

## The Effect of the Vermont Diabetes Information System on Inpatient and Emergency Department Use: Results from a Randomized Trial

Shamima Khan, MBA, PhD<sup>a</sup>, Charles D. MacLean, MDCM<sup>b</sup>, Benjamin Littenberg, MD<sup>b</sup>

<sup>a</sup>DEPARTMENT OF PHARMACY ADMINISTRATION AND ALLIED HEALTH SCIENCES, COLLEGE OF PHARMACY AND ALLIED HEALTH PROFESSIONS, ST. JOHN'S UNIVERSITY, JAMAICA, NEW YORK; AND <sup>b</sup>DIVISION OF GENERAL INTERNAL MEDICINE, UNIVERSITY OF VERMONT, BURLINGTON, VERMONT

### ABSTRACT

**OBJECTIVE:** To describe the effect of the Vermont Diabetes Information System (VDIS) on hospital and emergency department use.

**DATA SOURCE:** Statewide discharge database.

**STUDY DESIGN:** Randomized controlled trial of a decision support system for 7412 adults with diabetes and their 64 primary care providers.

**DATA COLLECTION/DATA EXTRACTION:** Charges and dates for hospital admissions and emergency department care in Vermont during an average of 32 months of observation. Data from New York hospitals were not available.

**RESULTS:** Patients randomized to VDIS were admitted to the hospital less often than control subjects (0.17 admissions vs 0.20;  $P = .01$ ) and generated lower hospital charges (\$3113 vs \$3480;  $P = .019$ ). VDIS patients also had lower emergency department utilization (0.27 visits vs 0.36;  $P < .0001$ ) and charges (\$304 vs \$414;  $P < .0001$ ). The intervention was particularly effective in men and in older subjects.

**CONCLUSIONS:** Despite data limitations that tended to reduce the apparent effect of the system, this randomized, controlled trial showed that VDIS reduces hospitalization and emergency department utilization and expenses.

**KEYWORDS:** Chronic disease; Clinical; Cost of care; Decision support systems; Diabetes mellitus; Emergency department use; Health services research; Hospitalization; Patient care management; Primary health care

**The** number of individuals in the US with diagnosed diabetes is now 17.5 million, with total estimated health care costs in 2007 of \$174 billion.<sup>1</sup> Although a range of effective treatments are available, diabetes patients continue to receive suboptimal care.<sup>2</sup>

The Vermont Diabetes Information System (VDIS) is a laboratory-based registry and decision support system that communicates directly with primary care providers and their adult patients with diabetes. It is designed for low-cost and easy integration into primary care. It requires no data entry, additional staff, office space, or capital investment by participating practices. Although VDIS can be easily integrated with office computers or electronic medical records, these are not required.<sup>3</sup>

VDIS uses the Chronic Care Model as an organizing framework, with daily data feeds from otherwise independent laboratories, automatic test interpretation using algorithms based on consensus guidelines, use of fax and mail to report to providers and patients not easily reached by electronic networks, and report formats that are accessible and useful to patients and providers. The primary function of the system is to collect pertinent clinical information (hemoglobin A1C, cholesterol, serum creatinine, and urine protein results) and generate 5 types of reports: flow sheets to providers with accurate and timely laboratory results, reminders of overdue laboratory tests to providers, overdue reminders to patients, alerts to patients with elevated test results, and summary population reports for providers regarding their diabetes roster.<sup>4,5</sup>

The intervention has been described in detail elsewhere, along with a prospective, cluster-randomized clinical trial in which 7412 patients and 132 providers in 64 practices were randomized to receive VDIS or usual care.<sup>4,5</sup> A random sample of patients completed questionnaires at the end of the study in which they recalled their use of medical services in the previous year, including hospitalization and emergency department visits. Intervention subjects recalled significantly less utilization than control subjects, with estimated savings of \$2426 per patient per year (95% confidence interval  $-4647$  to  $-205$ ;  $P = .03$ ).<sup>6</sup> Although randomized to minimize bias, this analysis was limited by the possibility of patient recall error.

A second analysis of the cost impact of this decision support system was undertaken in a cohort of patients covered by a single insurer, who used a commercially available version of the system called the Vermedx® Diabetes Information System (Vermedx Inc., Burlington, VT). In this observational study, total insurance claims paid before and after institution of the system were compared for 153 intervention patients and 870 control subjects.<sup>3</sup> Mean savings in the intervention group ranged from \$504 per patient in year 1 of operation to \$3563 in year 4. The cumulative net savings reached \$8134 in 4 years. Although not subject to recall error, these data were limited by the nonrandomized design and reliance on data from a single insurer.

These 2 studies have methodological limitations. In order to better understand the potential cost savings associated with the VDIS, we undertook the current study to describe the effect of VDIS on cost and utilization in the original randomized cohort using hospital claims paid across all insurers.

## METHODS

VDIS receives laboratory results (glycosolated hemoglobin A1C, cholesterol, and kidney function) from clinical laboratories, maintains a registry, and produces reports for primary care providers and their patients. Reports are automatically generated whenever a laboratory test is completed. They include flow sheets with guideline-based recommendations for the providers and alert letters for the patient when results are above target. Patients and practices also receive reminders when test results are overdue. Population reports listing all the provider's patients are sent to each provider quarterly, along with a report card indicating population-level performance. Reports are sent electronically or by fax to the practices, and mailed to patients. The system is not linked to any pay-for-performance incentive.

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