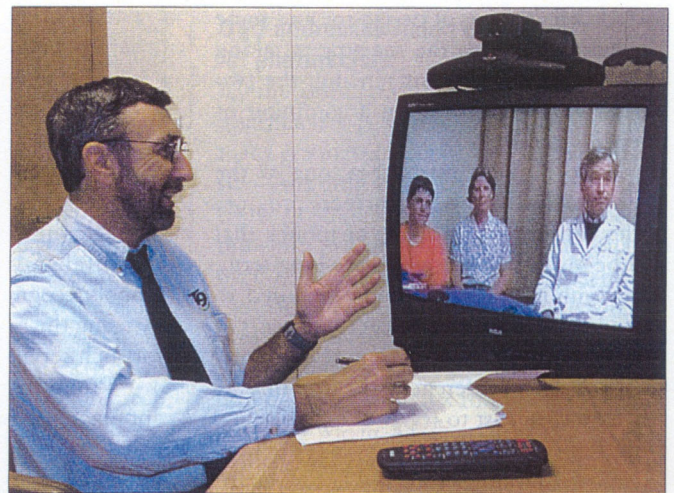
reach program for schools.

The idea for the program was proposed in 1998 by Steve Sulzbacher of the UW departments of psychiatry, pediatrics, and special education. He noticed that most rural communities are at a disadvantage when it comes to expert consultations because most specialists are in large cities. Another driving force was that public schools were being required to provide more special-services to students that needed them.

It is costly for a rural school to bring a specialist out for a consultation because the school must pay for travel time in addition to consultation itself. Sulzbacher felt it was possible to bring the expertise of UW specialists to school districts in the same way the WWAMI Rural Telemedicine Network brings expertise to clinics and physicians. WWAMI is a collaborative effort of Washington, Wyoming, Alaska, Montana, and Idaho to extend medical education and research to rural areas in the five states.

Coincidentally, another program, called K-20, was already in the process of wiring all of the schools in Washington State with T1 broad-bandwidth lines as a result of Governor Locke pushing to get the Internet into every school in the state. The hub of the K-20 network is at the UW, which provided the necessary telecommunication system for the Telepartners program to operate.

The Telepartners program works by allowing educators and parents to set up videoconference consultations with special-



Steve Sulzbacher, left, of the departments of psychiatry, pediatrics, and special education at the University of Washington, conducts a Telepartners session. The Telepartners program works by allowing educators and parents to set up videoconference consultations with specialists. Photo courtesy of Steve Sulzbacher and Joe Wilmhoff

"It is often said that the number one problem with healthcare is access," says Matsen. "Telehealth is a powerful tool for solving the access challenge."

ists. Consultations occur on a wide range of problems, from attention-deficit hyperactivity disorder to fetal alcohol syndrome. Most consultations will include the educator, parents, and the child with the disorder.

One case in which the Telepartners program might be used is that of a 10-year-old girl who has a brain tumor. She lives in a remote area of the state and travels to Seattle for what turns out to be a successful surgery. When she goes back to school in her hometown, her teacher wonders why she acts differently. The teacher sets up an appointment for a videoconference with the neurological specialist and the girls' parents to understand the changes in and needs of her student.

Sulzbacher often begins his consultation sessions with students by interacting with the child to build rapport. This process may include a few games of tic-tac-toe and some conversation. Since the meeting is taking place through videoconferencing, the two parties view each other on a computer or television screen.

According to Sulzbacher, one of the main benefits of the Telepartners program is the considerable amount of money that will be saved by the state in the long term. Since public schools are now required to provide better special services to students, it is necessary to spend money more efficiently by using videoconferencing instead of paying for a specialist to travel out to the rural community.

Grant funding from the U.S. Department of Education for the Telepartners program was scheduled to run out in September of 2001. After that, the program was expected to continue on a fee-for-service basis

Network Helps Deliver Curriculum and Learning Tools

The K-20 Network is a program that utilizes high-speed telecommunications to provide Internet access to every school in Washington State, from kindergarten to college.

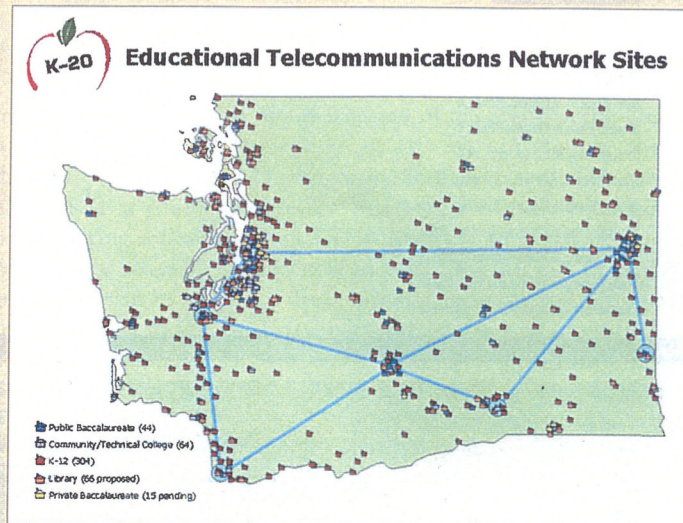
In 1996, the Washington State legislature recognized the need for Internet access in every classroom and allocated \$55 million for the building of the K-20 Educational Telecommunications Network.

The network, which is centered at the University of Washington, gives every school in Washington State access to Internet2 (called "Abilene").

"Teachers in Washington's schools will now be better able to develop and organize Web-based materials that will enhance student learning," says Louis Fox, vice provost of the University of Washington Office of Educational Partnerships & Learning Technologies.

During Phase I of the program, all postsecondary institutions and education service districts were connected.

Following the completion of Phase I, the K-20 network was extended to 294 of the states' 296 school districts.



Phase II also included the connection of off-campus branches and extension centers of the public higher-education institutions as well as the branch campuses of the community and technical colleges.

According to Erika Lim, senior policy advisor for the Department of Information Services in Washington State, the connection of all public schools from kindergarten through college was completed in December of 1999.

Still in the process of getting connected are the independent, non-profit baccalaureate institutions that received permission from the FCC to join the program.

Future plans call for the connection of all public libraries in Washington State, according to Lim.

through the K-20 network and Children's Hospital. Sulzbacher explains that the schools recognize the cost reduction afforded by using the program and are willing to pay for such services.

Proponents of telehealth believe the approach enables patients and their physicians to communicate more completely, more often, more conveniently, and less expensively than ever before. And it enables patients to have access to the expert specialists they need without being limited by geography or travel time—something very

important for patients who have difficulty getting around or for those who live in remote communities.

"It is often said that the number one problem with healthcare is access," says Matsen. "Telehealth is a powerful tool for solving the access challenge." ■

Jennifer O'Neil recently completed a bachelor's degree in materials science and engineering at the University of Washington. She is recipient of the 2000 Boeing Science & Technology Writing Fellowship.