Cross-Canada EMR Case Studies: Analysis of Physicians' Perspectives on Benefits and Barriers

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Abstract

Our objective was to provide physicians with practical information on best practices and lessons learned with regards to implementation and use of electronic medical record (EMR) systems in ambulatory clinical practice settings. Methodology: A cross-Canada EMR study—the first of its kind—used case study methodology to investigate how EMRs were implemented and used in primary care. Knowledge transfer methods included print and web publications by the Canadian Medical Association (CMA) and a workshop. Results: The 20 case studies informed us in detail of the critical success factors for implementation. These were validated and augmented through a workshop. Conclusions: Electronic medical record (EMR) uptake in Canada and the US significantly lags behind other countries. Hence, there is a need to spread the good news about the actual benefits of EMRs to patients, physicians and the health care system and to mitigate barriers to EMR adoption and use.

Keywords: Electronic Medical Records; Primary Health Care; Health Policy; Knowledge Transfer

1 Introduction

Patients, physicians and the health care system benefit from the integration of electronic medical records (EMRs) into clinical practice. One of the best ways to increase implementation of EMRs is to clearly illustrate their benefits to those who will be using them. To do so, one must examine both the benefits and the barriers to EMR implementation in primary care practice.

This was part of the rationale behind the series of 20 case studies of EMR implementation and use in Canadian primary care that was undertaken by researchers from the universities of Alberta, Dalhousie, Sherbrooke and Toronto. Ethical approval was required by each institution and was obtained and maintained throughout the course of the study. The study was sponsored by the Canadian Medical Association (CMA) with financial support from Canada Health Infoway. It was not based on any pre-existing hypotheses [1,2].

One objective of our research was to identify and capture best practices to help inform other physicians looking to move to an EMR. In a systematic review of 89 studies examining the impact of computers on primary care consultations, Mitchell and Sullivan reported on

the dearth of evidence evaluating whether computers provide real benefit to patients [3]. They recommended studying examples of current best practice and refining those. In health care, we currently lack something that is "uniformly accepted as a measure of health outcomes or technology contribution" [4, p.109]. Benefits of EMR implementation and use are not expressed in a standard way, so it is difficult to quantify the impact of EMRs on patients, physicians and the health care system.

We discuss how our results compared to the findings of the 2009 Commonwealth Fund International Health Policy Survey of Primary Care Physicians in 11 Countries, which showed that physicians' use of EMRs in Canadian practices ranked the lowest of the 11 countries, behind the US with second last place [5]. This ranking was unchanged from the 2006 study [6]. In our research and in the Commonwealth Fund survey, physicians were asked about their use of electronic information functions, such as gaining access to patients' lab results and prescription drug information. How the EMR is used in practice is key to successful implementation as just having an EMR is not sufficient to provide improved patient care [7].

This paper presents the methods used for conducting our case studies and for transferring knowledge about the results.

2 Methods

The aim of the EMR case studies research was to address an information gap on EMR use in Canada and to provide physicians with practical information on best practices and lessons learned regarding implementation and use of EMRs in primary care practices [1]. To do this, we developed three primary research questions:

- How are EMRs implemented?

- How are EMRs used in clinical practice?

- How can EMR adoption be increased and sustained?

The case study method was chosen for this research because it sought to explain the present circumstances using formal and explicit procedures [8].

The unit of analysis for these case studies was the clinical practice setting, rather than individuals, organizations, or the EMR system. Data was gathered using pre-visit surveys, key informant interviews and observations from May-October, 2008.

Clinic selection was based on being at the forefront of EMR use. The CMA initially contacted clinics which had an EMR system in place for a minimum of two years. They had to be using it for patient and practice management functions such as charting, generating prescriptions and referrals and clinical decision support—not simply for scheduling and billing [9]. The lead physician in the clinic accepted the invitation to participate in the research on behalf of the clinic.

All nine members of the research team participated in the design of the methodology and instruments. The conceptual framework for the research had the following components: EMR System and Use Assessment Survey, interview guide for site visits, transcription codes, observation guide and case study report template.

The EMR survey was originally developed by Infoway and modified extensively by the CMA. Once the physician had given verbal consent to the CMA, he/she was contacted by the university-based researcher and asked to complete the survey online prior to the site visit. Completion of the survey implied informed consent, and survey results were used to tailor the one-hour interview with the recruited physician in the clinic.

