

Use of Telehealth to Improve Chronic Disease Management

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(See the commentary by Saeed and colleagues on pages 219-222.)

Remote patient monitoring that tracks vital signs of patients with chronic diseases is offering more-frequent contact between the patient and the primary care provider, providing earlier detection of potential problems, and allowing real-time alerts, resulting in a proactive, affordable option for best-practice health care.

“I have my life back,” Tamara J. says as she clutches her twin 7-year-old boys wriggling out of her lap. Tamara received a diagnosis of diabetes as a young girl, congestive heart failure and cardiomyopathy in 2000, and ventricular tachycardia requiring implantation of defibrillator in 2001, and after complications due to the premature delivery of her boys resulted in kidney failure, she received a kidney transplant in 2005. Her recovery from the transplantation was slow, and she was ricocheting around the medical spectrum, from one specialist to another, in and out of the hospital, with frequent trips to the emergency department (ED). She was homebound, restricted in her activities, and having trouble caring for her young boys. Before their birth, she had been a foster mother for a number of children and had been active in her church and community. In July 2008, Tamara was referred to the Patient Provider Telehealth Network (PPTN) by her primary care provider.

The use of telehealth remote patient monitoring, rather than broadband or other networks, in patients' homes, community centers, assisted living facilities, and even the workplace to track vital signs of patients with chronic diseases is a fairly new development for the primary care setting. Remote monitoring can detect health problems sooner, reduce hospitalizations, improve life quality, and save money [1]. By enabling more-frequent contact between the patient and the primary care provider, the use of remote monitoring can result in earlier detection of potential problems and allow real-time alerts when a patient's data are abnormal, resulting in a proactive solution.

Characteristics of the PPTN Model

Heart disease, stroke, and diabetes hit the people in Roanoke Chowan Community Health Center's (RCCHC's) very rural and poor service area hard [2]. Factors such as provider shortages, time constraints among available pri-

mary care providers, aging populations, transportation barriers, and limited financial resources are common in the primary care setting. By using traditional strategies, as well as the innovative and affordable strategies of telehealth remote patient monitoring, to manage the effects of chronic disease, RCCHC has been able to deliver a solution not only for the patients, but for the providers and the overall health care delivery system.

Telehealth evidence-based data, guidelines, and standards are being embraced by a myriad of health care services. The outcomes are dramatic and compelling. In 2006, RCCHC developed the PPTN on the basis of a telehealth conceptual model. The North Carolina Health and Wellness Trust Fund provided funds to conduct a 3-year feasibility study of the network in order to determine clinical and financial outcomes for RCCHC's patients with cardiovascular disease, diabetes, and hypertension. The model is driven by the patient and their primary care provider.

The PPTN expands current telehealth models in 4 ways. First, new technology allows multiple users to use one telehealth kiosk, producing a strong return on investment, cost-efficiency, and increased access to care. Second, this model is driven by the patient and the primary care physician. Providers determine the need for and the frequency of health education and monitoring, the type of technology needed, and the patient-specific critical indicators and parameters, allowing providers to manage patients beyond the confines of 15-minute office visits. Third, RCCHC telehealth nurses have access to the patients' electronic medical records and communicate with the primary care physician via the electronic medical record. Finally, when critical indicators do not meet established individualized parameters, the provider and nurse respond, achieving early detection and intervention.

The primary care physician identifies patients, completes a 1-page plan of care, and faxes the plan to the telehealth reg-

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istered nurses. The registered nurses customize the technology software, notify the patient, and visit the patient's home to install the telehealth equipment, educate the patient about use of the equipment, and validate the patient's competency about its use. On a daily basis, the patient self-monitors their blood pressure, pulse, body weight, blood sugar level, and oxygen saturation and answers questions about their health. These data are transmitted to a secure server and are accessed by the registered nurses. Monday through Friday, the nurses monitor the data for abnormal indicators, as prescribed by the primary care physician. When a patient's data are abnormal, the nurses call the patient, conduct a nursing assessment, and provide education. If the nurse, on the basis of their professional judgment, determines that the patient may need medical intervention, the nurse contacts the primary care physician via the electronic medical record. Every 2 weeks, the data are compiled and put into the patient's electronic medical record.

