

Toward a Model of Successful Electronic Health Record Adoption

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There is nothing so practical as a good theory ...

– Kurt Lewin

The Canadian healthcare landscape abounds with pressures to address wait times, chronic disease management, aging at home, information and service integration, health human resource shortages, pandemic planning and most importantly health outcomes of individuals receiving care in our system. Investment in clinical information technologies is often touted as significant to the successful resolution of most if not all of these issues. For example, Baker and Norton (2001) uncovered an alarming rate of preventable adverse events occurring within Canadian hospitals. A particularly high error rate associated with the administration of fluids and medications suggests that there is a dire need to introduce processes and tools to reduce human error in healthcare facilities. The implementation of clinical applications such as computerized physician order entry (CPOE) with integrated electronic medication administration records (MAR) has been identified as a key step to safer care (Bates and Gawande 2003; Leape et al. 2002; Leatt et al. 2006). It has been suggested that the full value of electronic health records (EHR) will only be realized with the implementation of CPOE and that its use (by physicians) is a reasonable proxy for adoption (Ash and Bates 2005). Considering recent surveys of Canadian and American hospitals, those that have fully implemented CPOE remain in the minority (Ash et al. 2004; Davis 2007; Gudbranson 2007); most have yet to tackle the challenges of the change imperative and adoption issues associated with the use of a complete EHR.

Critical factors for successful implementation of systems have been identified by several authors (Ash and Bates 2005; Davidson and Heineke 2007; Golden 2006; Leatt et al. 2006; Lapointe and Rivard 2005; Leonard 2004; Studer 2005; Van der

Meijden et al. 2003). To varying degrees, these writings suggest that if any one of the people, processes or technology is not adequately addressed, clinical information system implementations have a high risk of failure. Following a comprehensive review of the literature, Studer (2005) and others (Leatt et al. 2006) hypothesized that there are key organizational factors that can predict the effectiveness of electronic medical record (EMR) implementations. Studer purposively reviewed literature that addressed the effects of: (1) management support, (2) financial resource availability, (3) implementation climate and (4) implementation policies and practices on implementation effectiveness. Leatt and colleagues (2006) examined the literature that addressed these factors in relation to EMR, CPOE and MAR. They suggest that this framework can be useful in evaluating whether implementation effectiveness has led to the realization of anticipated benefits from these tools.

Lapointe and Rivard (2005) examined the issue of implementation success versus failure at the individual, group and organizational levels. They found that negative perceptions were derived from (1) ongoing technical and response issues; (2) inflexible or inappropriate business processes; and (3) limited or no perceived benefits. In response to these findings, they recommended the importance of (1) responding promptly to concerns; (2) recognizing and responding to technical issues; and (3) creating value for the users. Further, they described the importance of addressing group dynamics, power structures and the engagement of stakeholders in problem resolution. At the organizational level, they identified the need to create coordination and engagement structures and recognize variability of needs and expectations among users.

In general, the literature related to the acquisition and implementation of EHRs consistently identifies several key considerations regarding leadership, engagement, communi-

cation, process redesign, training and support. How much of each is necessary, at what point and for how long in order to achieve successful EHR adoption remains somewhat unclear. The authors submit that these requirements *must* be scaled in accordance with investments in EHR technology and the relative change management effort. It is our hypothesis that successful adoption can be monitored through the measurement of these two important elements – and that there will be a functional relationship between the level of adoption achieved by health-care organizations and their investments in these two critical elements. Specifically, the functional relationship of adoption, investment in EHR and investment in change management can be examined throughout the evolution of the EHR within organizations. The function would be stated as

$$a = f (ie, ic),$$

where *a* represents adoption, *ie* means investment in EHR and *ic* stands for investment in change management. *Adoption is a function of investment in EHR and change management.*

Investment in Electronic Health Records

Studies and experience indicate that individual healthcare organizations are highly varied in their clinical and business information systems evolution (Gudbranson 2006; OHA 2007). Moreover, comparative studies demonstrate that the information technology (IT) spent as a percent of hospital operating budgets typically averages around 2.0%, but is inconsistently reported and difficult to compare (Irving 2003; Pederson and Leonard 2005; Rappaport et al. 2006). Despite almost 40 years of development in health information management tools, it is only recently that considerable investment is being directed to clinical information systems, particularly the EHR.

