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NORTH AMERICAN PERSPECTIVE

Current use of electronic medical records in primary care of chronic disease

The implications for clinical governance

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(Information about the authors can be found at the end of the article.)

Abstract

Purpose – This paper aims to explore the perceptions of facilitators and barriers to their using electronic medical records (EMRs) for these functions and contributes baseline data about the use of EMRs for chronic disease management. The sub-study reported here is a baseline process evaluation of EMRs and their current use, preliminary to a larger, pragmatic, randomized controlled trial. Its purpose is to understand how EMRs are currently being used by primary care physicians to facilitate chronic disease prevention and screening in their practices.

Design/methodology/approach – This is a qualitative case study where the lead physician at each of eight primary care clinics (four in Alberta, four in Ontario) participated in semi-structured interviews. Data were analyzed using thematic content analysis.

Findings – Although EMRs are being used in a limited fashion for chronic disease prevention and screening, clinicians identified few current benefits. Participants noted some instances in which paper charts were preferred and that the lack of human and financial resources is inhibiting the use of chronic disease applications already incorporated in EMRs.

Research limitations/implications – To understand fully how EMRs can best be used in the logistical management of chronic disease prevention and screening requires research efforts towards improvement of the data structures they contain.

Practical implications – Data extraction needs to be easier so that screening of patients, at risk or living with chronic disease, can be facilitated.

Social implications – Evaluation of the benefits, for the content of care and care relationships, conferred by this new method of communicating, needs to be complemented by a parallel exploration of the risks.

Originality/value – The paper illustrates that with the tremendous investments in EMRs it is important to learn how changes in their design could facilitate improvements in patient care in this important area.

Keywords Electronic medical records, Chronic disease, Screening, Prevention, Quality of care, Primary care, Record keeping, Canada

Paper type Research paper

NTS is the senior author on the BETTER case study process evaluation. She designed the study, including the data collection instruments, and provided editorial advice. DM and EG are senior investigators of the BETTER Coalition. VA conducted the interviews and observations, wrote the manuscript, and performed the data analysis. All other authors are members of the BETTER Coalition.

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Introduction

The promotion by policy makers of electronic medical records (EMRs) as a means to realize efficiency and cost savings requires careful evaluation. The rapid pace of healthcare innovation and change in practice, policy, and technology carry the potential for unintended consequences to care delivery. Unintended consequences resulting from EMR implementation can reduce the quality of care delivery and precipitate potential adverse health events (Harrison *et al.*, 2007). As primary care physicians are increasingly turning from paper records to EMRs with the goal to improve care for patients, understanding how the quality of patient care is impacted as a result of the new system is critical to the sustainability of EMRs (Bergamaschi *et al.*, 2006). Early research has not definitively concluded that the use of EMRs can improve or reduce the quality of patient care. Thus, this case study attempts to explore how EMRs are used and how that use influences the quality of chronic disease prevention and screening.

Previous research has explored various aspects of clinical governance and the potential of EMRs to improve such quality assurance practices. For example, Hillestad *et al.* (2005) claims the information kept in paper records cannot promote better care than EMRs as EMRs can better facilitate coordinated care, the measurement of quality, or the reduction of medical errors. Murray *et al.* (2011) predict that health informatics may lead to improved healthcare quality of efficiency. Conversely, there are challenges associated with integrating a new information system, and these challenges have plagued EMRs with stasis. Thus, evaluating the use of EMRs is imperative in ensuring that existing systems are used optimally in primary care, and to design future systems to deliver on the vision of improved coordination, safety and efficiency.

Shaw (2006, p. 713) defines clinical governance as "concerned with accountability, professional responsibility, clinical audit, quality improvement and quality assurance". With respect to primary care and chronic disease, clinical governance is particularly important in the improvement of quality patient care as interactions between health professionals and patients are becoming more complex (Bergamaschi *et al.*, 2006), especially with chronically-ill patients who require more attention from a healthcare team.

