## OBSERVATIONS

# Improving Diabetes Care via Telemedicine: Lessons From the Addressing Diabetes in Tennessee (ADT) Project

The prevalence of diabetes continues to escalate around the world, with an estimated 24 million people affected in the U.S. (1). Its prevalence has more than doubled in Tennessee the last decade from 5.0% in 1997 to 11.0% in 2007 (2), with estimated diabetes related mortality of 31 per 100,000 population (2). Rising prevalence and shortage of physicians, especially in rural areas, contribute to poor outcome in diabetic patients (3). Telemedicine, the transfer of electronic medical data to a remote location utilizing telecommunications technology, may be beneficial in improving access, care, and outcome in diabetic patients. Therefore, we investigated the impact of telemedicine on the quality of care in diabetic patients in five health professional shortage areas with diabetes related mortality rates of 41.5–84.7 per 100,000.

ADT was a prospective interventional study, which recruited diabetic patients aged ≥18 years, with A1C ≥8.0%. Diabetes self-management education (DSME) was delivered by a certified diabetes educator via videoconference every 3 months. The DSME classes addressed pathogenesis of diabetes, nutritional education, physical activity, self blood glucose monitoring, effects of insulin and other diabetes medications, sick day management, and complications of diabetes. DSME classes were delivered from the telemedicine studio of the University of Tennessee Health Science Center in Memphis, which was connected to the remote locations by videoconference using Polycom VSX 7000 video cameras (Pleasanton, CA), television monitors, and the Internet. Vital signs and anthropometry were obtained at each visit. Laboratory data such as A1C and lipid levels were obtained from the patients' primary physician. Statistical analysis was done using Student $t$ test or ANOVA and $\chi^2$ test.

Thirty-six patients aged 55.6 ± 10.0 years, with mean duration of diabetes of 12.0 ± 10.0 years completed the study; 55% of the subjects had concomitant dyslipidemia and hypertension. Subjects showed significant improvement in A1C after 3 months (9.8 vs. 8.4%, $P < 0.001$). Reduction in A1C at 3 months was sustained over 12 months of the study (8.4 vs. 8.3%, $P > 0.5$). The proportion of subjects achieving target A1C of <7% increased to 40% after intervention ($P < 0.001$). There was also a significant rise in the proportion of patients who achieved target blood pressure (61 vs. 78%), HDL (11 vs. 22%), and triglyceride (3 vs. 30%) ($P < 0.001$); and 97% of the participants were satisfied with the program, and 90% acknowledged it saved time and money.

Given the average duration of uncontrolled diabetes of 12 years, this degree of improvement in 3 months is quite encouraging. The improvement in A1C, which was maintained throughout the study, may suggest that a 3-month program may be more cost-effective than a longer one. This prospective study is a useful addition to the evidence for the efficacy of a well-designed telemedicine program in diabetic patients (4,5). However, it is limited by the small number of subjects. A prospective randomized study would be required to verify the observations in this study. In conclusion, a telemedicine-based management program that delivers diabetes education and consultative service through videoconference was effective in improving diabetes outcome measures. It proved to be an acceptable means of providing care in diabetic patients at high risk for cardiovascular disease.

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## References

1. Centers for Disease Control. National Diabetes Fact Sheet, 2007 [Internet]. Available from www.cdc.gov/diabetes/pubs/factsheet07.htm. Accessed 26 October 2010
2. Tennessee Department of Health. Prevalence rate of diabetes in Tennessee 2007. Nashville, Tennessee [Internet]. Available from http://health.state.tn.us/statistics/. Accessed 26 October 2010
3. U.S. Department of Health and Human Services. Health personnel shortage areas [Internet]. Available from http://hpsafind.hrsa.gov/HPSASearch.aspx. Accessed 27 October 2010
4. Montori VM, Helgemoe PK, Guyatt GH, et al. Telecare for patients with type 1 diabetes and inadequate glycemic control: a randomized controlled trial and meta-analysis. Diabetes Care 2004;27:1088–1094
5. Farmer A, Gibson OJ, Tarassenko L, Neil A. A systematic review of telemedicine interventions to support blood glucose self-monitoring in diabetes. Diabet Med 2005; 22:1372–1378