

Telehealth and Diabetes Monitoring

Introduction

The numbers are sobering. According to the Centers for Disease Control and Prevention (CDC), nearly 24 million Americans now have diabetes. This represents approximately 8% of the U.S. population. Just in the past 2 years, the number of cases has increased more than three million. Most of these individuals are living with type-2 diabetes, the result of obesity, poor diet, and lack of exercise. Add to these numbers another 57 million people with pre-diabetes and you have a health crisis in the making.

Like other chronic diseases, diabetes offers an opportunity to employ basic and complex applications of telehealth to provide home health monitoring and tight glucose control. In addition to patient management and monitoring, telehealth also focuses on diabetes education, decision support for the clinician, and screening for complications.

The applications of telehealth in diabetes represent a broad spectrum of approaches. Basic interventions may include educational websites, nurse call centers, video phones, and telephone case management using clinical practice management protocols. An example of an advanced application is providing patient education, counseling, and nutritional support through the use of videoconferencing. More recently, sophisticated technologies allow for the use of digital glucometers along with Internet-based disease management portals and retinal imaging capabilities. From voice and e-mail to high-resolution images and video, the goal is to take advantage of every technology so that patients with diabetes can control their disease and lead normal lives.

The IDEATel Project

Telemedicine, telehealth, and medical informatics came together in an interdisciplinary approach to diabetes management with Columbia University's Informatics for Diabetes Education and Telemedicine (IDEATel) project. It was started in 2000 with a \$28 million, 4-year demonstration grant from the Centers for Medicare and Medicaid Services, Health Care Financing Administration. IDEATel is the largest telemedicine effort ever funded by the federal government. In 2003, the Medicare Modernization Act extended IDEATel for another 4 years.

An overall goal of the project is to evaluate the feasibility, acceptability, effectiveness, and cost-effectiveness of telemedicine as it relates to diabetes home care monitoring. Central to the project is the technology—a home telemedicine unit (HTU) developed by American Telecare with the following four functions:

- Synchronous videoconferencing over standard telephone lines,
- Electronic transmission of finger stick glucose and blood pressure readings,
- Secure Web-based messaging and clinical data review, and
- Access to Web-based educational materials.

Almost 25% of Americans age 60 and over have diabetes. Therefore, the HTU was designed so that the elderly and those with little to no computer experience could use it effectively. The project set up Web-based computing and telecommunications networks in urban and rural economically disadvantaged areas in New York State. When IDEATel went live in December 2000, an initial 1,500 patients residing in Northern Manhattan and Central and Upstate New York were enrolled. This ensured that both inner-city and rural residents would be represented in the study. According to the CDC, nearly 12% of blacks and 10% of Hispanics have diabetes. This compares to only 7.5% of Asian Americans and 6.6% of whites. Currently, more than 600 HTUs are actively being used.

All subjects participating in the project received a HTU. This consisted of a Web-enabled specially configured personal computer with a dial-up modem connection to an existing ordinary phone line (see sidebar). A video camera and microphone allowed for videoconferencing with nurse case managers. Both the home glucose monitoring device and blood pressure cuff were connected to the HTU for patients to upload readings. There was also the ability to access clinical data and send messages over a Web portal. Participants were able to view a number of educational websites developed exclusively for the project by the American Diabetes Association.

IDEATel has generated numerous published results on a host of outcomes data. All have shown long-term improvements in HbA1c, low-density lipoprotein cholesterol, and blood pressure when com-

pared to usual care controls. Patients also demonstrate high levels of satisfaction with major intervention components. With its large population size, sociodemographic diversity, and hundreds of independent physician practices involved, the IDEATel project demonstrated the effectiveness of home telehealth services in managing diabetes. This evidence now paves the way for even more innovative approaches in use today.

Cell Phones to the Rescue

Several commercial enterprises are looking to cell phones as the answer to keeping diabetic patients under tight control. Confidant Inc., a technology startup, envisions these phones as powerful databases when it comes to chronic disease management. Their software technology equips patients with Bluetooth-enabled cell phones that can communicate wirelessly with glucose meters. Readings are regularly sent to a central database where clinicians monitor the data for dangerous trends. When a patient forgets to test their blood sugar, a text message is sent to the phone, reminding the individual to do so.

Conducting one of Confidant's trials has been Mark Piehl, M.D., medical director of WakeMed Hospital's Diabetic Pediatric Center. When interviewed for ABC News, Piehl shared his vision of cell phones as instruments for improving patient management. "I see this as a tool to work with patients to see what might be causing the problems and to send them back a job-well-done text message when they are doing well and a reminder if they are forgetting to test."

In a 6-week trial of 10 young patients with type-1 diabetes, Piehl gave each kid a free cell phone equipped with the Bluetooth technology. Patients soon discovered how easy and fun it was to use. "We found that it made them test more often," points out Piehl. The patients started to stick to their normal disciplined routine of testing at regular appointed times.

