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Implementation of an electronic medical record in family practice: a case study

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ABSTRACT

Background Electronic medical records (EMRs) have the potential to foster a safer, more effective and more efficient healthcare system. However, their implementation in primary care practice remains a challenge.

Objective This study aims at exploring factors that have influenced the successful implementation of an EMR system in a family medicine group (FMG) in the Province of Québec, Canada.

Methods A case study approach was selected to get a deep understanding of the phenomenon in its context. The case was chosen on the basis that it was the first FMG in Québec to implement a full EMR used by all clinicians. Fifteen semi-structured interviews were conducted with key informants.

Results Factors that have influenced the success of the EMR implementation were classified under

three broad themes: a project leader who combined the roles of clinical, technology and knowledge champion; an organisation that was open to and supportive of change; and an evidence-based implementation strategy tailored to the local context and adoption pace.

Conclusions This study underscores the importance of a champion for successful EMR implementation. It proposes a set of roles and characteristics that could be found in a champion as well as other elements for a successful EMR implementation strategy.

Keywords: champion, electronic medical records, family medicine group, implementation, knowledge transfer

Introduction

Electronic medical records (EMRs) integrate various tools that could improve clinical decisions and thus favour a safer, more effective and more efficient health-care system.¹ Since the 1990s many countries have experienced the implementation of EMRs in primary health care. While some European countries, such as the Netherlands, report over 90% use of EMRs by primary care physicians, the situation in Canada is very different.² Despite a recent report stating that the number of EMR projects has risen from 53 to 254 over the last three years,³ Canada is still lagging behind many other industrialised countries.⁴ At the same time, Canada is implementing an ambitious project featuring an interoperable electronic health record (EHR) comprising a set of basic health information (emergency, medication and lab tests) that will eventually communicate with (but not replace) the more extensive EMR. In Québec this ambitious project has led to family medicine practices and hospitals engaging in choosing and implementing EMRs.

Primary care has unique characteristics with specific data and information needs that require suitable informatics solutions. Previous studies suggest that high-quality primary care can be enabled through computerised health records.⁵ Therefore EMRs could improve patient safety and the efficiency of primary health care.⁶ Primary care EMRs need to provide integrated information for better decision support.⁷ However, technological standards, better coordination across healthcare levels and incentives for physicians are still needed to facilitate EMR implementation in primary care.^{8,9}

Over the last few years, there have been some successful EMR implementations in specific regions

of the Province of Québec. However, at the time of the present study, only one rural family medicine group (FMG) has implemented a full EMR system. This article reports on the implementation of an EMR in this FMG and on factors leading to its success.

Context

In Québec, the first FMGs were created in 2003. These are accredited networks of physicians and nurses established by the Québec government in order to promote better access to care and better follow-up for patients.¹⁰ The FMGs are integrated either into private family medicine practices, community health centres or family medicine units in hospitals. They have a more extensive role in the primary care network and, with these changing structures, the need to implement systems that facilitate communication between the various providers and settings became obvious. The provincial government secured some funding to computerise the FMGs. In spite of that, medical records have remained mostly paper based in the majority of FMGs.

Among the few FMGs that have adopted an EMR system, one constitutes a particularly interesting model of success since a full EMR has been implemented, comprising; scheduler, billing, alerts, computerised orders/results, imagery, prescriber, clinical note and e-documents (Figure 1). This EMR is based on a secured network linking five physical sites and can also be accessed from clinicians' home with a secured authentication token.

A case study was conducted in order to gain a deep understanding of the process of implementing an EMR in this FMG and to highlight specific factors that were