The CMA identified specific topics to explore in the face-to-face interviews conducted by the six academic members of the research team. These topics were based on the CMA's knowledge of physicians' use and attitudes towards information technology generally and EMRs in particular.

The 89-item transcription coding scheme was developed based on the research questions and the data. Two researchers coded each interview independently. The audio recording of each of the French interviews was transcribed in French, and the transcription was then translated to English. This ensured that interviews could be conducted in English or French, as appropriate.

The observation guide was used by the researcher to focus on the interactions with the EMR when shadowing the different members of the clinic staff.

Researchers analyzed the data from the survey, interviews and observations and wrote up individual case studies, which were shared with the clinics. The template for the case study report included sections for executive summary, introduction, methodology, limitations and challenges of research, EMR capabilities and use, workflow and process changes, organizational impact, key success factors, lessons learned, future plans, discussion and conclusions, and a clinic sketch.

To expand the body of knowledge about how EMRs were implemented and used by Canadian physicians, the individual case studies were summarized in the form of an easy to read, evidence-based "short story" and disseminated to the CMA members in print form.

To support knowledge transfer, we distributed the EMR case studies print publication [1] at the American Medical Informatics Association (AMIA) Fall 2009

Symposium, and conducted a workshop, "Experiences from the forefront of EMR implementation and use in Canadian primary care: benefits & barriers". Through group exercises, we explored the potential implications of our findings for advancing the uptake of EMRs in primary care. We asked participants to share their thoughts about why uptake of EMRs in Canada and US significantly lagged behind Australia and many parts of Europe.

Researchers used a qualitative analysis software program, Atlas.ti, to code transcribed data to an agreed upon set of 89 concept categories. Each interview transcript was analyzed by two coders for reliability. The researcher who completed the interview compared the two analyses, incorporated the second coder's perspective into the final coding, and then wrote up the final case study report. This report was reviewed for accuracy by the physician. A full case study report example is given in [7]. A thematic analysis was conducted for the cross-case analysis of findings from individual case studies. Survey data was used to complement qualitative data.

3   Results

The aim of the research was to address an information gap on EMR use in Canada. The primary focus of this paper is to give the physicians' perspectives on the benefits of EMR use and the barriers to EMR adoption.

3.1   Recruitment

The CMA used knowledge about its members to recruit 20 lead physicians from across Canada. The physicians who were interviewed in each study were EMR supporters and many had been involved in professional and advisory groups that addressed and resolved EMR issues. The case studies captured best practice.

The community-based physicians were in urban and rural settings and worked in a variety of practice types. Clinics were recruited from all ten provinces and the Northwest Territories. The clinics, their characteristics and years of EMR use are listed in Table 1.

3.2   EMR System and Use Assessment Survey

The pre-visit survey was completed for the 20 clinics. All participating clinics had used their EMR for at least 2 years, and, as shown in Table 1, 13/20 clinics had used their EMR for 5 or more years. Clinics varied by practice type, setting and geographic location. Due to the small sample size the results are neither generalizable nor representative.

A detailed analysis of survey findings was submitted to the study sponsors, the CMA and Infoway [2]. Survey results for items that dealt with electronic information functions similar to those asked about in the Commonwealth Fund survey [7] are given in Figure 1 [2, p19].

There was wide variation in the level of satisfaction with the EMR's clinical functionality. The majority of clinics were either highly satisfied or moderately satisfied with 9 functions within their EMR [2]. These were billing; scheduling/appointments; intraoffice communication between physicians and staff; entering patient encounter notes; scanning and storage of documents; generating and recording prescriptions; generating referral or consultation letters; generating patient reminders; and maintaining and generating patient summaries.

Some clinics were distinctly dissatisfied with downloading and direct import of lab results; ordering lab tests; completing forms; integration with clinical decision support tools; and accessing patient files from outside the office.

A few functions had a mixed level of satisfaction because the functions were dependent on interoperability. These included capturing and storage of X-ray images; accessing other information systems; electronic communication of patient information to other facilities; and electronic receipt of patient information from other facilities.

3.3   Case Study Reports

Full and summary versions of each case study report were written and made available on the CMA web site, http://www.cma.ca/EMRCaseStudies. Case study summaries were produced for the physician audience and published in two issues of the CMA's physician IT magazine, Future Practice (January and May 2009) and as a standalone document [6]. Each summary describes the practice setting; how the EMR was implemented; how the practice is using its EMR, including the benefits and challenges of the system; future plans for the system; EMR features; and, key lessons and advice for facilitating EMR adoption.