In the 1970s, healthcare organizations primarily invested in the acquisition of information management tools to support business processes such as financial information management, health records, workload measurement and human resource management. Subsequently, throughout the 1980s and 1990s, clinical departmental systems (e.g., laboratory, diagnostic imaging and pharmacy) became the focus of clinical IT spending within many acute care organizations. These investments were often accompanied by the acquisition of the supporting systems architecture for distributed access and application integration. Organizational networks became increasingly sophisticated and saw a significant shift from centralized to decentralized computing, largely to deliver desktop office solutions to all levels of management. Numerous hospitals also implemented applications to support specific areas of clinical care such as the operating room, cardiology, picture archiving and communications systems, emergency triage and tracking and obstetrics. But for the most part, all of these applications had limited functional

scope, affecting specific clinical units and users, with limited impact on an entire enterprise.

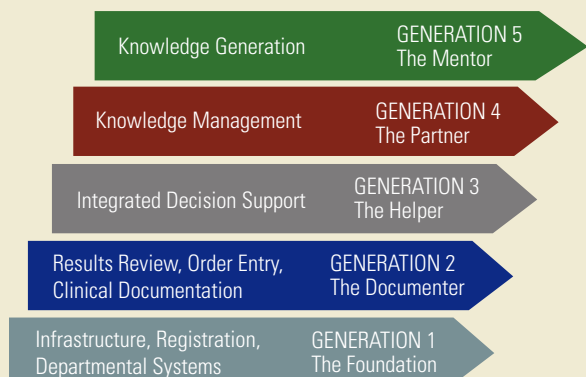
In the past five to 10 years, an increasing number of health-care organizations and community-based providers have begun to acquire software and technology solutions to wholly support the processes of direct clinical care. However, recent studies (Gudbranson 2007; OHA 2007) indicate that few providers have completely migrated to a fulsome EHR. Recent surveys have also highlighted limited utilization of EMR by physicians. Although the reported percentage of uptake varies, it is fair to say that EMR adoption is still less than 25% among Canadian physicians. To date, the applications used by the health professions in the delivery of care have been largely limited to passive applications such as results reporting for laboratory and diagnostic imaging. Despite the online availability of diagnostic information, process integration is not complete and work-arounds abound, for example, printing of results rather than viewing them electronically. Consequently, the impact on clinician system users has been relatively minor and minimally disruptive to the processes of clinical care.

A majority of settings continue to function with dual systems for the management of clinical information. Nevertheless, there is a growing cadre of organizations immersed in the processes of designing and deploying applications with a measure of complexity previously unparalleled. Relative to applications like results reporting, CPOE and clinical documentation are ostensibly the most difficult and disruptive of all applications. Both require the active engagement of health professionals and a significant work effort focusing on (1) process analysis, (2) application design, (3) policy and procedure development and revision, (4) standardization of terminologies and protocols and (5) significant user education, training and support. Challenged by the cost of implementing these tools, the limitations of vendor solutions and the vagaries of large-scale wholesale organizational change, many organizations are struggling to find the path of least resistance and strategies to optimize their success.

The Gartner Group (2003) described stages of the EHR lifecycle providing increasing levels of capability as more sophisticated tools become integrated. Their work largely describes the EHR generations as a function of clinical decision support, but for our purposes, we are adapting the evolutionary model to reflect the migration from foundational systems (e.g., infrastructure, laboratory, diagnostic imaging, pharmacy) to interactive systems (e.g., clinical documentation and order entry), to highly integrative decision support, knowledge generation and knowledge management (Figure 1).

