

Improving primary care for patients with complex chronic diseases: Can health information technology play a role?

Richard W. Grant MD MPH, Blackford Middleton MD MSc

∞ See related research paper by Holbrook and colleagues, page 37

The primary care of patients with type 2 diabetes mellitus remains suboptimal despite the availability of potent medications and clear evidence-based guidelines.¹ With its increasing prevalence, its substantial economic burden and impact on health, and an extensive list of measurable health care parameters, type 2 diabetes has understandably become a focus of many quality-improvement efforts. Moreover, the complexity and abundance of clinical data to be processed by clinicians has made diabetes a frequent paradigm for testing advances in tools based on health information technology. An evidence-based model we created suggests that a variety of interventions in diabetes care based on information technology may have a beneficial impact on health care costs and clinical outcomes.²

Early efforts to improve diabetes care using health information technology were based on the assumption that providing physicians with guideline-based reminders during the clinic visit would lead to improved care.^{3,4} It was assumed that a deficit in physician knowledge was somehow a key contributor to suboptimal management of diabetes. Several well-conducted meta-analyses have since clearly shown that these physician-directed, visit-based clinical reminders have only a modest impact on care processes and generally little to no effect on clinical outcomes.^{5,6} Clearly, physician reminders alone are not the answer.

Implementation research has now entered a new phase in which tools based on health information technology are being used to engage both patients and health care providers. In this issue of *CMAJ*, Holbrook and colleagues conducted a randomized trial involving 511 patients with type 2 diabetes and the 46 primary care providers responsible for their care.⁷ They implemented an innovative electronic system that included an individualized, Web-based decision-support tool that patients could access from home. The result was better overall composite scores in both diabetes processes and (to a lesser degree) clinical outcomes among intervention patients than among control patients over a 6-month period.

This study has 2 major strengths. The investigators successfully implemented a randomized controlled trial to rigorously assess the impact of their intervention. Although this approach presents significant logistical challenges, the results are internally valid and not subject to the major flaws seen in before-and-after trials. These flaws are (a) the temporal trends in improvement that are seen in most systems regardless of interventions and (b) the participatory bias (sometimes called the Hawthorne effect) often found in observational studies of quality-improvement interventions.⁸

Key points

- A multi-modal intervention directed at both patients and their primary care providers resulted in significant improvements in both processes and clinical outcomes related to diabetes care.
- The study demonstrates that randomized trials of innovative interventions based on health information technology can be successfully conducted in the community setting.
- Standards for data exchange and system interoperability are essential for interventions based on health information technology to be effective.

The second strength is the environment in which the study was conducted. Many innovative interventions based on health information technology have been implemented within integrated systems that share a single underlying electronic health record. Often, these systems are in academic medical centres or health maintenance organizations that are not necessarily representative of the practices in which most patients receive their care. To implement their intervention in the community setting, Holbrook and colleagues needed to interface their intervention with 5 different types of electronic health records. Although the technical challenges limited the interactivity of their intervention somewhat, the results provide strong evidence that complex research interventions can and should be implemented in community-based practices.

Despite the strengths of the study, there are 2 major caveats. First and foremost, the authors ascribe the positive impact of their intervention to the influence of individualized decision support and to the role (again) of reminders. However, the intervention was multi-modal: patients in the intervention group had Web-based access to their diabetes tracker, they were sent a colour-coded tracker page by mail, and they received a series of automated telephone reminders. Given that about half of the patients at baseline never used a computer, it is likely that the mailings and phone calls were the main intervention many patients received. Moreover, it appears that the intervention patients (but not the control patients) were instructed “to visit their respective local laboratories for a predetermined set of relevant blood tests and then to make an appointment with their respective family physicians

Richard Grant is with the Department of Medicine, Massachusetts General Hospital and Harvard Medical School, Boston, USA. Blackford Middleton is with the Department of Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, and Clinical Informatics Research and Development, Partners HealthCare System, Wellesley, USA.

