Implementing Electronic Medical Record Systems

William MacKinnon and Michael Wasserman
Clarkson University

The US healthcare industry is a massive information enterprise, yet it's surprisingly inefficient when it comes to information management. Some estimates put it decades behind other industries with respect to information technology (IT) adoption and utilization.[1] In fact, an article in the *Journal of Healthcare Management* described the industry as a knowledge-based enterprise that doesn't consider knowledge part of its value proposition.[2] A 2003 report found the healthcare industry spending 2 percent of gross revenues on IT compared to 10 percent for other information-intensive industries, such as banking.[3]

The consequences of this health IT gap are matters of life and death. In 1999, the US National Academies' Institute of Medicine published a report, *To Err Is Human: Building a Safer Health System*, which attributed between 44,000 and 98,000 deaths per year to medical errors.[4] Subsequent studies have confirmed a general assessment of healthcare delivery system as inefficient, unreliable, and even dangerous.[5]

Health and IT

Greater use of IT is generally expected to support many healthcare reform goals. In addition to the improved quality of medical care that electronic medical record (EMR) systems can provide, the cost savings from properly implemented systems are estimated between US$81 and $162 billion annually.[6] Furthermore, warehousing EMR data, combined with data-mining techniques, should help healthcare providers predict risks and measure medical care against benchmarks.[2]

Government involvement in this issue seems to be an important factor. Most recently, the American Recovery and Reinvestment Act of 2009 earmarked $19 billion in grants to encourage doctors and hospitals to install and use electronic health records (EHRs),[7] a fundamental component of EMR systems (see the sidebar, "EHRs and EMR Systems").

A Boost from Theory-Based Research and ERP

To help close the health IT gap and speed the adoption of EMR systems, we conducted a literature search of relevant theoretically based research.[8] Although health IT is still emerging as a mainstream field in the acdemic literature, we believe everyone working in it can benefit from research that's theoretically based and empirically tested. The EMR literature for our review came mainly from healthcare-specific journals. This literature goes back about 10 years, but the vast majority of the articles we found appeared in the past three or four years.

We augmented this EMR literature with research from enterprise resource planning (ERP) system implementations. The primary difference between EMR and ERP implementations is project scope. Most US physicians run small-group practices, using only a handful of people who aren't necessarily computer literate. Most ERP projects are undertaken in much larger organizations with IT staff and implementation teams.

We nevertheless argue that EMR implementations can leverage many aspects of existing ERP research. Both EMR and ERP systems are architecturally similar, relying on real-time access to a common database and a platform that can systematize, inte-

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grate, and streamline business processes and workflow. Both systems are based on improving the speed and accuracy of data sharing, reporting, and planning functions. Finally, both EMR and ERP systems represent disruptive technologies; their implementations require a significant investment in money and time as well as process changes and training, all of which carry a great deal of organizational risk.

We wanted to study EMR system adoption at or near the physician level, where two-thirds of US primary care occurs.[9] To further narrow the research scope, we focused our search on implementation as a primary factor in the success of enterprise system projects.

EHRs and EMR Systems

The Health Information and Management Systems Society has defined an electronic health record (EHR) as a longitudinal electronic record of a patient's health information generated by one or more encounters in any care delivery setting (www.himss.org/ASP/topics_ehr.asp). EHR is often used synonymously with other terms, such as computerized physician order entry (CPOE) and electronic medical record (EMR), to suggest a database of patient medical records with functionality to retrieve and manipulate relevant data.

Although EHR databases are the foundation of EMR systems, our literature search showed a general consensus that EMR systems define a software suite of integrated functionality built around a common database. The functionalities aren't limited to but typically include EHRs, diagnostic tools, electronic prescriptions, patient billing, and practice management.

These functionalities are often modular and can be purchased at various levels of integration, but we restrict our use of EMRs and EMR system to an integrated system with the listed functionalities.