A major challenge is that, as the point of entry to the health care system, primary care must work to screen and prevent a broad spectrum of conditions simultaneously, and for patients who present irregularly, and frequently with concomitant acute concerns. EMRs can promote the opportunity to improve disease management, overall wellness, and create a patient-physician partnership (Holbrook *et al.*, 2009; Demiris *et al.*, 2008; Grant, 2009). While the adoption of EMRs is increasing in Canada (Nemeth *et al.*, 2008; Kondro, 2007), the effectiveness of EMRs in facilitating the ambulatory care of chronic diseases has been less than expected. Only 8 per cent of Ontario family physicians use EMRs to send reminders for cancer screening, and only 45 per cent use electronic reminder systems for any form of patient care. (Ontario Health Quality Council, 2009). Main barriers to the uptake of the existing functionality include a lack of awareness of how to use the system and how to incorporate these functions efficiently into clinical workflow. In addition it has been shown that for EMRs to be used effectively for CDPS it must be non-interruptive and at the point of care (Schnipper *et al.*, 2008). When the functionality for CDPS is non-interruptive we do see improved healthcare delivery based on these guidelines (Follen *et al.*, 2007; Garrett and

William, 2002; Griever, 2009). While widespread EMR adoption is projected to save costs by improving efficiency and safety, it is projected that EMR enabled CDPS and management could eventually double these savings. (Hillestad *et al.*, 2005) Canada still lags behind most European countries in EMR uptake, and while federal, provincial and territorial governments have spent billions of dollars on the problem, EMR use among family physicians has not dramatically increased. As a result, studies such as this one are important in order to understand why it is that EMR uptake lags and where potential opportunities lie to overcome these challenges.

The BETTER process evaluation of the practice intervention is a sub-study of the larger pragmatic randomized controlled trial "Building on Existing Tools to Improve Chronic Disease Prevention in Family Practice" (BETTER) project. The BETTER project aims to improve chronic disease prevention and screening (CDPS) for cardiovascular disease, diabetes, and cancer (breast, cervical, colorectal and lung) in the family practice setting. A key element of the project is an evaluation of the existing use of the EMR by a practice facilitator who, working together with the clinic teams, derives a tailored intervention to enhance the function of the EMR to promote CDPS of the target conditions in their practice.

The objective of this sub-study is to understand how EMRs are currently being used by primary care physicians to facilitate chronic disease prevention and screening in their practices. It explores their perceptions of facilitators and barriers to using their EMR for these functions. Baseline data collection on the use of EMRs for chronic disease management was also obtained.

Methodology

The BETTER process evaluation of the practice intervention is a sub-study of the BETTER coalition's larger investigation which aims to improve chronic disease prevention and screening (CDPS) for diabetes, cancer, and cardiovascular disease in family practice settings through:

- *Patient-level intervention*. A "prevention practitioner," trained by BETTER in CDPS maneuvers and care paths meets with patients for a 60 minute visit to discuss their risk for chronic disease and develop a personal prevention prescription.
- *Practice-level intervention*. A "practice facilitator" will complete a needs assessment to identify barriers and supports to improve CDPS at the clinic level, and help the clinic to develop a "practice prescription" which includes enhancing the clinic's use of their electronic medical record.

This case study differs from the larger BETTER investigation as it aims to examine whether clinics are using electronic medical records effectively to manage chronic diseases in a primary care setting. Plainly, this case study looks at how electronic medical records are used to manage chronic disease after patients have been identified as having a chronic disease or are on the cusp of developing one.

A case study method was chosen for this investigation as a practical way to explore and describe current practices. Case study method allows for the in-depth examination of a single phenomenon through extensive description and contextual analysis. This case study is unique in that it is designed as a case study within action research. The case study is exploring not only the uses of EMRs for chronic disease prevention and

screening, but also how the BETTER action research is affecting change of the clinics' uses of an EMR. As a result the findings can potentially provide insights into how EMRs are being used as well as how action research aimed at improving EMR use alters the use of the system. As this study is a case study within action research we can look for a change in the use of EMRs because of the EMR intervention. The data collection methods reflect this through a before-after design.

Data collection

A mixture of academic and community family practice clinics, eight in total, (four Alberta-based and four Ontario-based) from the BETTER Project were used as the research sites for this case study. The same data collection process was employed at each of the eight clinics, which varied in size and number, where one physician from each of the eight clinics was interviewed. The physicians at each of the clinics participated in semi-structured interviews for 30 minutes to an hour in order to gather in-depth data about EMR use in the clinic. The interviewer had an interview guide to follow throughout and ensure interview completeness. Interviews were audio-recorded and transcribed by an external contractor to reduce any transcription bias.

Data analysis

Case study findings were analyzed on an individual case basis. Following Yin (2003), we relied on the theoretical propositions that led us to this research study, thought about rival explanations and developed a case description. Interview transcripts were analyzed thematically and quotes from the interviews were used to highlight key findings. Qualitative analysis software, ATLAS.ti, was used in analyzing the interview transcripts.