Based upon current data, a majority of Canadian organizations could be described as being at the *Generation 2* stage. Organizations that have invested in clinical information systems over the past two to three decades have likely had one or more of the following: (1) the opportunity to embed

Figure 1. Electronic health record lifecycle



Source: Adapted from Gartner Group 2003.

a clinical information system as core to the infrastructure of a new physical plant; (2) visionary and risk-taking leadership; and/or (3) financial capacity. Many of these early adopters have had the experience, good and bad, of the first generation clinical systems and are now at the juncture of updating or replacing legacy systems that have become costly to maintain and support. Notwithstanding several years of experience with clinical computing, many of these organizations face the same challenges as those with less experience.

Most organizations have been slowly and steadily building the technical infrastructure and acquiring downstream clinical systems over the past decade. These healthcare organizations are emerging as the majority and are about to hit the “tsunami” of challenges associated with trying to garner clinician adoption. These organizations are focused on initiatives

that include order entry, results reporting, clinical documentation and automating the processes of medication administration. In general terms, they are often challenged in obtaining C-level support (CEO, CFO, CNO and CMO [chief executive officer, chief financial officer, chief nursing officer and chief medical officer]), clinician buy-in and sufficient capital funds to aggressively move forward.

But there are also many *Generation 1* healthcare organizations that have made little or no investment in clinical systems to date and are just beginning to develop the core infrastructure to support the functional components of an EHR. These entities might typically include smaller organizations, but among them are also some very large and complex organizations. They often have limited financial and IT resources and may not yet understand or accept the value proposition of EHRs. To a large extent, the community sector including primary care, public health and home care are substantially lacking the foundational infrastructure and necessary capital to acquire EHRs.

In conclusion, there is a measurable evolutionary advance in clinical information systems in moving toward a comprehensive EHR. Secondly, there is generally still a long way to go in advancing to *Generation 3* in the EHR lifecycle within the institutions and communities across our country. Finally, the necessary investments are not trivial yet most available vendor solutions leave much to be desired on the usability front. Few vendors have designed functions to effectively support certain aspects of the EHR (e.g., clinical documentation) and meet the needs of all the health professions.

Change Management Driving EHR Adoption

It is our premise that a confluence of numerous theoretical and practical strategies needs to be brought to bear on the complex work of implementing clinical information systems. Many authors have cited the importance of addressing aspects of

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Table 1. Golden's change process: questions to consider**Determine Desired End State**

What is the performance gap?
 What is the vision for the EHR? Is it clear to all?
 What are the goals to be achieved? By CPOE? By clinical documentation?
 What new behaviours are expected?
 What changes are needed to organizational structure and systems?

Assess Readiness for Change

Is there a shared view of the need for change within the organization?
 Are there competing priorities?
 Are new organizational capabilities needed?
 Is there organizational history that can inform the new change?

Broaden Support and Organizational Redesign

Communicating the essence of the change: What is it? Why? Why now? What will be the impact on individuals? How will they be supported?
 What structures will be needed? Are there barriers to successful adoption?
 What resources and skills will be required?
 Do we have effective change leaders?
 Does the organizational culture value anticipated benefits of the change?
 Are the deliverables manageable?
 Is there sufficient support?

Reinforce and Sustain Change

How are we doing?
 What can we celebrate and showcase?
 What has been lost? What has been gained?
 Has the change been woven into the organizational culture?
 What needs fine-tuning?
 CPOE = computerized physician order entry;
 EHR = electronic health record.
 Adapted from Golden 2006.

organizational behaviour and change management in this work. Although the methodologies associated with process redesign or process improvement such as Six Sigma may have direct relevance to optimizing the benefits from systems, the bench strength in these skills is often lacking in healthcare organizations.

