Information Technology Implementation in a Rural Hospital: A Cautionary Tale

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Information Technology Implementation in a Rural Hospital: A Cautionary Tale

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EXECUTIVE SUMMARY

An increasing number of hospitals are implementing electronic medical records and other information technology (IT), and national policy is focused on fostering expansion of these systems. In September 2004, a 100-bed acute care hospital in a rural community was awarded a grant to implement and evaluate an integrated hospital IT system. The evaluation used qualitative and quantitative methods, including examining data on patient outcomes, conducting surveys of staff, and interviewing leaders and staff about the implementation process.

In the end, the hospital suffered a number of setbacks during the implementation that could provide lessons to other hospitals. The hospital was hindered by a lack of clinical leadership, staff skepticism, turnover in the executive team, an overly aggressive schedule, and a vendor whose products were not ready on time. The IT implementation was associated with a large increase in patient care errors, including medication errors, procedure errors, and patient falls. These patient errors might have been averted if the launch of the IT system had been better planned and implemented. The experience of this hospital exemplifies difficulties that can be encountered when implementing IT systems. IT implementation must have unbending support from the top level of management, strong clinical leadership, a proactive internal marketing campaign, a timeline and implementation approach that allow for learning and change, and a good IT partner. Careful planning and thoughtful perseverance are required to ensure a successful IT implementation that benefits patients.

An increasing number of hospitals are implementing electronic medical records and other information technology (IT) systems, and national policy is focused on fostering expansion of these systems (Burt and Hing 2005; Poon et al. 2006). These systems are expected to bring about improvements in patient safety (Coye and Bernstein 2003), although previous research has shown mixed results (Kazley and Ozcan 2008; Menachemi et al. 2008; Patterson, Cook, and Render 2002; Nebeker et al. 2005; Chaudhry et al. 2006; Han et al. 2005). A number of factors could lead to negative outcomes, particularly during the implementation period. During this period, new procedures and processes are established, creating an environment in which change can beget errors (Ovretveit et al. 2007; Kraus et al. 2008).

In September 2004, an acute care rural hospital with approximately 100 beds was awarded a grant to implement and evaluate an integrated hospital IT system. The hospital received the grant in partnership with a health information system vendor that had worked with the hospital since the late 1990s in developing its current financial systems. The hospital planned to create an integrated IT system with an electronic medical record (EMR) and computerized physician order entry (CPOE). The goals were to improve overall patient safety, decrease medication errors, and offer physicians remote access to data.

To assess whether the hospital met these goals, a mixed-methods evaluation was undertaken that included examining data on patient outcomes, conducting surveys of staff, and interviewing leaders and staff about the implementation process. In the end, the hospital suffered a number of setbacks during the implementation that could provide lessons to other hospitals and may explain substantial increases in adverse patient events at the hospital.

METHODS

The evaluation plan focused on how the IT system affected medication errors, patient safety, and hospital finances and on the implementation process. Three site visits were conducted, during which hospital leaders and staff were interviewed. Staff were recruited through flyers posted at the hospital and were offered a gift card for their participation. All interviews were conducted in private offices and conference rooms at the hospital or at a nearby hospital-owned fitness center.

Four surveys of hospital staff were conducted. The first survey was performed before most of the IT modules had been implemented, and it was conducted to measure overall attitudes toward computer technology and the role of computer technology in healthcare. Survey items were drawn from a previously developed instrument to assess acceptance of computer systems in the healthcare setting (Gardner and Lundsgaarde 1994). The second survey was launched about two years later, during training for the electronic patient documentation module. This survey was designed to learn about nursing documentation before that module's implementation and was adapted from a survey previously developed at the University of California, San Francisco

(Cucina 2005). A third survey was conducted about six months after the electronic medication administration record (eMAR) system was implemented. It was designed to learn how well staff thought eMAR training had prepared them for its launch and whether eMAR was perceived as increasing patient safety, saving time, and providing useful warnings and alerts. This survey was adapted from one developed for research on the Sutter Health System's bar-coding system for medication administration (Sakowski 2005). The final survey focused on the patient care documentation system and included questions about time spent collecting and entering chart data, ease of use, completeness and accuracy of the electronic record, and satisfaction with the system. The survey questions were drawn from several previously published surveys (Kjerulff et al. 1981; Doll and Torkzadeh 1988).