Reliability

To ensure reliability, each interview transcript was analyzed by two separate coders, one of whom was the interviewer. The research team developed concept categories, individually coded the articles with the assistance of ATLAS.ti and then the second coder sent the interviewer a coded copy of the transcripts which was compared and used to incorporate the second coder's perspective.

Theoretical propositions

Sociotechnology, originally coined by the Tavistock Institute, is a theory that looks at the combination of social and technical bodies into one communal entity. This theory has been used extensively in health informatics research as information and communication in healthcare is critical to the effective delivery of healthcare services. The tension between the importance of information and communication and the delivery of services in healthcare is reflected in socio-technology as the theory does not place uneven importance on the social or technical components of systems. Lindgren and Eriksson (2010) infer that evaluations should be approached through a sociotechnical lens as it can illuminate the change of work routines and culture which may impact the system's use. A socio-technical approach is taken in this study as it is a case study embedded in an action research study. Therefore the theory allows the researchers to look at the influence of EMRs on chronic disease prevention and screening from a quality of care perspective.

Results

From eight interviews, over 150 codes were drawn out through data analysis, which resulted in the creation of major categories. Major categories included: change management, communication and information management, gaps in functionality, training, EMR improvements, and security, privacy and patient safety concerns. While all these categories are critical to the understanding of current EMR use, of interest to this article is the category provision of care changes. This category addresses several factors as to how physicians perceive the quality of care to be improved through EMRs, how paper charts are optimal in some aspects of care, and the intervening conditions that affect the extent to which EMRs are used to improve the quality of patient care. The following results section will outline the findings from the case study, and the discussion section will connect the findings with the theoretical propositions of the case.

Quality care improvements

Participants noted different areas in which the quality of care, specifically chronic disease management, is perceived to improve while using EMRs. Areas in which the participants viewed an improvement to chronic disease management when using an EMR included: improved information retrieval, data extraction and the integration of care.

Information retrieval

Electronic information systems are assumed to improve the organization and retrieval of important information. While this is an important benefit, the significant improvements to patient care have sometimes been overlooked by this basic assessment. Participants frequently emphasized how improved organization and easier information retrieval enhanced patient care. "It allows me to have more time to spend talking to the patient rather than searching things through the chart" (Participant 8). Theoretically this would allow physicians more time to discuss issues with patients, instead of using that time to retrieve information, more opportunities for fruitful discussions with patients which allow for more information capturing and the potential to enhance the patient-physician relationship. Information which is easily retrievable allows physicians to better see the gaps in information within the chart, "being able to find their [patient] data, so that when you go into the exam room you're not shuffling through a whole bunch of paper to find stuff. It's definitely brought more structure to the way that you're collecting data from patients as well. . .you're not going to forget to ask them whether or not they've had their eyes examined in the last two years because there's a prompt in the EMR to do it" (Participant 7). Assumed to be complete charts reduce the chances of health care providers missing a critical piece of information which is particularly important in diagnosing a condition or deriving a chronic disease maintenance plan. Enhanced information retrieval through the EMR can improve the quality of care as patient charts are more complete and physicians can find information more efficiently.

Data extraction

The potential of EMRs to assist physicians in screening for chronic diseases at the practice level is something that was difficult to accomplish with paper charts. One participant noted that EMRs are "a much smarter way of handling data and it's the only way to really implement the kind of primary care-based preventative care that every jurisdiction is pushing for right now, because the only way to do it is with an EMR. You

cannot track data and you can't look at outcomes and targets unless you have an easy way to manipulate your data" (Participant 2). Being able to track data is useful for the physician's ability to see all the data and make more informed decisions regarding treatment courses, maintenance plans, or other medical decisions. Access to patient data, and the capability of EMRs to pull the data efficiently, is important in screening and preventing chronic disease, as well as epidemics, such as H1N1. One participant noted that in the previous flu season, the clinic was able to identify high risk patients in order to contact them (Participant 7). Functions such as those used in the previous example have widespread applications in improving the quality of care as high risk patients are able to become vaccinated before getting sick which can substantially reduce the risk of hospitalization, complications, treatment setbacks, or even death.