Change Theory

Kotter (1996) identified key processes to be followed in the face of organizational change: (1) establish a sense of urgency, (2) build the guiding team, (3) create a vision, (4) communicate the vision, (5) empower action, (6) celebrate short-term wins and (7) make the change stick. Kotter's processes emphasize support and engagement of those affected by the change. In other words, all of the stakeholders need to buy in to the value proposition of

an EHR, the leadership should be visible and clinically credible (e.g., clinical informatician) and the EHR vision should be shared and understood by all. Providing individuals with the necessary training and removing barriers to use (e.g., sufficient and appropriate hardware access) will be crucial. Celebrating successes, making remedial training available and providing ongoing user support in the form of a responsive and "helpful" help desk will contribute to successful change.

Similarly, Golden (2006) synthesized several theoretical perspectives of change citing the work of Kotter and others. He identified four stages of change: (1) determine desired end state, (2) assess readiness for change, (3) broaden support and organizational redesign and (4) reinforce and sustain change (Table 1). In general, the overall processes and ingredients for successful change are relatively similar as described in these models: a vision, a guiding coalition, communication, support (instrumental and informational) and continuous reinforcement. In setting out on this journey, organizations might consider guiding their process by posing the questions in Table 1 each step of the way.

Rogers (2003) theory on the diffusion and adoption of innovations provides a perspective that can be considered to be focused on the specific technology. Focused on issues of relative advantage, compatibility, complexity, trialability and observability, his theory suggests that innovations need to be viewed by the users as adding value and being congruent with their work patterns. The more complex the innovation, the more challenge to adoption. The opportunity for users to test and refine and observe demonstrable benefits is also deemed to be facilitative in the process. In terms of the EHR, the problems with applications like CPOE and clinical documentation become readily apparent: (1) the anticipated benefits are not always well understood or articulated, (2) these applications are disruptive to traditional practice patterns, (3) they are typically complex to design and implement, (4) although "pilot tests" are not unusual, they are not usually true pilots but rather a trial of implementation processes and (5) the ultimate benefits are difficult to observe until all of the entire system functionality is deployed. As yet, clinical practice supported by a fully functional EHR is difficult for most clinicians to envision.

Beyond change and innovation theory, there are other theoretical views that can provide further guidance in the work of implementation and specifically end-user engagement. In particular, understanding issues of organizational behaviour, methodologies of process re-engineering, approaches to adult learning theory and human factors considerations will bring additional value and likelihood of successful EHR adoption.

Practical Approaches to Change Leadership and Engagement

In recent times, authors have repeatedly highlighted the inherent problems of not attending to the "people needs" relative to the

implementation of clinical system components (Golden 2006; Leatt et al. 2006; Studer 2005). Those chronicling implementation experiences (Golden 2006; Lapointe and Rivard 2005; Strating et al. 2006) have stressed the overwhelming importance of clinical leadership and ownership of EHR initiatives. Clinical teams should partner with IT, but ultimately drive EHR initiatives – these are not IT projects and should have clinical ownership and broad participation from the outset.

King and Peterson identified the importance of involving “key influencers and those with passion and enthusiasm” (2007b: 60). In their study, healthcare leaders described the significance of finding reputable and credible individuals to lead critical change initiatives. In combination with those who bring passion, energy and a desire to be involved, change can be effectively fuelled. Their application of the physics formula

$$\text{momentum} = \text{velocity} \times \text{mass},$$

where velocity applies to the speed of creating tangible deliverables and mass is the depth and breadth of commitment from the stakeholder community, is a useful concept in considering the selection of teams and leadership. In their words, “successful leaders generate sufficient momentum to achieve *critical mass*, the point at which ideas, energy and resources effortlessly begin to flow toward the initiative” (King and Peterson 2007a: 54).

The work associated with the development of new policies and processes must also be led by clinicians. EHR initiatives such as CPOE and clinical documentation must solicit input from the various stakeholder entities from system acquisition to evaluation and beyond. Additionally, executive commitment and sponsorship must be highly visible and constant. With substantial investments underpinning these applications, the need to invest in user support pre- and post-implementation is critical.