3.4   Themes Across Case Studies

A thematic analysis of data from the interviews and observations generated 20 themes. Two of these themes were "Benefits of EMR" and "Barriers to EMR adoption". These are described in depth below. Other themes were clinic culture and leadership; motivation; EMR capabilities and use; technical issues; scanning; workflow and process change-organization impact; implementa-

Location	Practice Type, Setting	Years
Yellowknife, NWT	Multidisciplinary; large group; rural/remote	3
Prince George, BC	Multidisciplinary; large group; urban; first nations	5
Victoria, BC	Primary care; small group; urban	7
Calgary, AB	Multidisciplinary; large group; urban	6
Raymond, AB	Family practice; small group; rural	4
Regina, SK	Specialist (ENT); solo; urban	6
Saskatoon, SK	Primary care; large group; urban	25
Portage la Prairie, MB	Multidisciplinary; large group; rural	4
Roblin, MB	Primary care; small group; rural	5
Hamilton, ON	Primary care; small group; urban	8
Ottawa, ON	Primary care; large group; urban	6
Paris, ON	Primary care; solo; urban	8
Willowdale, ON	Family practice; small group; urban	2
Montmagny, QC	Family practice; large group; rural	4
Rivière-du-Loup, QC	Family practice; large group; urban	10
Sherbrooke, QC	Primary care; large group; urban	8
Middleton, NS	Family practice; small group; rural	4
Moncton, NB	Primary care; solo; urban	3
Crapaud, PE	Family practice; solo; rural	19
St. John's, NL	Primary care; small group; urban	6