All editorial matter in *CMAJ* represents the opinions of the authors and not necessarily those of the Canadian Medical Association.

for a week later.” The consequence of all this outreach was that intervention patients had a significantly greater number of visits during the 6-month study period. Thus, although on conceptual grounds it is attractive to ascribe the benefit to individualized decision support, an alternative explanation is simply that the intervention increased patient contact with their primary care providers, which in turn led to more testing and other visit-based actions for clinical care. The modest impact, the relatively short study period and the uncertain mechanism of this intervention underscore the fact that we do not yet know which components of innovations in health delivery are necessary to create durable changes in diabetes care.

The second caveat is generalizability. This is the Achilles heel of randomized controlled trials in general, and of interventions based on health information technology in particular. In the current study, patients were screened first by their primary care providers for appropriateness. Even in this select group of patients, less than one-third agreed to participate. Although these enrolment rates are consistent with those in other clinical trials, the consequence of this selection process was that certain individual risk factors were well controlled at baseline (glycated hemoglobin about 7%, blood pressure about 135/75 mm Hg and low-density lipoprotein cholesterol about 2.5 mmol/L).

A major hurdle faced in this study was the lack of standards for data extraction from electronic health records, which created expensive integration challenges and inhibited rapid access to data by providers and patients. In our work, we have found that seamless interoperability between provider record systems and personal health records is essential to maximize potential value.⁹ Without common standards for data exchange and system interoperability, implementation of health information technology will remain limited.¹⁰

We are entering an exciting era of research into health information technology in which new models of care must be developed and rigorously evaluated. The work by Holbrook and colleagues is an important step toward a more effective

system of primary care in which patients are better informed and more easily connected with their providers.

The next steps in the process will be to create patient-centred (rather than disease-specific) systems that can address a wider range of patient concerns and to establish a framework that will facilitate clinical management independent of the clinic visit.

Competing interests: Blackford Middleton is a member of the Scientific Advisory Board of Intercomponentware, Inc. No competing interests declared by Richard Grant.

Contributors: Both of the authors were involved in the drafting and revision of the manuscript and approved the final version submitted for publication.

REFERENCES

1. Saydah SH, Fradkin J, Cowie CC. Poor control of risk factors for vascular disease among adults with previously diagnosed diabetes. *JAMA* 2004;291:335-42.
2. Bu D, Pan E, Walker J, et al. Benefits of information technology-enabled diabetes management. *Diabetes Care* 2007;30:1137-42.
3. Classen DC. Clinical decision support systems to improve clinical practice and quality of care. *JAMA* 1998;280:1360-1.
4. Balas EA, Weingarten S, Garb CT, et al. Improving preventive care by prompting physicians. *Arch Intern Med* 2000;160:301-8.
5. Garg AX, Adhikari NKJ, McDonald H, et al. Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review. *JAMA* 2005;293:1223-38.
6. Chaudhry B, Wang J, Wu S, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med* 2006;144:742-52.
7. Holbrook A, Thabane L, Keshavjee K, et al.; COMPETE II Investigators. Individualized electronic decision support and reminders can improve diabetes care in the community: COMPETE II randomized trial. *CMAJ* 2009;181:37-44.
8. Sacks H, Chalmers TC, Smith H. Randomized versus historical controls for clinical trials. *Am J Med* 1982;72:233-40.
9. Johnston D, Kaelber D, Pan EC, et al. A framework and approach for assessing the value of personal health records (PHRs). *AMIA Annu Symp Proc* 2007;Oct. 11: 374-8.
10. Walker J, Pan E, Johnston D, et al. The value of health care information exchange and interoperability. *Health Aff (Millwood)* 2005;Jan-Jun:W5-10.

Correspondence to: Dr. Richard W. Grant, 50-9 Staniford St., Boston MA 02114, USA; fax 617 724-3544; rgrant@partners.org



Call for papers

“Hilarity and good humour ... help enormously in both the study and the practice of medicine.” — William Osler

Research with a twist, humorous reflections, witty rants, culturally current missives — we'll consider it all for CMAJ's 2009 Holiday Review. Articles should be no longer than 1200 words; photographs and illustrations are welcome. Submit your article online at <http://mc.manuscriptcentral.com/cmaj>, and specify in your cover letter that it's for the Holiday Review.

Deadline: October 1, 2009.