The Literature Search

We searched both the ERP and EMR literature in electronic journal databases, using the keywords "electronic medical record (EMR)," "electronic health record (EHR)," and "computerized patient record (CPR)."

The search yielded more than 200 results. Many articles promised the benefits of EMR systems and a few emphasized their drawbacks and the obstacles to their adoption. However, our interests were only in research with a theoretical basis for its results, and we were able to eliminate most of the search results by analyzing the abstracts. In cases where abstract analysis was insufficient to render a decision, we reviewed the entire article.

Of the accepted EMR articles, most used some reconceptualization or extension of Fred Davis's *technology acceptance model*.[10] TAM is a specification of a more general theory of reasoned action—namely, that beliefs lead to behavioral intentions, which lead to enacted behavior. TAM asserts a particular technology's *perceived usefulness* and *perceived ease of use* to be positively correlated with *behavioral intention* to use it. We report results in detail elsewhere.[8] To generalize here, these studies suggest that greater computer literacy facilitates greater EMR system adoption and that physician attitudes can facilitate or hinder the process. Physicians, especially those in private practice, are often overbooked with patients and can see the system learning curve as too great a hindrance to workflow. Limited IT resources also pose significant challenges in small-practice system implementations.

All the TAM-based theories related to technology adoption and acceptance rather than implementation, but they suggest how influential computer literacy can be during an implementation process. Two articles specifically addressed EMR systems implementation. Guy Paré used a multicase study approach to formulate theoretical propositions regarding successful implementations in healthcare organizations.[11] His results suggest that implementing healthcare information systems is a reflective, often unpredictable process. Successful implementations are characterized by socially constructed goals, anticipated challenges, and exploited opportunities. The skills, beliefs, and motivations of the key stockholders affect how effective the implementation strategy will be.

Liette Lapointe and Suzanne Rivard examined physician resistance to EMR implementation in a multicase study of three hospitals.[12] Their results suggest that resistance evolves throughout the implementation, beginning with individual physician resistance to perceived threats from the new system, escalating to group resistance as the system's organization-wide implications emerge. They recommend dealing with resistance early when it's still at the individual level.

The ERP literature resides primarily within information systems research but extends to

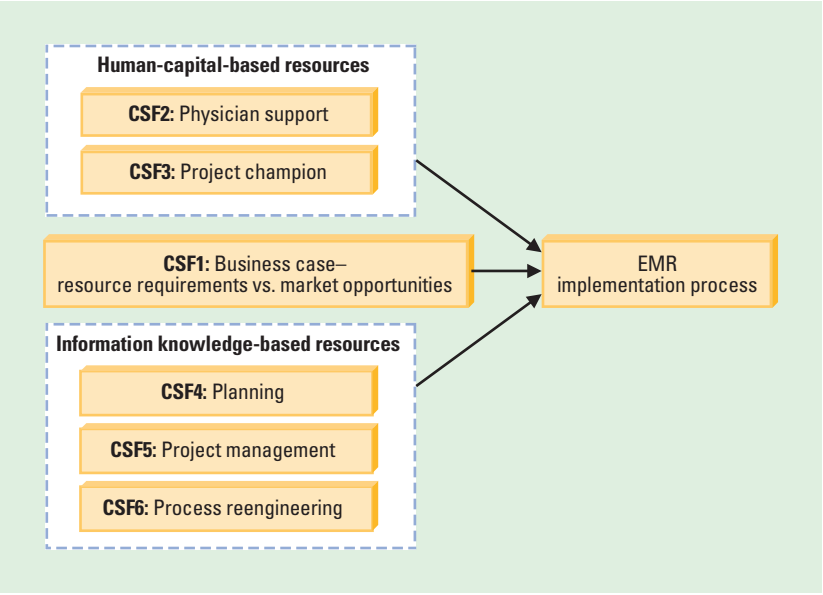

Figure 1. Theoretical model of critical success factors for electronic medical record implementations. A clear business case is at the center of human and information resource requirements.

other disciplines as well, such as technology management and operations management. Much of this research has focused on critical success factors (CSFs) for ERP implementation. Although the literature includes a wide and varied range of CSFs, researchers are in general agreement about several of them—for example, that enterprise systems are expensive, disruptive technologies, so organizations should have a clearly defined business case for adopting and implementing them.[13] We incorporated the generally agreed CSFs into a model for successful EMR system implementation.