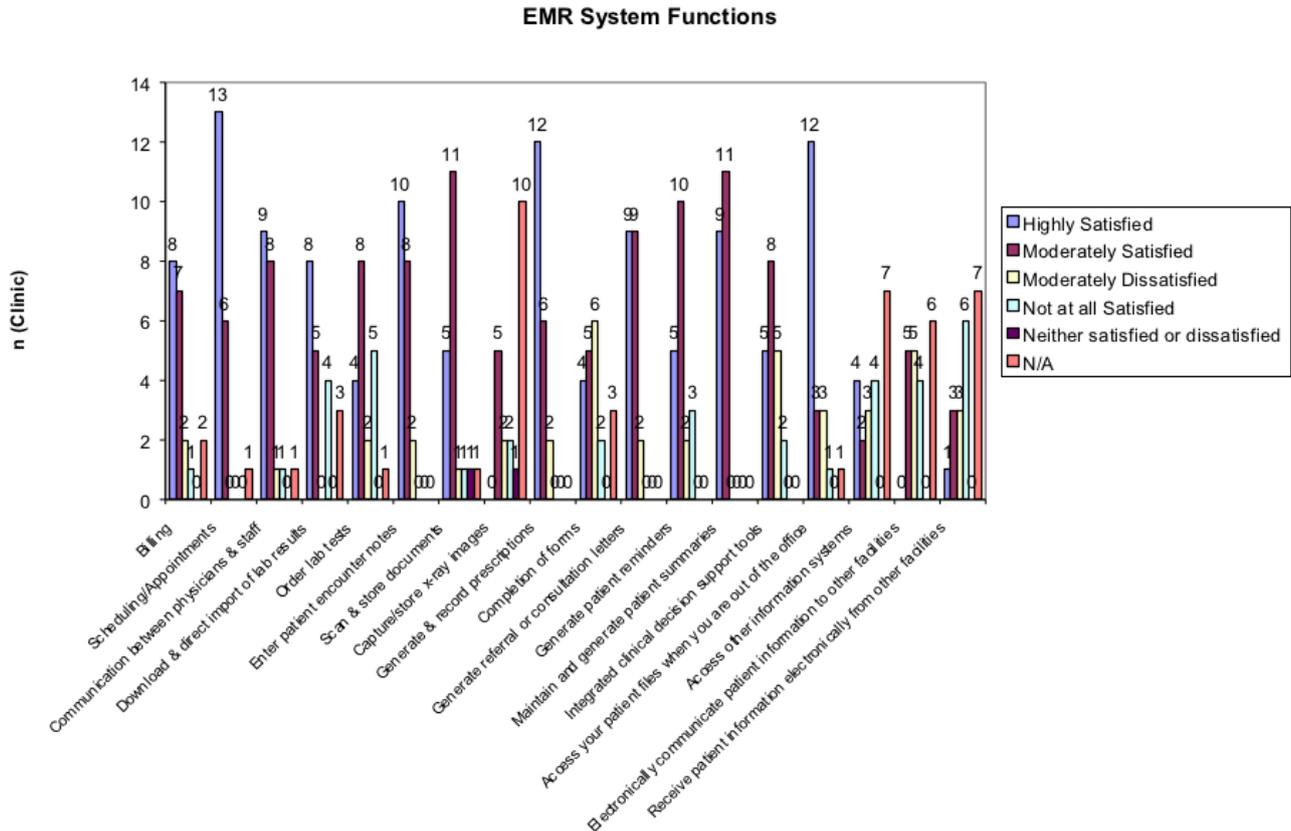*Table 1: List of clinic case studies*

Figure 1: EMR System Functions

tion strategy; productivity; impact on patients; patient perspectives; patient safety; key success factors and lessons learned; facilitators of EMR adoption; quality of care; costs versus benefits; efficiency; lessons learned; and future plans [2].

Benefits of EMR The first-hand experiences of physicians were expressed in interviews. There were 169 statements in the interview transcripts (N=20) that were coded as "Benefits of EMR". A subset of statements is associated with the EMR System Function question posed in the survey instrument (Figure 1). These are given in Table 2.

The intrinsic benefits were peace of mind at the end of the day, provision of better care and patient satisfaction. The benefits to the practice included reduced physician turnover, saved space and improved morale. The EMR facilitated creation of data available for research and/or practice audit. It made trainee management easier. The financial benefits appeared to accrue most often to the system as a whole rather than to the physician who made the EMR investment, so it was difficult for physicians to weigh the costs and benefits.

Barriers to EMR Adoption We asked respondents what they considered to be current barriers to EMR adoption in Canada. There were 80 statements in the set of transcripts (N=20) coded as "Barriers to EMR adoption". They addressed attitude, misconceptions, lost productivity, lack of interoperability, and outdated and restrictive legislation.

- Fear of change/mistakes

- Need to scan documents and possibility of introducing errors from this and/or data entry

- Lack of speed and reliability

- Need for expert IT support

- Start up delays due to need to populate

- Changes to office configuration

- Lost productivity

- Insufficient interoperability – "electronic island"

- Outdated/restrictive legislation

- Fee-for-service reimbursement model

3.5 Comparison

In Canada, 1,401 primary care physicians in fee-for-service practices completed the mailed Commonwealth Fund International Health Policy 2009 Survey of 11 Countries [5]. This was a 35% response rate.

Physicians were asked about their use of 14 electronic information functions in practice. These were: "EMR, electronic ordering of medications and tests, computer access to test results and medication lists, computer alerts/prompts, and decision support; computerized reminder systems for prevention and follow-up care; computerized ability to list patients by diagnosis, lab results, and medications; and electronic entry of notes and medical histories"[5].

Only 14% of Canadian primary care physicians responded positively to using nine or more of these functions. This was the lowest ranked response. In contrast, 92% of New Zealand physicians, 91% of Australian physicians, and 89% of United Kingdom physicians had adopted 9 or more of these functions [5].

Many of the EMR functions are dependent on interoperability with external systems in hospitals, labs and other health providers. In those countries with near universal EMRs, physicians were able to order lab reports electronically. Canada can learn from other countries that rated much higher on this survey about ways to enhance the adoption of EMRs in primary care. The findings from the Commonwealth Fund survey call into question why EMR use is not part of normal clinical practice in Canada.

3.6 Knowledge Transfer

The findings from the EMR case studies were shared with attendees at AMIA Fall 2009 Symposium and other venues. The significance of our research was that it was focused on real experience, and this led to a rich dialogue with participants about their own EMR experiences.

These experiences included problems with voice recognition in a noisy clinical environment, problems with structured data entry that skewed coding and the use of different systems in inpatient and outpatient settings that were not integrated.

In response to the question of why the uptake of EMRs in North America lagged behind Australia and many parts of Europe, three answers were discussed:

- In a capitalistic society, it is not easy to mandate change. Widespread adoption of EMRs is achievable if peers are using them.

