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Refereed paper

Feedback and training tool to improve provision of preventive care by physicians using EMRs: a randomised control trial

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ABSTRACT

Background Electronic medical records (EMRs) have the potential to improve the provision of preventive care by allowing general practitioners (GPs) to track and recall eligible patients and record testing for feedback on their service provision.

Objective This study evaluates the effect of an educational intervention and feedback tool designed to teach GPs how to use their EMRs to improve their provision of preventive care.

Methods A randomised controlled trial comparing rates of mammography, Papanicolaou tests, faecal occult blood tests and albumin creatinine ratios one-year pre- and post-intervention was conducted. Nine primary care practices (PCPs) representing over 30 000 patients were paired by practice size and experience of GPs, and randomly allocated to intervention or control groups. Physicians at the four intervention practices received a two-hour feedback session on their current level of preventive care and training to generate eligible patient lists for preventive services from their EMR database.

Results One-year post-intervention results provided no evidence of a difference. The intervention was not a significant predictor of the one-year post-

intervention test rates for any of the four tests. On average, the intervention practices increased post-intervention test rates on all tests by 16.8%, and control practices increased by 22.3%.

Conclusion The non-significant results may be due to a variety of reasons, including the level of intensity of the educational intervention, the cointervention of a government programme which provided incentives to GPs meeting specific targets for preventive care testing or the level of recording of tests performed in the EMR.

Keywords: albumin creatinine ratio, electronic medical record, faecal occult blood test, intervention, mammography, Papanicolaou Test, primary health care, randomised controlled trial, vaginal smear

What this paper adds

- EMR software provides an opportunity to identify patients eligible for preventive care testing.
- Tracking eligible and tested patients is dependent on the accuracy and completeness of the recording of procedures and results.
- Educating physicians on the use of their EMRs to generate lists of eligible patients did not increase rates of preventive care testing.
- Physicians require both the desire and time investment to use the technology to improve the provision of care.
- A more effective intervention may have provided ongoing information technology support, and training to improve data entry and completeness.

Introduction

Electronic medical records (EMRs) can be used to provide feedback to general practitioners (GPs) on their provision of preventive care. The Canadian Task Force on Preventive Health Care has recommended several preventive care services to be provided routinely by GPs, including biennial mammography, Papanicolaou tests (Pap test) and colorectal cancer screening in the form of faecal occult blood testing (FOBT).[1] Some Canadian provincial governments including the Ontario Ministry of Health and Long-Term Care (MOHLTC) are tying GP remuneration to achieving specific preventive care targets.[2] EMRs have the potential to improve the provision of preventive care services by allowing GPs to track and recall eligible patients and record testing. For example, electronic reminder and recall systems using EMR data are being implemented by GPs to improve revenues from MOHLTC preventive care bonuses and improve preventive care.[3] Successful interventions designed to improve GP provision of preventive care services have been multicomponent strategies,[4] including combinations of manual or computerised reminder systems, information technology support, various forms of audits with feedback, benchmarking to construct performance targets, academic detailing to review published information and physician methods, and practice facilitation by mentors and trainers. These interventions have helped GPs to implement recall and reminder systems, as well as standing orders for tests, which increased delivery of preventive care services.[5] Feedback and benchmarking alone have not been found to change clinician behaviour in most cases.[6]

The objective of this project was to assess the impact of an educational intervention and feedback tool on the provision of preventive care testing in PCPs located in southwestern Ontario, Canada. One-year pre- and post-intervention rates were compared for the following tests: mammography, Pap tests, FOBT and nephropathy screening for diabetics (albumin creatinine ratio, ACR).

Methods

The Improving Practice Outcomes Via Electronic Health Records Project (IMPROVE) initiative was part of a larger programme, Deliver Primary Healthcare Information (DELPHI). The DELPHI database is located at the Centre for Studies in Family Medicine at The University of Western Ontario, London, Canada. This research database contains de-identified EMR data for 30 151 patients, from ten primary care practices (PCPs) in southwestern Ontario. Sample size was determined by the number of practices contributing to the database. Nine practices agreed to participate in

the IMPROVE Project. All practices were using one common EMR software. To protect patient privacy, the DELPHI database does not contain information from the encounter notes or scanned image attachments which would contain patient names. Patient data were extracted between 1 October 2005 and 31 August 2008.