The software works with off-the-shelf cell phones. Confidant works with the AT&T wireless network in a Java environment. Medical devices connect to the phones without wires due to the carrier's open serial Bluetooth framework. The company plans to roll out the service at points of care with a single software download costing \$1 a day. Refinements to the software now include the ability for patients to enter data on their diets, exercise routines, and medications.

Another company hoping to capitalize on the cell phone-based diabetes management platform is WellDoc Communications, Inc. Their software securely captures data and provides real-time diabetes management feedback. The system analyzes patient data and then provides suggested action plans to the patient's healthcare provider. According to Suzanne Clough, M.D., the company's chief medical officer, immediate feedback can dramatically impact how patients

NETWORKING

American TeleCare, Inc.

Eden Prairie, Minnesota
www.americantelecare.com

Center for Connected Health

Boston, Massachusetts
www.connected-health.org

Centers for Disease Control and Prevention

Diabetes Public Health Resource
Atlanta, Georgia
www.cdc.gov/diabetes

Confidant, Inc.

Durham, North Carolina
www.confidantinc.com

IDEATel Project

New York, New York
www.ideatel.org

Microsoft HealthVault

Be Well Fund
Redmond, Washington
www.healthvault.com/fund

WellDoc Communications, Inc.

Baltimore, Maryland
www.welldoc-communications.com

manage their disease. "Our system captures the teachable moment by providing patients with the information they need to better manage their health." For healthcare providers, the software gives them careful analysis of patient data as well as the latest evidence-based guidelines with recommendations.

An initial pilot study enrolled 30 patients with type-2 diabetes and an average age of 50 years and older. By using the new software, participants achieved, on average, a two-point drop in their HbA1c within 90 days. The company is now joining forces with CareFirst BlueCross BlueShield to sponsor a 12-month randomized clinical trial involving 260 patients with diabetes. Researchers at the University of Maryland School of Medicine will conduct the study, which is open to doctors and patients outside of CareFirst's network and membership.

Saving Room for Microsoft

When it comes to home-health monitoring of patients with diabetes, Microsoft is making its mark as well. Already generating buzz

with HealthVault, its secure patient information portal, Microsoft recently awarded funding to the Center for Connected Health to develop a home-based glucose monitoring system for patients with diabetes. Microsoft's Be Well Fund is designed to assist academic and research health organizations in the creation of innovative online health applications for patients. These applications make use of shared health data and connected home health devices to improve the potential for positive health outcomes in patients.

Called Diabetes Connected Health, the new initiative will use available online technology to expand patient knowledge about diabetes and improve patient-physician communication. Plans call for the development of a Web-based system that will easily integrate home-based glucose monitoring results within the clinical workflow of diabetes care. As part of the evaluation process, patients will be selected from six Massachusetts General Hospital physician practices. They will be given commercially available glucometers and blood pressure monitors to transmit personal health data, using HealthVault, into a secure clinical system with diabetes management applications.

Already, the Center for Connected Health has completed a 3-month study of patients from a primary care practice. All of these participants were highly satisfied with home monitoring of their glucose levels. In addition to feeling more knowledgeable about their condition, the patients also felt more confident in their ability to control their blood glucose.

Conclusion

Undoubtedly, given the initial success with some of these early initiatives, there will be a great deal more research into telehealth and diabetes management. Already, those investigating how to exploit this marriage correctly have identified some challenges inherent in the process. For example, some centers have found it difficult to recruit patients into these nontraditional clinical trials that involve Web-based technologies. Those who do agree to participate must be equipped with a computer and reliable Internet access. In addition, they need to adapt to novel provider approaches that do not involve face-to-face interaction.

Perhaps the biggest hurdle yet to be overcome is reimbursement for telehealth initiatives that involve patient monitoring and messaging feedback. In the April 2008 issue of *HME Today*, Joseph

IDEATEI PROJECT HOME TELEMEDICINE UNIT (HTU) CAPABILITIES

- Read blood glucose levels
- Check blood pressure
- Take pictures of skin and feet
- Allow patient to view own medical information
- Educate patient about diabetes
- Give recommendations and care instructions
- Analyze patient data via an automated care guideline system
- Send automated alerts to the physician or nurse
- Provide suggestions and reminders to patients

C. Kvedar, M.D., founder and director of the Center for Connected Health, expressed his frustration at getting local payers to reimburse the Center for monitoring patients with congestive heart failure (CHF) at a per-enrollee-per-month fee. Such payers believe there is no need for these monitoring technologies to replace the contracts already in place with disease management enterprises.

Kvedar disagrees with this assessment that such phone-based services take care of the problem with CHF and diabetes. "We are convinced that a provider-driven approach will be more valuable," he says. "Some home care providers may still question their participation in diabetes remote monitoring, because there is no obvious revenue stream in it at this point." Kvedar sees a win for home care agencies when a telemonitoring nurse reviews a patient's data. It ultimately leads to streamlined home skilled nursing visits. However, the agency may not see a role in all of this since no skilled nursing visits are required. "Connected health will flourish," he says. A new class of healthcare provider will emerge—the telemonitoring professional." As the field continues to evolve, expect to see more investigations—and investment—into managing the seventh-leading cause of death in the U.S.

—Kevin D. Blanchet