To study the relationship between IT implementation and patient outcomes, data from the hospital's quarterly review reports and from the California Nursing Outcomes Coalition were analyzed. The hospital uses internal quarterly review reports to identify lapses in the quality of care. The outcomes available from the quarterly review reports include total patient incident rates, incident rates in medical-surgical units, medication error rates, procedure error rates, and patient complaint rates.

The California Nursing Outcomes Coalition (CalNOC) is a voluntary program in which participating hospitals submit unit-level data on nurse staffing and quality outcomes (Aydin et al. 2004). Data submitted to CalNOC from January 2001 through December

2007 were accessed. Over this period, data were available on nurse staffing, agency staffing, and patient falls. The hospital did not report nurse staffing data to CalNOC for the first quarter of 2006 (January to March) and did not report any data during the third quarter of 2007 (July to September).

To examine the effect of IT on patient safety, simple comparisons of the data over time were performed to identify apparent changes in rates of errors or types of errors after the systems were implemented. Conducting a multivariate analysis was not possible because of the short period of post-implementation data.

IMPLEMENTATION AND LEADERSHIP ISSUES

Signs of Trouble in the First Two Years
During the first quarter of the grant, the project had a change in two key personnel: the IT vendor's project manager and the hospital's clinical IT implementation coordinator. The replacement clinical IT implementation coordinator had neither a clinical background nor prior experience with hospital IT systems. One of the coordinator's primary responsibilities was to work with the director of nursing to train clinicians and provide support for the new systems.

In its grant application, the hospital had established an aggressive timeline for implementing its IT system, and it strove to adhere to this timeline despite the change in project leadership. The first components—the pharmacy management system and Pyxis medication dispensing units in the emergency

department—were launched within the first month of the grant. The implementation of Pyxis was universally praised, leading to accelerated rollout to all other hospital units.

A bar-coding system was also implemented in the first grant year, but only to scan supplies. Hospital leaders thought they reaped benefits from the system soon after its implementation, primarily because of improved inventory data. Patient care units were not running out of supplies as frequently as they had before the module was installed. One manager reported that staff had previously "stashed their supplies" to protect themselves from running out of supplies, and this practice had lessened. However, managers reported problems with malfunctioning scanning equipment, missing bar codes, unreliable support from materials management, slow computing speeds, and flimsy equipment.

Several modules scheduled to be implemented in the first year were delayed, including the EMR scanning system, the operating room scheduling and management, and the eMAR. Nearly all modules scheduled for implementation in the second year were also delayed, such as remote access of clinical records, CPOE, and electronic patient care documentation.

Hospital leaders pointed to the vendor as the cause of some delays. For example, the EMR scanning module was not launched on time because the software programming sought to retrieve data from a computer hard drive that could not be accessed. The vendor had to reprogram the software, and new hardware had to be ordered before installation could begin. The eMAR was delayed because the IT vendor was reprogramming that system in Java.

The causes of other delays were more complex. The eMAR was designed so that nurses could scan a patient's wristband and then the medication to electronically verify the correct patient and medication. The pharmacy, however, first needed to develop a system for bar coding all medications, and this required more time than expected. When the IT manager tested the wireless bar-code scanners that had been purchased, he found that they often disconnected and lost communication while in use. Hospital leaders decided to purchase hard-wired scanners, which led to more complications. The IT implementation team also decided to place hard-wired computers in every patient room, and the hospital installed computers and computer cabinets in all patient rooms. However, the computer cabinets could not accommodate both a hard-wired computer and a hard-wired scanner, and the hospital had to return the cabinets and replace them with cabinets that could accommodate hard-wired scanners.

By the end of the first two years of the grant, most of the hospital's leaders recognized the implementation problems. Three of the seven managers interviewed expressed some frustration with the IT vendor. They thought the vendor was still in a development stage for many of the IT modules, which made them concerned about the quality of the software and its long-term ability to meet the implementation schedule. Some leaders also expressed concern that nonclinical people were making

decisions that have significant effects on clinicians.

Chaos in the Third and Fourth Years

The final two years of the grant were extremely chaotic for the hospital. Over a six-month period, turnover at the executive level was high; by June 2007, the executive team consisted entirely of interim managers. During the period of interim management, the IT implementation team continued the implementation process, which included launch of complex modules such as eMAR and electronic patient care documentation. The hospital operated with its interim executive team until March 2008, when a permanent chief executive officer was hired. When the evaluation ended in autumn 2008, the leadership of the hospital seemed stable for the first time in nearly two years.