Improved integration of care

EMRs are useful in clinics where multiple health care providers are working together with one chronically ill patient. Various allied health professionals can provide different levels of care and types of support. The EMR is perceived to improve the quality of care as the health team can see each other's notes and the patient's progress from different perspectives. "I think that because they [allied health professionals] have greater to access to the chart they therefore have better knowledge of the patients. So they can take more direct responsibility. Our nurse, for example, can do a lot more phone triaging, phone counseling communication of results, and checking what's been going on in the charts" (Participant 6). Having a more complete picture of the patient, the patient's history, and the opinions of other health care professionals can improve the quality of patient care as each professional has a more detailed picture of the patient's health. The varying perspectives from different health care providers are important in facilitating more coordinated care and efficient treatment of chronically ill patients. "I think it [the EMR] provides better care of patients because the team knows what's going on with somebody, and the communication is relatively clear. When you have more people thinking about an individual's care and providing their different perspectives, I think it provides better care" (Participant 1). Further, the EMR facilitates improved communication among the health care team, which relates to the believed improvement of patient care. Moreover, EMR integration can enhance patient care as different levels of care are provided for in a single clinic setting where the patient is comfortable with the environment and the health care providers know one another.

Paper chart preferences

While participants described several positive outcomes from using EMRs, careful consideration must be taken to understand where paper charts are preferred in chronic disease management. Not one participant discussed a detriment to patient care in using EMRs, however many raised areas of care provision in which paper charts were superior in chronic disease management.

Paper chart as superior

While some aspects of chronic disease management are better served using EMRs, participants indicated that information retrieval was more efficient or easier to find with paper charts. "The diabetes flow sheet I much preferred the paper, it was in one spot you didn't have to scroll, I could see everything at a glance... So, I really don't like

it, it was much easier for me to use the paper one... I liked it where I knew where it was, it was a different colour paper in the chart, I looked at it and at a glance I could see everything" (Participant 3). There are always comparisons between different systems and this quote highlights the importance of understanding that there are features of the EMR which are not superior to some paper processes. Another participant highlights the inefficiency of the system in signing off on faxes, "What's problematic is if you get faxes coming in, you can't just sign off a fax, you have to actually log in to the patient encounter and then change the med [medication], so, it takes extra steps" (Participant 4). These inefficiencies, while appearing minor, can tie up a physician for a couple of minutes each time which overall leads to time consumption in the physician's day.

Intervening conditions

Various intervening conditions are hindering further improvements and upgrades in EMR use. These intervening conditions, the lack of resources and data structure, affect the use and advancement of the EMR in improving chronic disease management.

Lack of resources to improve EMR

Several resources, including human and financial, are required to improve or just maintain an EMR within a clinic. Participants noted that the lack of such resources were the main causes of EMR underutilization or stasis, "that's a whole new job that didn't exist before, which is a fair bit of work for somebody. It's a benefit to patients, but it's a new task that didn't exist before and costs resources. And those increases in quality take time" (Participant 4). Resources required to improve the quality of care through EMRs are not always available or clinics do not have time to educate themselves on the system. Consequently, this hinders the improvements to patient care as the physician is not utilizing all available EMR functions. The BETTER project is focused on reducing this gap by providing clinics with a prevention prescription which will focus on how clinics can optimize the use of existing information tools and resources within the EMR to improve chronic disease prevention and screening. With clinic revisits after this prescription has been filled we hope to see a change due to the intervention by the BETTER project's practice level intervention in this area.

Lack of data structure

A second main condition which affects the improvement of EMR use in clinics is the lack of data structure required to effectively extract patient information. Free texting options in the EMR allow different health care providers the opportunity to call conditions by unique names. For example, one participant explained that physicians could describe a patient who previously smoked as, an "ex-smoker", an "ex smoker", or make a spelling error. In creating queries the small differences in typing would exclude those patients from the results. This impedes the physicians' ability to appropriately survey their population and effectively prevent and screen for chronic diseases.

Discussion

As electronic medical records (EMRs) become more prevalent in primary care practice, physicians have increased comfort with using EMRs. In the observed clinics all EMRs have been in place for at least three years, meaning that the EMR is not a newly

implemented system, thus the research team assumes that the clinic has had the opportunity to use the system. Accordingly, EMR use has influenced the provision of care to some degree with the introduction of an EMR into primary care practice. The assumed intention of integrating EMRs into primary practice is to induce clinical improvements to the delivery of health care. Preliminary findings from this study describe how these changes affect clinical governance and look at perceived changes to patient care in terms of benefits, preference for paper charting, and intervening conditions. The socio-technical underpinnings of the study assist in the explanation of how these perceived changes are influencing the provision of care.