Communication

Clear and consistent messages need to be delivered to the clinical community, with the EHR vision being a constant thread in all communications. The objectives of EHR phases and specific applications need to be understood by all affected stakeholders. Multi-moded approaches are necessary to reach into clinical communities, and messages need to be purposeful focusing on: (1) goals, (2) process and policy changes, (3) timelines and rationale for changes to same, (4) availability of supporting resources, (5) successes and (6) any systems changes related to post go-live fine-tuning. Perseveration in communication is the order of the day – there will always be the person who says “nobody told me about this.”

Process and Workflow Integration

Process analysis is an area to which few organizations have directed enough attention and investment in order to under-

stand the implications of new clinical applications. Moreover, the requisite skills are not necessarily within every organization’s domain of expertise. Deploying technology solutions without a good understanding of the current and future process implications (e.g., changes to work, communication or policy) is a recipe for failure if not a false start or protracted rollout. Computerized clinical documentation and CPOE are particularly disruptive to the work of clinicians and will by their nature necessitate thoughtful analysis, design and integration with workflow. Furthermore, if process efficiencies are to be realized, it behooves organizations to take the time to carefully design the tools of order entry and documentation. While an analysis of current processes frequently reveals issues of inconsistent or widely varied clinical practice, it also presents organizations with an opportunity to address variations. The CPOE work of designing order sets and clinical protocols offers a mechanism to embed standards for evidence-based clinical practice. Additionally, organizations that implement CPOE but retain the practice of written physician orders transcribed into the computer by nurses or ward clerks have not addressed one of the most common sources of medication error, illegible handwriting. With no changes to practice, the possible benefits of CPOE will be limited if not unrealized.

Another common pitfall of organizations is the tendency to replicate the paper record with all of its constituent forms that are frequently discipline-specific with unbridled data redundancy. Migrating to online documentation presents organizations with an incredible opportunity to streamline and reduce duplicative charting and adopt a patient-centric rather than discipline-centric approach. Additionally, the adoption of integrated, standardized approaches to order sets, clinical protocols and/or critical pathways will set the stage for downstream clinical and financial analysis of the relationship between treatments and outcomes.

Emerging best practices and current literature suggest that attending to the issues of process, design and workflow considerations are central to successful EHR integration. Consideration needs to be given to investing in resources to support the development of designs and processes that are clinically safe and work for clinicians. It is also critical to cycle back to units/programs post-implementation to determine whether or not clinicians and other support personnel have developed work-arounds because of system limitations. These work-arounds could be potentially posing new risks in the clinical environment. The work effort associated with these tasks is not trivial, but at the end of the day will be critical to successful adoption.

EHR Education Training Model

An organizational model to support EHR education and training will necessitate delivering a core set of competencies for the users. Determining “who” delivers them, “how” they are delivered and

“when” and “where” the education and training is delivered are key decision points that will underpin any strategy. Beyond these decisions, the development of a model to support EHR education and training will necessitate the consideration of several key factors including the following:

- Accountability structure for associated human resources
- Cost for incremental human and material resources
- Appropriate number and type of resources required by each program, unit and/or site
- Depth of expertise – pedagogical, clinical systems and clinical program
- Consistency of communication and training methods
- Alignment of training methodologies with academic affiliates

EHR Education Curriculum

Corporate-based core competencies should be requisite for all knowledge workers within the organization. We suggest that these core competencies be standardized, delivered and evaluated in a consistent manner. It is recommended that this activity be centrally managed in conjunction with general orientation. If deemed necessary, classes in basic computer use should be required and provided to staff prior to EHR training.