During the third grant year, the primary strategy for offering continuous support to staff was dismantled. The clinical IT implementation coordinator had developed a novel strategy for providing IT and patient support to clinical staff on patient care units. The hospital retrained clerical support staff, rather than clinical staff, as "patient advocates." Each patient advocate learned to use the electronic system and was offered the opportunity to train in multiple areas. Three patient advocate leaders were selected to receive significant training and serve as super-users and peer trainers. Midway through the grant, in the words of one manager, "the patient advocate system fell apart." The patient advocates did not gain enough competency in all skills needed to operate and troubleshoot the IT system.

Moreover, nurses wanted to have a clerk assigned to their department specifically to support nursing work. Most of the patient advocates had been unit clerks before their new role was created; when the patient advocate positions ended, they returned to being unit clerks.

The eMAR system was launched in February 2007. Shortly after eMAR was implemented, difficulties arose. Nurses and their managers advised the IT team about where to install the computer and scanner cabinets. However, once the eMAR was in use, nurses realized that the placement of the computers raised privacy issues for patients. In rooms where the computer was near one bed of a multi-bed room, the nurses had to ask questions of the patients "over the head of the near bed to do the assessment for the far bed," thus compromising patient confidentiality and potentially violating HIPAA (Health Insurance Portability and Accountability Act) regulations. The second problem with eMAR was that some medications were not bar-coded properly. Nurses could scan patient wristbands but not most medications; thus, supplies and some medications were scanned, while most medications were not.

The modules that would allow local physicians to remotely access patients' records, electronically sign orders, and directly enter electronic orders into the hospital's system were implemented in the third year. Members of the hospital's IT team went to physicians' offices to train local providers to use the first module, Clinical View. At the end of the evaluation, 15 to 20 physicians were able to access the system, but IT managers estimated that only 5 or 6 were using

it. One hospital leader noted that many physicians found it easier to ask nurses for information rather than look up the answers themselves. Another leader thought some local doctors did not yet have computers and Internet access in their offices.

The CPOE module was launched later than scheduled because the IT vendor did not yet have a working CPOE product, even though the vendor had promised such a product two years earlier. To meet the goals of the grant, the hospital purchased a product from another vendor. Users found the substitute CPOE product cumbersome and time consuming. None of the physicians who were trained on CPOE used it; they all refused to do so during the training sessions, and the reasons for their refusal were not clear. Clerks continued to send orders (e.g., for lab work) for physicians through electronic systems, when available.

Issues with the Patient Care Documentation

The Patient Care Documentation module was designed to be used by nurses and other staff. It was launched in June 2007, a month after the departure of the chief nursing officer (CNO) and the installation of an interim CNO. The implementation plan involved starting the Patient Care Documentation system on one unit and then adding units as appropriate. Nurses were reportedly enthusiastic about the system for the first few weeks.

After a few weeks of the system operating in a single medical-surgical unit, the hospital stopped the implementation and shut down the system. The IT team was "facing a revolt from

the RNs," as one leader stated. Complaints were numerous, but the most significant issue was the speed of the system. Sometimes records could be loaded to a computer in 10 seconds, and sometimes the process took 10 minutes. Nurses found themselves dropped from the system in the middle of a patient assessment, and they lost their data. Several hospital leaders thought the problem was inherent in the way the system was programmed. However, others thought the customization the hospital had requested was a factor.

The placement of computers in patients' rooms also affected the Patient Care Documentation module. As with the eMAR module, nurse managers thought the computer placements compromised patient privacy. In response, nurses were documenting patient assessments and other components of care on paper and then reentering the data online at the nurses' station. Some nurses were not using the system, including nurses who floated to multiple units and had not been trained to use the system. Lapses in the quality of patient records were observed, and overtime accrual rose.

After shutting down the Patient Care Documentation system, hospital leaders worked with the vendor to rectify the problem with the system's speed. The system was relaunched in early January 2008 in one medical-surgical unit. Numerous problems arose again. The hospital was at full capacity because of a severe influenza season, the system continued to operate slowly, and concerns about patient privacy had not been addressed. Many nurses refused to use the system, contending that the system was too slow and that they wanted a

wireless system with mobile carts. The system's use ended about six weeks after the second implementation.