Socio-technology theory focuses on the critical influence that the social environment and technology places on its users. Understanding the extent to which the use of EMRs impacts the quality of chronic disease prevention and screening in primary care practice can be explored through this theory. Participants emphasized the quality of care improvements realized through the introduction of the EMR. The ease of retrieving and extracting data from the EMR positively impacted their perceived ability to improve care for their patients. Previous literature illustrates the importance of ease in providing quality care as Harrison *et al.* infers that if a system is easy to use and follows the workflow of a clinical environment, then the system will be used appropriately with improvements to the quality of care. This principle was illustrated in the case study as participants noted that improved information retrieval and gathering assisted in the increased time with patients. Time with patients is highlighted by Harrison and Saleem *et al.* (2005) as an indication that the quality of care may be improving not only because of increased face-to-face communication opportunity, but also because it affords the healthcare provider time to input information at the point of care increasing the accuracy of the information.

Alternatively, if the system does not fit well in existing clinical workflows, then previous processes will continue to be used. Ash *et al.* (2004) call this phenomenon a "workaround" and is defined as "clever alternative approaches, are artfully developed by the users... allow users to live with the system while avoiding some of the demands that are deemed to be unrealistic or harmful" (Ash *et al.*, 2004, p. 108). This phenomenon is reflected in participants highlighting their continued use of paper charts for Diabetes flow sheets as it was easier to navigate than the electronic version of the flow sheets. Workarounds, although seemingly innocent, undermine the EMR and can cause confusion or potentially lead to miscommunication and patient harm.

A main principle of socio-technology theory is the interaction between a system and the organizational social structure it is housed. Seminal work by Strauss (1985) delineated an important concept for health informatics research, the social organization of medical work, which claims that the interaction between healthcare providers is a critical feature in health informatics design and eventual success (Ash *et al.*, 2004). In this case study, participants stated that the EMR allowed for increased integration of care across the continuum as providers from different disciplines are able to enter information and access other providers' notes on a shared patient. This increased visibility and expression of perspectives has created the perception of an improvement to the quality of patient care.

Realized improvements to the quality of care through the use of EMRs can be quickly undermined through the lack of resources to enhance an existing EMR. Participants highlighted the lack of financial and human resources to fill the resource gap between old

processes and new processes stemming from EMR implementation. The limitations of EMRs can be further compounded with inadequate resources. As an example, participants noted that the lack of data structure and high volumes of free text impeded their ability to perform population searches and properly screen for potential chronic ill patients. Functionality gaps can potentially create problems in the establishment of EMRs in everyday clinical workflows as healthcare providers must still rely on paper records to record and retrieve patient information. Although there are many factors which can influence the inability of a clinic to become truly paperless, the lack of resources to effectively move towards such an environment is an important consideration.

Conclusion

Electronic medical records (EMRs) have been viewed as a major tool in the improvement of quality patient care in primary settings. This study explored the current use of EMRs in the screening, prevention and management of chronic diseases to improve the quality of care. There are two main limitations of this study; first one of the eight interviewees is an executive member of the BETTER project. Although not involved in the design of the sub-study and not privy to analysis procedures, the participant has a general knowledge of the aims of the study.

The findings are not conclusive as to if these changes are overwhelmingly for the better or stasis of patient care, however preliminary findings indicate that these changes are significant in understanding how EMRs are believed to affect the individual clinic, users, patients, and the health care system. Follow-up research will reassess the perceptions of the clinics to the use of their EMRs for CDPS following the EMR intervention of the BETTER Study. We will endeavor to assess perceptions of the impact of the intervention on factors which facilitate or hinder CDPS.

Future research should look into improving data structure in EMRs in order to more effectively facilitate data extraction and screening of patients with a risk for or living with chronic disease It would be beneficial to investigate the benefits and risks that this new method of communicating has for the content of care and care relationships.

Findings indicate that physicians' perceptions that the use of EMRs improve the quality of care are related mainly to the benefits of enhanced information retrieval and data extraction. The EMR facilitates better screening of patients and enhances the integration of care within individual clinics. However, various qualities of paper charts were preferred particularly in some charting instances where the layout of a printed page is easier to review. Conditions perceived to effect the improvements of EMRs included the lack of financial and human resources and data structure. Nonetheless several participants highlighted the importance of EMRs and the ability of such systems to improve the quality of care, specifically in managing chronically ill patients. Understanding how EMRs are used in managing chronically ill patients is imperative to the continued innovation in health care service delivery.

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