Nine practices participating in the randomised, controlled trial were paired by size and level of EMR experience of the physicians, and the researcher conducting the intervention randomly allocated one of each pair to the intervention group; and the other of the pair was the control group. Six physicians were located at the four intervention practices, and represented 9067 patients. Sixteen physicians were located at the five control practices, and represented 14 621 patients.

In August 2007, the physicians located at the intervention practices received a two-hour intervention session. The intervention included a combination of hands-on training, instructional materials and feedback on current levels of preventive care. Feedback was provided on the physician's current level of preventive care provision in the form of a bar graph displaying the percentage of eligible patients who had received a mammogram, Pap test, FOBT and ACR from the physician between July 2006 and June 2007. To provide a comparison, the Ontario MOHLTC targets for preventive care, and aggregate level of care provision at other intervention practices were presented alongside the physician's results. Figure 1 shows an example of the bar graphs used to provide physician feedback. During the hands-on training, physicians were taught how to query their EMR database to generate lists of patients eligible for preventive care tests. Instructional materials in the form of a toolkit with step-by-step instructions and software screen shots were provided to use as a reference to help physicians query their EMR database after the intervention session and potentially identify patients eligible for prevention care.

Results of the intervention were assessed using the DELPHI database, containing the pooled EMR data from the nine practices. The number of patients eligible to receive a mammogram, Pap test, FOBT or ACR in each practice was found for each month in the one-year pre-intervention period (1 August 2006 to 31 July 2007) and one-year post-intervention period (1 September 2007 to 31 August 2008). Patient data from the problem list, referrals, investigations, billing and laboratory testing contained in the EMRs were used to determine eligibility and testing. Patients' data were used from 1 October 2005 to 31 July 2006 to exclude those who had been tested prior to the start of the pre-intervention period. Additionally, patients who had been tested in the pre-intervention period were excluded from eligibility in the post-intervention period. Age on the first day of the pre-intervention period was used to determine eligibility.

Patients were eligible for a mammogram if they were female, aged 50–70 years, and had no indication of a bilateral mastectomy being performed, for breast cancer. Patients were eligible for a Pap test if they were female, aged 35–70 years, and had no indication of a partial or total hysterectomy being performed. Patients were eligible for an FOBT if they were aged 50–74 years, and had no indication of colorectal

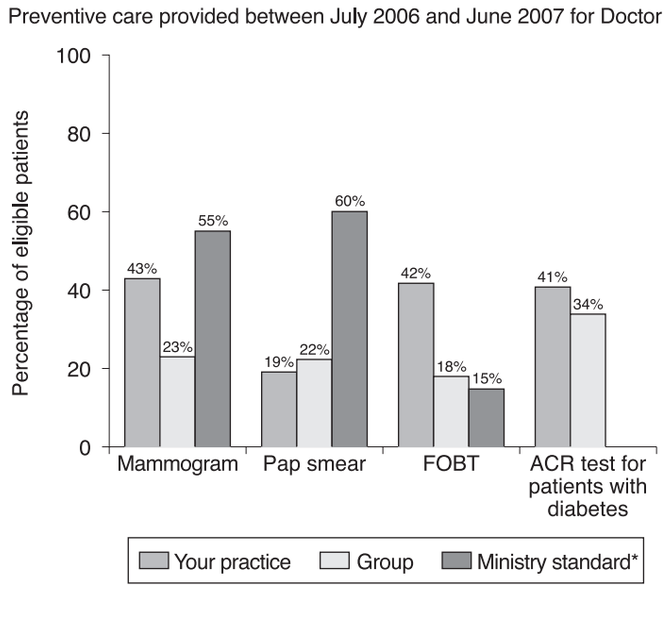


Figure 1 Example of the feedback tool shown to physicians.

cancer, or a sigmoidoscopy or colonoscopy being performed. Patients with at least one billing code for diabetes mellitus were identified as having diabetes, and were considered eligible for ACR testing.