Outcomes of the PPTN Study

The total sample size for the 3-year feasibility study was 198 patients. Fifty-nine percent were female, 72% were African American, and 65% were older than 70 years. A total of 74% had cardiovascular disease, and 23% had cardiovascular disease and diabetes.

Financial data were obtained for 64 patients. The majority of these patients (83%) received funding through Medicare only or from both Medicaid and Medicare, with fewer receiving funding through Medicaid only (4%) or self-paying (7%). The total charges for hospital care among these patients decreased from \$1.34 million during the 6 months before implementation of the telehealth model to an average of \$121,000 per 6-month period after discharge from telehealth. This represents a reduction in hospital charges of more than \$1.2 million every 6 months.

The telehealth program was associated with decreased hospital use and ED visits. The total number of hospital-bed days was 199 during the 6 months before implementation of the telehealth model, 99 during the 6 months of telehealth activity, and 70 during the 24 months after discharge from telehealth. The average total number of hospital-bed days per 6-month period after discharge from telehealth was 18 days. The total number of ED visits was 27 during the 6 months before implementation of the telehealth model, 5 during the 6 months of telehealth activity, and 23 during the 24 months after discharge from telehealth. The average total number of ED visits per 6-month period after discharge from telehealth was 6 visits.

Discussion

Since 2006, RCCHC has evolved into the PPTN "hub," providing daily remote monitoring for patients with cardiovascular disease, diabetes, hypertension, and pulmonary disease in 28 North Carolina counties. In addition, RCCHC has consulted with and implemented follow up after hospi-

FIGURE 1. Expansion of Telehealth in North Carolina

This figure is available in its entirety in the online edition of the NCMJ.

Note. HRSA, Health Resources and Services Administration; HWTF, North Carolina Health and Wellness Trust Fund; RCCHC, Roanoke Chowan Community Health Center.

tal discharge for Roanoke Chowan Hospital (Ahoskie, NC) and Chowan Hospital (Edenton, NC). We also consulted with and implemented remote monitoring and chronic care management with Gaston Community Care (Gastonia, NC). Currently, RCCHC funds the PPTN through multiple state grants (via the North Carolina Health and Wellness Trust Fund), federal grants (from the Health Resources and Services Administration Office for the Advancement of Telehealth), private grants, and various partnerships with grants and programs of other organizations (Beacon Community, PACE, Community Care of North Carolina, and University Health Systems) (Figure 1).

Today, Tamara is preparing a room for her newest foster child, leading the children's ministry and music at her church, and homeschooling her sons, Jonathan and Brandon. Her hemoglobin A_{1c} level has decreased by 20%, her low-density lipoprotein level has decreased by 53%, her blood pressure has decreased by 34%, and her weight has decreased by nearly 5%. Tamara has had no ED visits or hospitalizations since beginning the program in July 2008. She continues to use the remote patient monitoring program, and her patient data are transmitted not only to her primary care physician, but also, as needed, to her renal and cardiology specialists, in Greenville, North Carolina.

Success in translating the savings and positive patient outcomes RCCHC has seen depends largely on public policy decisions that accelerate the acceptance and use of telehealth remote patient monitoring. The realignment of reimbursement policies for telehealth is critical. For example, Medicare, Medicaid, and insurance reimbursement policies that recognize the value of investments in telehealth equipment and expertise can spread the use of remote monitoring by reducing out-of-pocket costs and encouraging buy-in among practitioners [3]. We can expect to see telehealth and remote monitoring play significant roles in the health care delivery system of the future. NCMJ

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my friend's got mental illness.

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