- EMR systems can be horrible to use and developers do not pay sufficient attention to human factors engineering principles.

- The public does not demand them, in part because of the numerous negative stories about privacy invasion and lack of sanction for those responsible.

EMR System Function	Benefits of EMR as paraphrased from interviews
Billing	Improved clinical practice management; Improved billing accuracy
Scheduling/Appointments	More efficient workflow; Patient recalls; Improved patient safety through faster access
Communication between physicians and staff (i.e. intra office messaging)	Improved communications among physicians, staff and patients; Easier to manage another physician's patients; New staff responsibilities but no decrease in staff; More team-based care/better use of team members
Download and direct import of lab results	Electronic lab results available for trending; Electronic receipt of diagnostic test results is faster than paper
Order lab tests	Less duplication of results
Enter patient encounter notes	Easier generation of progress notes based on access to consultant's letters;
Scan and store documents (E.g. letters, faxes)	Data security and stewardship
Capture/store x-ray images	Found it quicker in the electronic record than in the chart
Generate and record prescriptions	Better medication management; Legible prescriptions and faster refills
Completion of forms (e.g. Prenatal, WCB, etc)	Templates for repeated tasks/practice;
Generate referral or consultation letters	Quicker referral letter production;
Generate patient reminders (e.g. PAP, mammogram, diabetes follow up)	Better management of population-level health measures; Provision of preventive health care services; More direct sharing of information with patients
Maintain and generate patient summaries/ cumulative patient profiles	Better organized patient information
Integrated clinical decision support tools (E.g. drug interaction alerts, chronic disease management guidelines, etc.)	Better chronic disease management; Improved patient management; Linked continuing medical education (CME) activities to practice; Direct links to clinical resources, such as medical journals; Decision support tools; Better access to high quality information and patient education materials–more patient education
Access your patient files when you are out of the office (remote access)	Improved access to data remotely
Access other information systems (E.g. Hospital clinical information system)	More efficient information flow
Electronically communicate patient information to other facilities	Easier to refer patients to specialists
Receive patient information electronically	Facilitates group communication and integrated patient care

Table 2: Statements coded as "Benefits of EMR"

Attendees concluded that: the social benefits outweigh barriers, EMR use should be started in medical school and there is a need to re-engineer practice and champion EMR use.

4   Discussion

Our results demonstrate the breadth and depth of Canadian primary care practice and show that the drivers for EMR implementation and use are as variable as the practices themselves. "Despite this, the common message is that not one clinic would return to paper-based charts, even if paid to do so" [1,p.2].

The organization responsible for paying for the information infrastructure plays a role in controlling choice. This leads to health information technology policies which demand that EMRs conform to a set of standards and fulfill other criteria in order to achieve interoperability. Further study of the impact of such policies on EMR adoption by physicians is needed. The CMA is committed to helping to develop policies and to ensuring that information technology investments lead to better health outcomes (patient safety, wait-time reduction), increased accessibility, better integration of health care "silos," cost efficiencies and improved patient/consumer satisfaction" [11].

From a technological perspective, clinicians need to work with the vendor to ensure the creation of adaptable systems that are responsive in this culture of change. An implementation strategy using a socio-technical model based on the incorporation of human factors engineering principles may help increase EMR uptake [12].

It has been recommended that the Canadian research agenda for health informatics be dominated by the requirements for usable, useful and used systems [13]. We know from literature that integration of EMRs into workflow takes time and the technological change process needs to be managed [4,12].

The key message that arose from this research is that there is a need to spread the good news about the actual benefit of EMRs to patients. Not knowing the benefits of EMRs is a key barrier to their adoption and use.

In our case studies, the clinics were using an EMR that integrated clinical and administrative data. This integration was a key success factor in improving clinical and administrative workflow.

Successful implementation of an EMR requires strong clinical leadership. EMRs introduce change, and this needs to be managed. A collaborative work culture was found in the best practices that we researched. However, many jurisdictions still have outdated and restrictive legislation that hinders electronic communi-

cation. More work is required to bring health policies and procedures into alignment with modern technology.

5   Conclusion

The EMR case studies expand our knowledge base and improve our understanding of benefits and barriers to EMR use in Canadian primary care. The areas that need further research include financial, social, policy, pragmatic and human factors engineering issues which affect EMR implementation.

Acknowledgements

Conflict of Interest

No conflicts of interest.

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