Development of the core EHR curriculum should be undertaken centrally and distributed for use by all users. This core curriculum should provide the basis upon which all programmatic customization occurs. Adapting the core curriculum to specific programs should include the development of clinically relevant scenarios that are widely accessible to end users. Clinical program leads should be identified to provide input to the development of case scenarios. These scenarios could be equally useful in the preparation of student users. Multiple modes of content delivery should be utilized (e.g., classroom, intranet, blended learning) for users, sites and clinical programs.

Ongoing *revision* and updates to the curriculum should be undertaken centrally and delivered throughout the organization. Program leads should assume the role of gathering feedback from the “super user” community within each program.

Education/Training Team

There may be a variety of individuals (full-time, part-time or temporary) who provide EHR education and training to clinicians, support staff and students. A reconfiguration of existing educator roles or advanced practice clinicians may minimize the investment required for additional resources. In the short term, the resource requirement to support this function will be high until a threshold of EHR integration occurs in the practice arena. As with the delivery of any education and skills training, appropriate principles related to adult learning must be applied. Those providing the training should not be selected merely by virtue of

their “expert user” status; expert does not equate to educator.

User Assistance and Support for Clinical Applications and Processes

The level of support required for clinical applications in the short term will also be more intensive than when full EHR integration is realized. We suggest that it is important to have application support resources 24-7 that are clinically grounded. The identification of “super users” or “e-champions” strategically situated throughout the organization to support their peers is emerging as a common approach for assisting clinicians in the early stages of adoption. Assuring that these resources are wholly available (without the burden of a clinical assignment) to their peers during an application “go-live” is recommended.

Evaluation

Commonly a neglected component of EHR initiatives, formative and summative evaluation is also becoming a recognized necessity in ascertaining the success of the associated work efforts including education, training and integration with work practices. Lau and colleagues (2006) recently published a benefits evaluation framework, which describes net outcome measures of access, productivity and quality. Building upon the work of others, they also described dimensions of the antecedent measures of system, information and service quality and their impact on system use and user satisfaction. This framework is a useful guide to examine EHR outcomes at every step of the lifecycle.

Not only should evaluation be an explicit step of application and technology deployment, EHR metrics should become an integral part of an organization’s balanced scorecard. Has the organization actually achieved the goals set out for each of the functions of the EHR? Showcasing and monitoring these measures will serve to guide further fine-tuning and provide evidence of benefits to the user community.

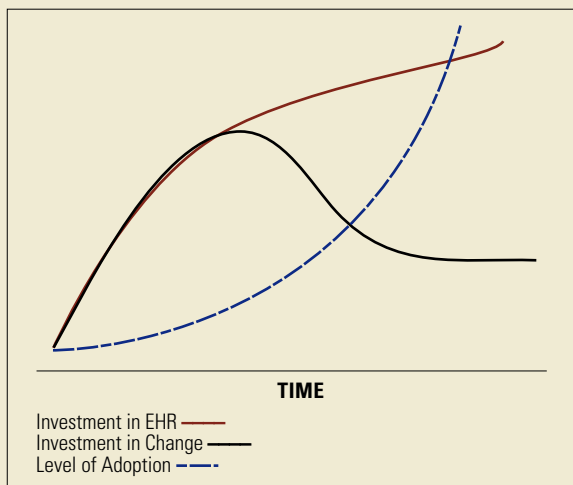
Assessing Your Approach to EHR Implementation

As stated in our introduction, the figure below describes the relationship of the variables in our function – with adoption being a dependent variable and relying on the investment in change management, EHR technology and simple passage of time as independent variables. In our view, as per Figure 2, there is a relationship between the required organizational investment in EHR and change management and the degree of clinician adoption, and these all vary over time.

Our hypothesis is that each stage of the EHR lifecycle will reflect variability in the investment required by organizations. In the early stages, *Generation 1*, there will be a constantly increasing level of investment in EHR and change management while adoption remains low. The level of investment will increase exponentially until a high degree of adoption has occurred. Once the organization has attained a high level of

adoption and EHR systems are fully implemented, there will be a declining investment in change management as there is a reduced requirement to support change. At that point, a majority of clinical users perceive that EHR utilization is part of their work, and no longer a separate and distinct project.