PATIENT SAFETY IMPACT

A primary goal of the IT system was to improve the quality of care. A variety of patient outcomes were examined with descriptive statistics. Figure 1 presents overall medication error rates, measured as incidents divided by patient census, from August 2004 through July 2008. Medication error rates were relatively stable after March 2005, ranging from 0.013 to 0.060 between April 2005 and June 2007. Medication error rates jumped sharply to 0.074 in July 2007 and then to 0.152 in August 2007, the first two months of the Patient Care

Documentation system. After the Patient Care Documentation system was shut down, medication error rates returned to normal. A review of the incident reports from each month indicated that most of these errors were omissions of scheduled medication administrations, which suggests that nurses forgot to perform some patient care functions, perhaps because they were overwhelmed by the effort to adapt to the new IT system. No notable changes in medica-tion error rates were observed after the Patient Care Documentation system was relaunched in early 2008.

Figure 2 presents the rate of all patient care incidents, as reported in the quarterly review reports. The rate was 0.234 in August 2004, but it remained

FIGURE 1

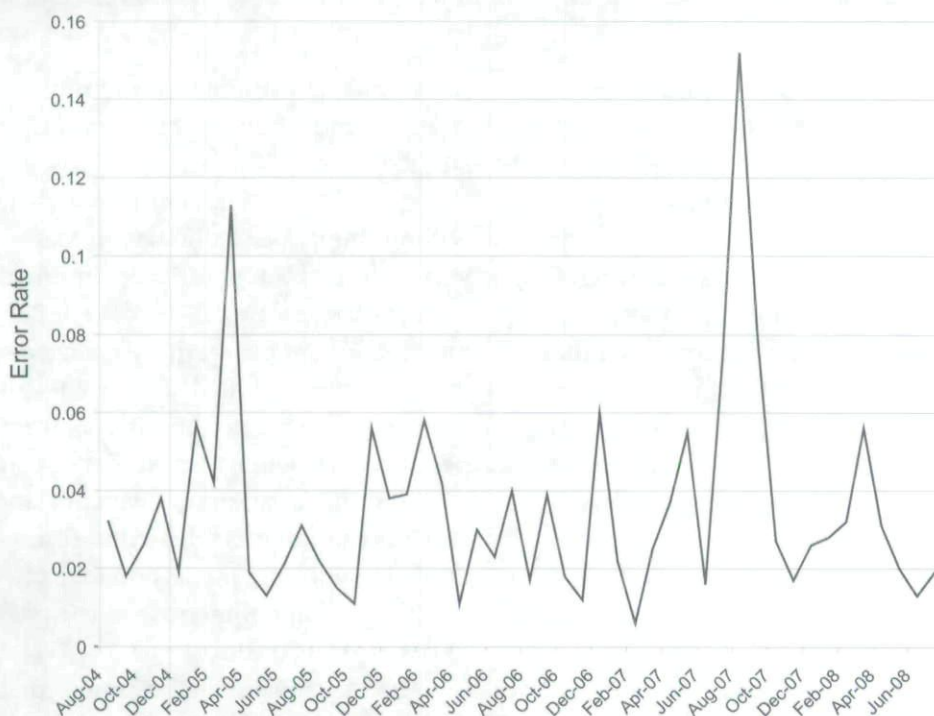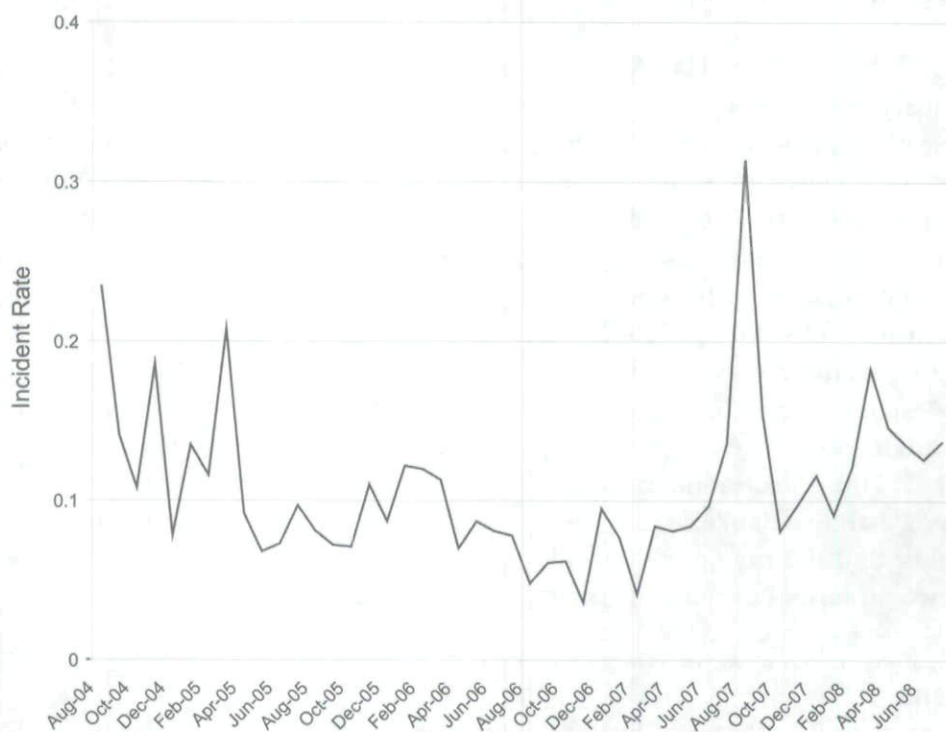Medication Error Rates: Number of Errors per Patient, August 2004–July 2008