The yearly rate of testing pre- and post-intervention for each of the four tests (mammography, Pap test, FOBT and ACR) was found per practice by dividing the total number of patients tested by the total number of eligible patients who visited the practice at least once during the year. The average yearly rate of testing for all four of the intervention practices combined, and the five control practices was found for each test, both pre- and post-intervention. For the analysis of rates of mammography, two practices in the control group were removed because they both had only one patient with mammography screening recorded in the EMR.

A standard multiple regression analysis was performed in SPSS 18.0 for each of the four tests to determine whether the post-intervention scores for each practice could be predicted by membership in the intervention or control group, controlling for pre-intervention scores. After the study was completed, a toolkit containing the instructions on how to query the EMR database was provided to the physicians in the control group to enable them to benefit from the educational materials developed for the intervention.

The DELPHI and IMPROVE projects received approval from the University of Western Ontario Ethics Review Board (reference number 11151E).

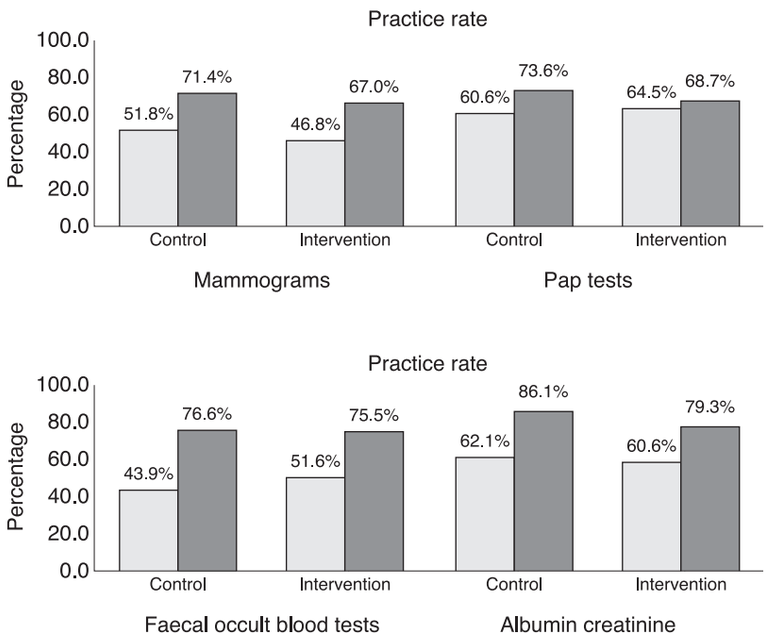
Results

The intervention was delivered as planned, and all six physicians at the four intervention practices received the two-hour training and feedback session. Figure 2 shows the rates of testing one year pre- and post-intervention for each of the four tests. The mean changes in test rates between practices are shown in Table 1. The results of the multiple regression showed that controlling for pre-intervention scores, membership in the intervention group was not a significant predictor of post-intervention scores for mammograms, Pap tests, FOBTs and ACRs. Both the intervention and control practices showed similar changes post-intervention, with an increase in the rate of mammography, Pap tests, FOBT and ACR testing. The largest increase in testing post-intervention was for FOBTs, followed by ACRs for diabetics and mammography. Pap tests showed modest increases at post intervention (see Figure 2).

Discussion

Principal findings

The educational intervention to teach GPs how to use their EMRs to locate patients eligible for preventive



*None of these differences were significant in the four multiple regressions using practice as the unit of analysis.

Figure 2 One year rates of preventive care testing for control and intervention practices.

care was not a significant predictor of the post-intervention test rates for any of the four tests (controlling for pre-intervention rates) including mammograms, Pap tests, FOBTs and ACRs. Minor differences between groups may have been related to test results that were not coded in the EMRs. For example, very low rates of mammography testing were found at two of the control practices, which were then removed from the analysis for rates of mammography. In these cases, the patients may have been using an external agency such as the Ontario Breast Screening Programme for their mammograms. The patients may have been tested, but their results recorded on paper instead of being entered into the EMR. Further, there was a co-intervention of a MOHLTC programme during the post-intervention period which provided incentives to GPs who met minimum targets on the percentage of patients provided with mammograms, and FOBT and Pap tests.