Figure 2. Relationship between investment in change and EHR and level of adoption



EHR = electronic health record.
Source: Nagle and Catford (2008)

Investment in EHR and Change Management

Investments include clinical application and technology acquisitions, and other efforts and resources that will contribute to organizational success. While most recognize the critical need for investment in technology and applications, an increased emphasis has to be directed to key change-management functions and processes related to: communication, process redesign, end user engagement, education and training, support and evaluation. Many healthcare organizations underestimate the investment needed for successful change management. In the case of the EHR or any clinically intensive technology, it should be identified as a significant component of the related capital budget. Investing substantially in these processes, potentially in equal measure, is pivotal to maximizing adoption. Ideally, the development of these processes should be a centralized activity so as to assure optimal use of resources within multi-sited or regional entities.

Rate of Adoption

For the purposes of this dialogue, we define the rate of adoption as the number of users actually using the EHR as their primary (and only) clinical documentation tool. We postulate that by

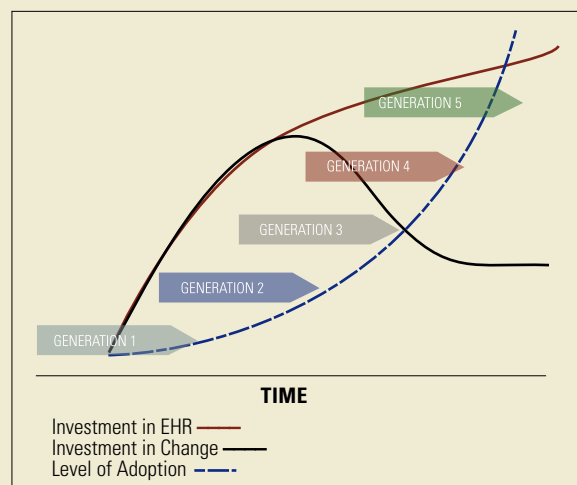
the exponential nature of the adoption curve (see Figure 2), there is a “tipping point” (Gladwell 2000) in adoption that is achieved when two critical points are reached: (1) a very high percentage of clinical documentation can be performed with the EHR (technology) and (2) a very high percentage of the clinical staff believe that its use is effective and facilitates care (change management).

Future work will assess the quantitative nature of these variables and further evaluate the driving forces that affect the rate of adoption. Specifically, we will seek to understand the degree to which specific change strategies and investments ultimately influence the rate of adoption.

EHR Evolution

If we overlay the stages of the EHR lifecycle, a picture emerges that suggests the peak of investment is required to achieve *Generation 3* (Figure 3). Further, as adoption increases, the investment in supporting resources begins to decrease and will ultimately plateau, but never return to the pre-implementation state. In time, the EHR will become increasingly integrated into clinical workflow and the likelihood of future success with advanced features will be strong. It may be stating the obvious, but the benefits of implementation of EHRs will be seen once the *Generation 4* and *5* levels are attained and implemented.

Figure 3. Relationship between EHR lifecycle, investment and adoption



EHR = electronic health record.

Conclusion

There are two key investments that contribute to accelerated adoption and realization of the benefits of EHR. They are neither trivial investments to make nor easy to execute.

History has shown that our healthcare system has been remiss in managing well the implementation of EHR solutions. When change management is not considered as critical to successful EHR adoption, there are likely to be higher project costs and failed or protracted implementations. Achieving the level of *Generation 3* systems and beyond and realizing the associated benefits for patient care and clinical outcomes is yet several years away. What is clear, however, is that we are beginning to understand the critical success factors and how to tackle the complex changes associated with the implementation of EHR solutions. It is our hope that this model and its premises are assistive to healthcare organizations in successfully achieving the goals and benefits of EHR integration.

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