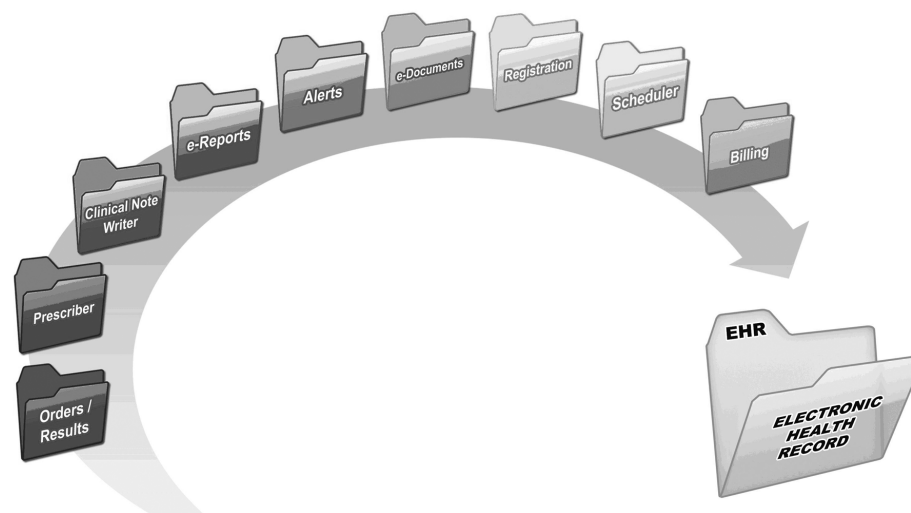


Figure 1 Clinical and administrative components of the electronic health record (EHR)

believed to have influenced the success of the implementation. This study was part of a larger research project which aimed at exploring the use of knowledge in decisions related to various e-health applications in the Québec healthcare system.¹¹

Methods

Case selection

The FMG that was identified for this case study is located in a peripheral region approximately 60 km from Québec City. It was selected on the basis of a successful implementation of EMR defined as the implementation of a full EMR and its use by all providers. This FMG is constituted of a family medicine clinic offering consultations through appointments or walk-ins, where family physicians are also responsible for hospital activities such as emergency hospitalisations and deliveries, as well as home visits and care for patients in long-term facilities.

Participants

The physician responsible for this FMG was first contacted to explore the group's interest in participating in the research project. Potential key informants were then identified through a snowball sampling technique. Purposive sampling was used to recruit respondents with different perspectives about EMR implementation and all professional groups were involved in the study. Recruitment of key informants ceased when all groups had been covered and when interviews did not furnish any new information, thus indicating data saturation.¹²

Research method and strategy

An in-depth case study method was selected since this strategy allows investigation of a complex phenomenon in a comprehensive way, by situating it in its social, political and historical context.¹³ An interview guide was formulated based on the literature on successful EMR implementation and on the previous research experiences of the team members.^{14,15}

Semi-structured interviews were conducted at the respondents' work site. All interviews but two were conducted with single individuals; two interviews involved two respondents from the same group of participants. Before their interview, participants signed a consent form. Interviews were audiotaped and lasted 50 minutes on average.

Analysis

Interview transcripts were analysed qualitatively with the N*Vivo software. We started with a deductive approach based on the review of the literature on successful EMR adoption that had provided the basis for our interview guide. Then an inductive approach was taken for the thematic analysis of interview content.¹⁶ The first interviews were codified independently by two investigators and a final codification frame was elaborated through consensus.

EMR adoption factors were first classified according to eight categories, based on the literature:

- 1 individual, i.e. personal characteristics of the user and attitude towards the technology (perceived benefits and drawbacks)^{14,17}
- 2 professional, i.e. professional roles and responsibilities and relations between colleagues^{14,17,18}
- 3 organisational, i.e. vision, leadership, support to users, communication, presence of a champion, involvement in EMR implementation and project management^{14,19,20}
- 4 contextual, i.e. external factors affecting the project, external perception of the project and particularities of the healthcare system^{17,21}
- 5 political, i.e. factors related to decision making at the central level and to healthcare policies¹⁴
- 6 financial, i.e. factors pertaining to project funding, costs and benefits
- 7 legal, i.e. laws and regulations that could affect the project¹⁷ and
- 8 technological, i.e. satisfaction with the technology, training and technical support.^{14,20}

Results

Table 1 presents the characteristics of the key informants interviewed. A total of 15 interviews were conducted. All those who were contacted agreed to participate in the study.

Individual factors

Personal characteristics

Individual characteristics such as interest in and familiarity with informatics, and being open to change, seem to play a key role in explaining variability in adoption between individuals. According to key informants, individual characteristics were taken into account in the implementation strategy. Therefore, professionals with greater openness were first targeted

Table 1 Characteristics of key informants

Characteristics/role	<i>n</i> (%)
Users	
Physicians	5* (27)
Nurses	2 (13)
Secretaries	2 (13)
Regional managers	2 (13)
Local managers	2* (13)
Informatics responsible	2 (13)
Medical informatics expert	1 (7)
Gender	
Male	8 (53)
Female	7 (47)

* One of the key informants has two roles: user and local manager. The percentage has been calculated on four physicians because the fifth is also the local manager

for EMR adoption, so they could then act as change agents and support their colleagues who showed less interest.