FIGURE 2

Patient Care Incident Rates, All Hospital Departments, August 2004–July 2008

between 0.036 and 0.122 from April 2005 to June 2007. The rate rose to 0.136 in July 2007, after the Patient Care Documentation system was launched. The rate continued to rise to 0.314 percent in August 2007, when the Patient Care Documentation system was shut down. The rate dropped after that time, returning to a somewhat higher range of 0.081 to 0.183 between October 2007 and July 2008. The incident rate in medical-surgical units reflected a similar pattern.

As with the total incident rate, a sharp increase occurred in procedure errors from a level below 0.040 to a rate of 0.104 in August 2007. The rate returned to its normal range after that

month. Patient complaints did not change significantly over the period studied.

The number of patient falls with and without injury per 1,000 patient days was examined for all units, including the medical-surgical units. The patient fall rate does not appear to have changed— and may have declined somewhat—after management changes began in November 2006. A CalNOC report was not submitted in the quarter after Patient Care Documentation was released in summer 2007. However, in the last quarter of 2007, a substantial increase in the rate of patient falls was observed.

The increases in medication errors, patient safety incidents, and patient

falls that occurred shortly after the first launch of the Patient Care Documentation system possibly reflect efforts of the interim CNO to improve reporting, or they may indicate that an electronic system identifies errors more frequently and accurately. However, if the primary reason for a higher reported incident rate was better reporting, no explanation could be offered for the drop in the incident rate after August 2007. If the primary reason was that the Patient Care Documentation system resulted in better reporting, one would expect that an increase would again be observed in early 2008, when the system was re-released, but this is not evident.

DISCUSSION

Hospital management was satisfied with some components of this project by the end of the evaluation period. As one leader said, "It's extraordinary what has been accomplished with a two-person staff." However, the IT implementation was hindered by several important problems: a lack of clinical leadership, staff skepticism, turnover in the executive team, an overly aggressive schedule, and a vendor whose products were not ready on time. The upheaval caused by the executive turnover and implementation of the problematic Patient Care Documentation model may have combined to increase risks to the safety of patients.

Clinical Leadership

Only two people were involved in the implementation from beginning to end, and neither had a clinical background. A nurse manager helped to launch eMAR because clinical involvement was needed. However, interviews with

nursing staff revealed a skeptical attitude toward the nurse manager; staff perceived this manager to be "out of touch" with the everyday routine of the nursing staff. No local physicians were identified as providing clinical leadership and advocacy for the system. One hospital leader observed that the implementation leaders had little support from the hospital's education department and had to develop IT training themselves.

Staff Skepticism

Staff expressed some concerns about IT effects on the work environment and professional roles. In the surveys, more than half of the nurses (55 percent) thought an electronic patient care documentation system would provide a more complete medical record. Only 24 percent of nurses agreed that "relying on computerized decision support enhances professionalism."