A Model for Success

Figure 1 illustrates the model we developed from our literature search. It comprises six critical success factors.

1. A clear business case. Successful EMR implementations will begin with a clear business case for the project. Strategic and economic justifications are crucial to project success and to the ability to measure it. Developing a business case is usually marked by creating broad but measurable project objectives and by identifying barriers to implementation.

2. Physician support. In EMR implementations, physician support for the project is equivalent to organizational or top management support in ERP implementations. In both cases, failure to get this support invites project failure.

Some research suggests that physician-owned practices are less likely to adopt EMRs than practices owned by a larger healthcare organization.[14] In general, US physicians have resisted IT as a fundamental aspect of modern medical practice.[5] Nevertheless, EMR implementations must have physician buy-in to succeed.

3. An internal project champion. The ERP literature makes a compelling case for an internal project "champion" as a requirement of successful implementations.[13,15] In EMR implementations, this person won't necessarily be a physician. Even though physician support is crucial, the demands of medical practices won't leave many of them time to play the champion's role.

4. A Planning phase. Careful, deliberate planning is critical to successful ERP implementations. However, ERP is usually associated with larger organizations, and smaller organizations—such as most medical practices—might be tempted to neglect the initial planning phase. However, this phase is important to making sure the business case is translated into clear implementation process goals and objectives. It's also the time to define project resource requirements.

5. Strong project management skills. Project management and, to a lesser extent, change management are crucial requirements for a complex, risky project that potentially affects every aspect of an organization's activities and processes. Healthcare organizations, especially smaller practices, often lack personnel with project management experience. This means they must look to independent or vendor consultants to fill that need.

6. Business process reengineering. Enterprise information systems are tightly integrated software systems that are configurable only to a point. Business process reengineering has become an accepted part of the price of implementing these systems, and research suggests healthcare organizational

change capability is crucial for EMR implementation success.

Qualitative Study of the CSF Model

We performed a preliminary, qualitative study of the proposed success factors.[8] The study consisted of structured telephone interviews with eight representatives of the EMR stakeholder community. Specifically, the interviewees included two physicians, one regional sales manager for EMR systems, two independent EMR consultants, one CEO of a medical group practice, and one registered-nurse office manager.

The interviewees represent a convenience sample in that they all had experience with EMR system implementations. The sample is also small, and we acknowledge the limitations of our analysis and findings. Nevertheless, this is a relatively new field, where qualitative research is often useful in developing theories. Our purpose was to generate a workable theory of EMR implementation that can be formally tested and adjusted as more EMR systems are implemented.

The study results showed strong support for all six propositions, with Likert-scale ratings especially positive about the need for physician support and an internal project champion. In addition, the interviews yielded noteworthy insights based on experience. For example, it's important to choose an EMR system that's certified by the Certification Commission for Healthcare Information Technology (www.cchit.org) and favorably reviewed by Klas (http://klasresearch.com), an independent evaluator of healthcare technology.

The next few years will mark a surge in the number of medical practices implementing EMR systems as government incentives and mandates take effect. We hope that providing some theoretical background and propositions can help EMR research move forward. We also hope that collecting qualitative data provides general support for identifying success factors and a basis for collecting more detailed empirical data. IT

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William MacKinnon *is an instructor and information technology coordinator at Clarkson University's School of Business. Contact him at bill@clarkson.edu.*

Michael Wasserman *is an assistant professor of consumer/organization studies at Clarkson University's School of Business. Contact him at mwasserm@clarkson.edu.*