Also, it is important to stress the specific characteristics of one of the respondents who acted as the champion for this EMR project. This champion was described as someone with a marked interest in and aptitude for informatics, and who showed strong leadership, an ability to persuade others and entrepreneurship.

Attitude

At the time the study was conducted, one year after implementation of the EMR, respondents generally perceived many benefits from its use. Direct and quick access to complete information about a patient, available from various sites (clinic, hospital and home), and information sharing between professionals working in teams were the most frequent advantages reported by informants. The EMR was perceived as being central to patient follow-up since it allows what has been done by the all actors involved in care, from nurses to physicians and from the lab to the pharmacy, to be seen. As this respondent reports:

‘So well, it’s medical information at your fingertips, complete and comprehensive in such a way that he understands your situation today, the doctor gets insights from your past situation, and he’s able to say: “look, to the

best of my knowledge, that’s my diagnosis and here’s the treatment I prescribe you”.’ (07)

Time savings were reported by several users once the EMR was fully implemented. For instance, not having to search for paper records, to call a colleague for missing information, or write repeat prescriptions were among the benefits mentioned by respondents. Furthermore, the EMR could improve information quality and some physicians have reported being more methodical with the EMR. Many respondents also reported EMR benefits for the patient, such as better and faster access to information (e.g. lab results), all information being centralised in one record, and the possibility of printing a medication list with a clinical note when the patient is travelling.

Most of the drawbacks perceived by respondents consisted of difficulties that occurred during the transition period before full implementation of the EMR. In fact, except for the concerns expressed by some respondents regarding possible loss of data and computer bugs, users mostly perceived advantages of the EMR once fully implemented.

Professional factors

Workload

During the transition phase, when the components of the EMR were gradually implemented, an increase in workload was reported by users. Some tasks, such as document scanning, required clerical users to do overtime and all users experienced an adaptation period that demanded particular efforts:

‘There has been a difficult period, at the beginning of the project, the first three months or so, for the adaptation. After that, normally, things are falling in place and everybody is happy for having done the necessary efforts to get there.’ (15)

Team work and work processes

As it was well accepted by all the different groups of users, be they healthcare professionals or support personnel, the EMR was also described as a tool to improve team work between those groups. However, respondents also recognised that the EMR posed a particular challenge since it led them to reconsider their work processes.

‘You have to accept to question your actual modes of functioning in order to make technologies be really useful. It changes the whole dynamics of interprofessional relationships and work organisation, and some people are not ready for that.’ (14)

Organisational factors

Leadership and presence of a champion

The presence of a clinician who combined extensive knowledge of informatics with leadership skills recognised by his colleagues appeared to be the most important factor that has favoured EMR adoption in the FMG in question. His role as a technology champion and an organisation leader has had a positive impact on decisions that shaped the implementation of the EMR, since all interviewees agreed on the key role that this champion had played in the success of the project. Interview quotes describing his various roles and characteristics are reported in Box 1.

Evidence-based implementation strategy

The development of a planned strategy based on the literature on information and communication technology (ICT) adoption played a role in this EMR implementation. The champion, having received advanced training in medical informatics, was particularly inter-

ested in ensuring knowledge transfer to the various players involved in the project. He therefore developed a progressive and tailored training program (available electronically) and periodically presented communications at meetings involving users.

‘Often, he sends us messages with all the programming, how to do when there is a new follow-up. So, all physicians and nurses are informed at the same time. There are many ways to transmit new information.’ (03)

The key elements of this evidence-based implementation strategy are detailed in Box 2.