Implications of the findings

To enable accurate tracking of the level of testing and identification of eligible patients' information on preventive care testing performed needs to be recorded in the structured portion of the EMR. Despite the ability for EMRs to identify patients eligible for preventive care testing, GPs need both the desire and time investment to use the technology to improve the provision of care.

Comparison with the literature

The rates of preventive care testing found in this study were higher than those found in other studies using Ontario Health Insurance Plan (OHIP) billing data. For example, a study using 2000–2001 OHIP billing data revealed that 31.1% of women 35 and older were found to have had mammography screening within the past two years.[7] In another study reporting rates of preventive care testing in Ontario, 59% of women aged 20–69 years were found to have had a Pap test over a three-year period from 2000 to 2003, and only 12% of the population aged 50–69 years had an FOBT between 2002 and 2004.[8] The OHIP billing data used in the above studies may underestimate the true rates of preventive care testing in Ontario for a variety of reasons. For example, approximately 94% of GPs submitted OHIP claims data, but patients who attended community health centres and health service organisations were under alternative payment plans, and would not have been included.[7] In addition, mammography screening offered by the Ontario Breast Screening Programme was not captured under OHIP billing, and Pap testing performed as part of a routine physical were included in the annual exam fee and would not have been billed for separately.[7] The higher rates of preventive care testing found in the study reported in this paper may have been a reflection of the additional information available in the clinical encounter data, such as investigations, referrals, laboratory testing and the patient's problem list which were in addition to the OHIP billing data submitted by the physician.

Limitations of the method

There are many possible reasons for the non-significant results of this study, including the nature or intensity of the intervention. Nonetheless, the intervention was multifaceted, and included audit and feedback with hands-on practice sessions, which are an essential feature of continuing medical education, as noted by Mazmanian and Davis.[9] It may have been that the intervention lacked a focus or motivation for the family physicians and did not support or coach the family physicians after the one session was complete.

Some of the physicians who received the intervention and software training to query their EMR did not think the results of their personalised feedback on

Table 1 Average percent change in test rates

	Control		Intervention	
	% change	95% confidence interval ($p < .05$)	% change	95% confidence interval ($p < .05$)
Mammograms	19.6	0.52 to 38.8	20.2	8.4 to 32.0
Pap Tests	13.0	–7.9 to 32.2	4.2	–9.9 to 18.3
FOBT	32.7	4.0 to 63.0	23.9	–23.0 to 71.0
ACR	24.0	13.2 to 36.4	18.7	–8.2 to 45.7

current rates of preventive care were an accurate reflection of the care they provided to their patients. Physicians acknowledged that the care provided to their patients could have been located in hardcopy and other documents not recorded in the EMR, which would prevent their inclusion in the analysis of the rates of preventive care. For example, physicians who provided Pap testing as part of a routine physical would have recorded the testing in the encounter notes, which were not included as data in the analysis. In a study by Schattner *et al.*,[10] the utility of data extraction tools for quality improvement activities was also found to be dependent on the accuracy and completeness of computerised clinical data, where it is necessary to have results recorded in specific structured fields to be detected by data extraction tools.

At the time of the intervention, some of the physicians indicated that they did not intend to use the training and feedback from the intervention to change their practice. Several of the physicians indicated that they already had a full schedule, did not have the time to call eligible patients, and expected patients to request the appropriate preventive care tests.

The improvements in rates of testing seen in both the intervention and control practices may have been associated with the length of time the physicians had been using their EMR. As physicians became more skilled at using their EMR over time, physicians in the control group may have had more opportunity to learn how to query their EMR database on their own.

Another potential confounder was the co-intervention of a government (MOHLTC) programme to increase preventive care testing across all practices in Ontario. This programme provided financial incentives to GPs who met preventive care target rates for three of the tests, including mammograms, FOBT and Pap tests. However, data on preventive care testing rates prior to the study pre-intervention period is not available to identify whether rates increased after the government intervention, therefore this is only one of many possible reasons for the non-significant results of this study.