At the end of the evaluation, hospital leaders recognized that staff preparation for the launch of a new IT system is essential to success. Several leaders thought that not enough had been done to convince staff that the system was necessary and beneficial. As one leader said, we "need to train people to think training is good." Several leaders observed that they did not account for the increased time staff needed to provide patient care while adjusting to the new IT systems. They believed increased staffing during the rollout periods would have given staff the time needed to learn the system.

Executive Turnover

The turnover in nursing leadership during the time the Patient Care

Documentation system was being launched and relaunched contributed to the failure to fully adopt the system. The interim CNO supported the Patient Care Documentation system, even though she was not involved in its selection, design, or implementation plan. Because the interim position was temporary, the CNO could not easily make a decision to terminate the system or to force its full adoption.

Implementation Scheduling

The original implementation plan was ambitious. Staggering the implementation over time could have allowed the implementation team to modify the training and support on the basis of other units' previous experience. A caution about staggered implementations was offered by one manager, however: Staff who work in multiple units would find it difficult to switch between electronic and paperless systems. Assignments may need to be adjusted during the implementation period to ensure continuity for staff.

Vendor Problems

Hospital leaders expressed frustration toward the vendor. The widespread belief was that the vendor did not have a good understanding of its own product and that technical support was lacking. Several people wanted the vendor to provide more guidance on how to implement the software; for example, the vendor offered no advice on how to organize supplies for the bar-code system for supplies or how to select hardware for eMAR and Patient Care Documentation. Most leaders said

they expected the IT product to be "fully ready," but many of the modules were not completed on time.

The vendor was selected for two reasons: (1) the hospital was already using the vendor's financial modules with success and (2) the clinical products were much less expensive than those of competitors. Given the budget constraints the hospital faced, leaders selected a system that was expected to work and was affordable. Some leaders think the problems experienced with this vendor could have occurred with any vendor.

CONCLUSION

Hospitals that are contemplating their own IT implementations need to pay attention to the lessons presented in this article. An IT implementation must have unbending support from the top level of management, strong clinical leadership, a proactive internal marketing campaign, a timeline and implementation approach that allow for learning and change, and a good IT partner. Implementation is a long process, and leaders have to work consistently over time to ensure that IT implementations are completed well.

The hospital in this study achieved some successes with an extremely ambitious IT project. Several IT components were implemented in a short period of time and on a limited budget; larger hospitals have invested much more money only to abandon the investment. Careful planning and thoughtful perseverance are required to ensure a successful IT implementation that benefits patients.

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PRACTITIONER APPLICATION

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This article is a real-life representation of an issue that faces all healthcare institutions. It brings to light fundamental elements that are critical to the success of any project. Nothing can succeed in an organization unless it has clear focus, careful planning, and strong, persistent leader support. The IT project described here may have started with noble ideals, but it lacked every key element for a successful implementation. Put simply, it is a case study for how *not* to do an implementation. The details provided are just enough to show any reader how the plan went awry and how it appears to have been doomed from the beginning. Good intentions do not make for a good implementation.

The project started with a poor method of choice for a vendor, and planning was not carefully done, but the major point of failure was when leadership was lost. Sometimes great leadership can overcome even the worst-laid plans. Another point of failure was not involving physicians and nurses in decision making before the purchase was made. No one can convince an angry medical and nursing staff that it is best for all if they use a system when they were not involved in the purchase process. Another missed opportunity was not having clear expectations before implementation.

The vendor appears to have been relatively new in the arena and obviously not prepared to meet expectations, but these facts should have been spelled out in an agreement where penalties would be imposed for failing to meet specific goals. These systems and their effects are too critical to not do this simple due diligence. Companies cannot be trusted to just do the right thing anymore. Expectations must be clear and measurable, outcomes must be listed and agreed upon, and a penalty (with financial consequences) for failure must be established. Failure is not an option; errors in healthcare are too numerous already without allowing system failures to introduce new ones.

The effect on patient safety is an important focus of this article, and patient safety must be the primary objective in implementing any IT system. Any evidence of a practice that is less safe cannot be tolerated and should be stopped immediately. The lack of leadership was probably the main element that allowed this situation to carry on for such a long time. Healthcare professionals cannot tolerate any additional risk to patients.