Innovation culture and openness to change

Another organisational factor that influenced EMR adoption according to the users was the particularly innovative culture of their organisation. Respondents reported how the culture of exploration, experimentation, collegiality and participation that characterises

Box 1 Roles and characteristics of the champion

Roles

Building a bridge between developers and users

‘In fact, you need a clinician; you don’t have to be a computer specialist . . . who has credibility that makes people say: “OK, let’s go there” and he will ensure that the clinical aspect is not neglected. We won’t get into a trap where nobody is accountable for a problem.’ (05)

Participation in the design

‘It is essential to have someone here who will work with programmers in order to adapt the various applications to the reality of our clinical practice, someone who will act as a bridge.’ (09)

Key role in decision making

‘He (Dr X) has a certain vision, so he told us about those things and if we disagreed or we had other suggestions, we could make it. But the person who made decisions in all that implementation was Dr X, in fact.’ (15)

Knowledge transfer

‘Dr X participates in all EMR pilot projects. He’s always solicited for participating in project committees.’ (07)

Technical support

‘Here we are lucky; we have a Dr X who could help us at almost any time when there’s a difficulty.’ (01)

Characteristics of the champion

Superuser

‘I don’t see a clinic as advanced as we are. . . to do it alone. It needs someone, a computer whiz like Dr X’(01)

Leader

‘It’s Dr X who has always led the project. Generally speaking, I think that he has the qualities of a leader and a *rassembleur*. I think that if it works well here, I think that it’s at 90 percent due to him.’ (12)

Entrepreneur

‘Dr X hasn’t waited . . . he has looked for what we needed. He said: “me, I’ve got a project and that’s it”. There are not many like this. . .’ (06)

Trainer

‘There are a couple of people whom he has trained in order to show others . . . to try the system, to see its applications. Moreover, he has prepared training videos on many applications that are accessible to team members.’ (10)

Box 2 Elements for a successful EMR implementation strategy

Presence of a leader/champion

'it really needs someone who takes it in charge, who is responsible because if everybody says: "well, I will take care a little bit, I will be there" then it won't work.' (03)

Clear goal and objectives

'You must have a goal, a horizon, and deadlines.' (05)

'Another important point to clarify from the start is: what's the goal? Eliminating paper through scanning and having exactly the same applications, or minimise as much as possible scanning through interfaces, direct data entry through physicians' and nurses' clinical notes, for instance.' (15)

Incremental and non-mandatory change

'the methodology was step by step, bit by bit, and then six months, one year later, you have something, after that you have to pass to something else, you keep adding' (09)

'to integrate it at each step (appointments, electronic record, computerised notes, lab ...) and give people time to get used to it.' (03)

Respect of everyone's rhythm

'We will try to always work by piloting, in the sense that we will try with some doctors and test what works, what doesn't work, to test it in a workflow and then, we will embark.' (05)

Progressive and adapted learning

'There was a learning curve that was relatively long since we have learned it step by step, little by little.' (06)

The 'ink stain'

'So, slowly we have trained two, three, four, five doctors, then it was getting bigger and I would go and help them, and as I told you, other doctors would go and help their colleagues when they were getting skilled. We helped each other ... So, it was done like an ink stain' (05)

Onsite technical support

'When we are with people who come from pure informatics only, well if we find that something is neither very friendly nor easy, oftentimes people will answer: "well no, we can't make that, it's like this, it's like this". But Dr X had knowledge in informatics and was able to say: "well, wait and sit a minute, we will try to see".' (04)

their FMG constituted a fertile ground for EMR implementation:

'Well everybody is involved, everybody. I think that this is a work that Doctor X has well achieved. He has involved nurses, secretaries, receptionists, physicians, everybody has been involved' (15)

Organisations' openness towards change was also discussed by the respondents. The state of organisational readiness for change not only affects the computerisation of the medical record, but also everything that it involves in terms of changes in the ways of working and operating modes:

'You can install new technologies, but if you don't accept to modify your operating modes, be it at the hospital or at the clinic, personally, I think that technologies will be useless.' (14)

Contextual, political, and financial factors

Context

According to respondents, characteristics of the setting of care have also played an important part in the success of this implementation. In fact, the medical practice in a rural setting is different from one in an urban setting, notably because of its greater multi-tasking as well as the presence of a delimited network of healthcare organisations that could stimulate the will to link these various settings through an EMR:

'Yes, of course, physicians in private practice all work at the hospital. They do hospitalization, rounds, guards, obstetrics ... This is not the case for those practicing in urban centres. So they try to make the whole system evolve; it is not only about "pulling the blanket on one's side".' (02)

Furthermore, in that type of milieu, the same people are often involved in many local committees:

'Our hospital is a general hospital. Physicians of the FMG are almost all on the same committees. That's why (a

physician) is responsible for the FMG and is also the chief of general medicine at the hospital.' (04)