An underestimation of the care provision at some practices may have been the result of some already noted limitations, including the small sample size, and modest intervention that occurred in the context of MOHLTC targets for preventive care being rolled out. Another limitation included the potential lack of completeness in the data. For example, records of mammography, Pap test, FOBT and ACR testing and results recorded in encounter notes, stored in hardcopy, or as scanned image files attached to the EMR were not collected for the DELPHI database. This may have resulted in an underestimation of care provision in some practices. However, there is no reason to believe that this occurred differentially between intervention and control practices.

Call for further research

Further research is needed on the role of computerised EMR systems in the improvement of provision of preventive care services. Increased recording of data in structured portions of the EMR is expected to facilitate tracking of eligible and tested patients. A more effective intervention may have included training to improve data accuracy and completeness, and ongoing information technology support.

Conclusions

The intervention provided hands-on training to physicians on how to query their EMR to find patients eligible for preventive care testing. Feedback was provided to physicians on their current rates of care in comparison with other practices in the database, and the Ontario MOHLTC targets. Knowledge of the functions of the EMR software has the potential to allow physicians to identify patients eligible for preventive care, and to improve the provision of care, which can contribute to additional remuneration in the form of preventive care bonuses provided by the Ontario MOHLTC. All of the practices in the study (with the exception of two control practices without data for mammograms) showed similar increases in their rates of testing. The non-significant difference between the intervention and control groups seen in this study may have been due to the co-intervention of the Ontario MOHLTC preventive care bonus programme, and the specific ways data were recorded at each practice site. Although this intervention did not succeed in changing outcomes, anecdotal feedback indicated a positive response and improvement in doctor's skills and confidence in querying the EMR for better patient care. To benefit all practices involved in the study, a toolkit with step by step instructions on how to query the database to find patients eligible for preventive care testing was provided to physicians at the control practices and is available on request.

REFERENCES

1 Strasberg S. Important fee information for primary care physicians in patient enrolment models: demystifying tracking codes, exclusion codes and preventive care bonuses. Ontario Medical Association and Ministry of Health and Long-Term Care Agreement Update, November 2006.
2 Ontario Ministry of Health and Long-Term Care. Information procedures for claiming the cumulative preventive care bonus. Revised. March 2008.
3 Anderson KK, Sebaldt RJ, Lohfeld L, Burgess K, Donald FC and Kaczorowski J. Views of family physicians in

southwestern Ontario on preventive care services and performance incentives. *Family Practice* 2006;23:469–71.
4 Moulding NT, Silagy CA and Weller DP. A framework for effective management of change in clinical practice: dissemination and implementation of clinical practice guidelines. *Quality in Health Care* 1999;8:177–83.
5 Mold JW, Aspy CA and Nagykaldi Z. Implementation of evidence-based preventive services delivery processes in primary care: an Oklahoma Physicians Resources/ Research Network (OKPRN) study. *Journal of the American Board of Family Medicine* 2008;21:334–44.
6 Jamtvedt G, Young JM, Kristofferson DT, O'Brien MA and Oxman AD. Audit and feedback: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* 2006; 19(2): CD000259.
7 Wang L, Nie JX and Upshur R. Determining use of preventive health care in Ontario. *Canadian Family Physician* 2009;55:178–9.
8 Jaakkimainen L, Klein-Geltink JE, Guttman A, Barnsley J, Zagorski BM, Kopp A *et al.* Indicators of primary care based on administrative data. In: Jaakkimainen L, Upshur R, Klein-Geltink JE, Leong A, Maaten S, Schultz SE *et al* (eds) *Primary Care in Ontario: ICES Atlas.* Toronto: Institute for Clinical Evaluative Sciences, 2006.
9 Mazmanian PE and Davis DA. Continuing medical education and the physician as a learner: guide to the evidence. *Journal of the American Medical Association* 2002;288(9):1057–60.
10 Schattner P, Saunders M, Stanger L, Speak M and Russo K. Clinical data extraction and feedback in general practice: a case study from Australian primary care. *Informatics in Primary Care* 2011;18(3):205–12.

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