Policy

The political will to implement information systems in the newly created FMGs has also been helpful for launching the local project. Together with the accreditation of the FMGs, the Québec Government also provided financial and human resources to support their computerisation. Although government support has allowed the setting up of some of the infrastructure that was necessary to implement the EMR (computers, printers, servers, software etc.), only two modules of the EMR system (electronic lab results and prescriber) were covered by those investments:

'Computerization of the FMG is very, very minimal. In reality, what the Ministry says is: we will pay your internet, email, transmission of lab results, but that's about it! It's very minimal, very limited, only a few tools' (07)

Financing

In the studied case, the project leader was able to find funding to implement the EMR through various programmes and opportunities. Indeed, implementing an EMR is associated with important costs in terms of equipment, contracts and human resources. As this respondent stated, one way to overcome this obstacle is to see it as an investment and not only as an expense. Nevertheless, further economic evaluation studies would be needed:

'There are costs involved, but there also must be gains at the practice and quality of care levels. There surely must be gains that will compensate for an important proportion of the costs. However, those gains have never been assessed to my knowledge. There have been no studies' (07)

Legal factors

Regulation regarding sharing of clinical information between the various EMR users across settings of care could represent a complex issue. During interviews, some respondents expressed concern with respect to the application of the law related to patients' consent in the context of EMR implementation. For some of them, this represents a potential obstacle to implementing the EMR:

'That's exactly what the law says: first, the physician is not allowed to consult clinical information from another physician unless the patient has given his or her consent. The existing rules could represent an obstacle to the project ... Suppose that information is at the university hospital, for instance: the physician has to ask the university hospital to get access to electronic data.' (07)

Other obstacles regarding security and confidentiality were also mentioned during interviews. In particular, the various requirements for accessing the system (password, token, rights of access etc.) were seen as irritants by many users.

Fear about the fact that the EMR would facilitate legal suits for professional responsibility was also mentioned. In fact, the EMR provides information that is centralised and complete, which facilitates its utilisation in case of litigation. However, this aspect was only reported once.

Technological factors

The transition period has been punctuated by many technical problems regarding networked printers, slow functioning of some equipment or operations, rigidity of the system, frequent changes of passwords, losses of data etc. The involvement of the project champion in system design, as well as on-site technical support to all users, were the solutions put forward to help overcome these obstacles. Likewise, the system's vendor was available to respond to users' needs and has shown a flexibility that has greatly contributed to the success of this EMR implementation:

'Our goal in fact is to adjust to work processes ... Well, yeah, we are open to all suggestions and there are many things that we have done in the database for this specific project that we will use elsewhere as well.' (15)

During the implementation, many respondents perceived the co-existence of paper and electronic records as an important barrier to EMR adoption. According to users, this transition period between the two systems constitutes a critical moment that should not last too long since it multiplies tasks which could quickly override the benefits of the EMR:

'Instead of having one part of the information on electronic support and the other on paper, I prefer the paper record ... This is a huge barrier, in general.' (08)

Discussion

While the literature reports that about 75% of information system implementations in health care have failed,²² this case study provides some key findings that confirm and expand current knowledge on successful EMR implementation. Identifying and implementing best practices is particularly important with ambulatory EMR implementation in order to avoid wasting time, money and efforts. The central role of the champion clearly appears as the key element

influencing the success of this implementation. In accordance with the literature on information systems, the most powerful success factor in the studied case was the presence of a project leader who combined the roles of clinical and technology champion.^{19,20,23}

The champion also played the role of knowledge broker by transferring information he had gained from his training in medical informatics, experiences from other sites and knowledge of the scientific literature into the day-to-day implementation processes. Thus, the champion combined the roles of clinical, technology and knowledge champion.¹⁹

Similarly, training of users seems to have been key to implementation success. Once again, the champion played a pivotal role in training his colleagues and developing learning material. He has used what he called the 'ink stain strategy', by training a few users who could then help him in training others. Tailored training constitutes another factor that is associated in the literature with the success of EMR implementation.²³

Although other factors influencing the success of this EMR implementation were identified, these seem to have had less influence in the studied case. However, this does not mean that these other factors should be ignored. Thus, it is essential to consider that different factors could influence the success of EMR implementation according to the particular setting in which the technology is introduced. Also, factors influencing the implementation of EMR at the local level could diverge from those ensuring the successful diffusion of this technology throughout the healthcare system as a whole.

Another important aspect to consider is the fact that champions need support to achieve their roles. Thus, material and human resources must be made available to champions and support from the organisation is essential to maintain their involvement.²⁰ In the studied case, the champion had easy access to technological support both from the organisation and the vendor. This stresses the fact that resources dedicated to supporting champions must be foreseen in the planning of EMR implementation. To this end, the culture of innovation of the study site was particularly helpful.

Also important in the success of this EMR implementation was the innovative culture at the professional level. As such, most of the users were open to change since they were already in a process of modifying their practices and work processes with the creation of the FMG. A recent study²⁴ focusing on barriers to ambulatory EMRs has highlighted the role of physicians who are 'imminent adopters'. These imminent adopters perceived financial barriers to be less pronounced than their colleagues who were non-EHR users. Furthermore, imminent adopters perceived significantly fewer productivity related and technical

barriers to EMR adoption. They were also significantly less likely to suggest that they lacked the time to acquire and implement an EHR system in their practice.

In the literature, organisational readiness to adopt information systems is a concept that has received little attention.²⁵ Nevertheless, as Ash¹⁹ reports, organisational attributes are among the most important predictors of information technology adoption in healthcare organisations.

An emergent finding from this study is the importance of knowledge sharing – both its use in the design of the implementation strategy and its application in everyday work (see Box 3). This particular case provides an interesting model of an evidence-based implementation strategy, since most of the decisions and actions made at the various phases of the EMR implementation were based on scientific knowledge.

Box 3 Implications of the findings and how they compare with the literature

- Our findings support the literature on the key role of organisational factors (presence of a champion, leadership, innovative culture, support) for a successful EMR implementation.
- Individual characteristics (computer literacy, attitude, leadership) and interprofessional collaboration have also contributed to the success of this implementation.
- An emergent finding from this study is the importance of using scientific knowledge in the design of the implementation strategy and in its application in everyday work. This case presents an interesting model of evidence-based EMR implementation.

In spite of the unique insight it offers into understanding the success of EMR implementation in primary care practice, this study has some limitations. The unique characteristics of the champion, combined with his leadership skills and his legitimacy make it very difficult to generalise findings to other settings where there is no equivalent individual. Nonetheless, these characteristics and abilities could be represented by more than one individual in a given organisation.²⁰ Also, the number of participants was small although the majority of EMR users participated. However, redundant information obtained from the last interviews was an indication that data saturation had been reached. Moreover, both early and late adopters were represented among the users interviewed, increasing the credibility of the data. Furthermore, the findings are highly concordant with existing literature on EMR implementation, thus increasing their transferability.²⁶

However, the implementation described here is one of a locally developed EMR system in a small market (a francophone region of North America). The creation of standards that vendors of EMR systems must meet and pressures from healthcare professionals have contributed to the centralisation of the EMR market.⁵ Consequently, many countries have gone from a large to a small number of suppliers of EMR systems. The experience related here is similar to that of other smaller countries, such as Croatia. In their study, de Lusignan and Katic⁶ reported that the Croatian market still contains small-scale vendors who produce trial systems leading to natural selection of the most effective system. However, this situation is changing with the increase in multinational vendors offering hosted systems that can be adapted and integrated into the local health system.

Finally, as in every study, be it qualitative or quantitative, we acknowledge that the researchers' background has had an influence on the results presented.²⁶ In order to take that into account, the interpretation of findings was validated by the whole research team and one of the study participants.

Conclusion

This case study aimed at understanding the success story of EMR implementation in a family medicine network, one of the few in Québec that has become paperless. This successful experience clearly rests on the presence of a champion who played the role of translator between the EMR system developers and its users. This champion also had another role, that of knowledge broker, transferring evidence on EMR implementation into day-to-day interactions with clinical and clerical staff. The implementation strategy was designed based on the literature on information systems and training was tailored to the needs of users. However, it should be stressed that different factors could intervene in the success of EMR projects depending on the context and level of implementation. Finally, this study highlights the importance of an organisational culture that supports change and provides a fertile ground for EMR implementation.

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ETHICAL APPROVAL

This study has received ethical approval from the Québec University Hospital Research Centre (# 5-06-09-02).

CONFLICTS OF INTEREST

JFR is the leader of the EMR project that was studied. His part in this article was to validate the information. JFR has no financial stake in this EMR system.

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