Implementing an Emergency Department Information System—How Complicated Can We Make This?

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The development and installation of an information system, whether it is department- or hospital-based, is sometimes a daunting challenge. When dealing with two separate campuses of a recently merged hospital with two different hospital information systems (HIS), two busy emergency departments (EDs), and two separate ED physician groups, implementing an emergency department information system (EDIS) is definitely a challenge.

The two campuses of our Midwest hospital, located only seven miles apart, are very different in terms of their histories and cultures. The smaller of the two campuses, located downtown, has been a verified Level I trauma center for many years and sees approximately forty-eight thousand ED patients per year. The ED physicians on this smaller campus were employed by a large national corporation. The larger campus, located in the suburbs, was only recently verified as a Level II trauma center and sees approximately sixty-seven thousand ED patients per year. The ED physicians on the larger campus were employed by a small, locally owned firm. The smaller campus had a very limited EDIS and the larger campus had an ED module of an HIS that was unsatisfactory in meeting the department’s needs. This article describes the hospital’s experience in implementing an EDIS using the framework of the system development life cycle as described by M. A. Jaworski. The entire process took less than two years.

Feasibility

The justification process for implementation of an EDIS was initiated by the administrative director on each campus, in conjunction with the two campus-specific medical directors. The smaller campus was in the process of building a new ED, a multimillion-dollar project. The larger ED, also desperately in need of expansion and renovation, is now in the process of planning major
changes. The administrative directors (both nurses) and the medical directors represented the primary end users of the system, the ED nursing and medical staff at each site. Two separate presentations were given to an information systems executive committee (ISEC) that consisted of senior administrators and information systems (IS) leadership. These presentations included descriptions of the current situation and work flow, processes that would need to be improved, possible solutions, and a cost-benefit analysis. The first presentation sought approval for a system that was a pure patient tracking device, whereas the second was a request for a more extensive system that included a triage system, clinical documentation, discharge instructions, and printed prescriptions, as well as patient tracking. The second presentation and request for a more elaborate system was the result of additional research into systems then on the market. The second proposal, to move ahead with the development and installation of a multifaceted EDIS, was approved in concept by the ISEC and, ultimately, the hospital board.

Requirements

We decided to use a consultant for the requirements phase of the project, due to the demands of ongoing IS projects in the organization and the resulting drain on current resources. An experienced consultant who was well known to the organization was engaged to assess the information needs in both EDs. After a thorough analysis of the identified needs and the establishment of objective criteria for use in system selection, a request for information (RFI) was developed and sent to eight vendors. In the meantime, the consultant recommended changes to the way we were using the existing information systems; these changes were quickly implemented as short-term fixes.

Responses to the RFI were evaluated by the project team and three systems were selected for further review. The consultant accompanied some of the members of the project team on site visits to assess two of the selected systems. This team consisted of a senior administrator whose responsibility included emergency services, two department administrative directors, a physician representative, and an IS representative. The site visits included meetings at the corporate headquarters of the vendors as well as hospital sites where the systems were in use. After the site visits, all of the key players held a conference to discuss the pros and cons of each system, and the group arrived at a final recommendation.

Design

Final approval to proceed with the implementation of a specific system was obtained from the ISEC committee and the board of directors. An implementation project team was formed in addition to a project steering committee. The steering committee was composed of the people who participated in the
site visits as well as the senior administrator from IS, and the medical director from each campus. The engagement of the consultant ended at this point in the project. The integration and standardization of the practices in the two EDs as they related to a new EDIS (with the associated politics) became a prime objective for the steering committee. The project manager, selected by the hospital’s IS department and experienced in system installation, was introduced to the group and assumed responsibility for the project.

Because of the clinical nature of the system to be implemented and of the unique nature of patient care in ED settings, we decided that one RN from each ED would be selected to function as informatics nurses on the project. These RNs would serve as the liaisons between the IS staff and the ED nurses and physicians. The positions for the EDIS informatics nurses were opened to all nurses working in the EDs on both campuses. Interested staff members applied and were interviewed for the positions. It was not clear what the future of these positions would be in terms of length of service and ultimate responsibilities, so the acceptance of these roles involved a certain amount of risk on the part of the applicants.

We reaped some benefits during the design phase because our selected vendor was in the process of developing an upgraded version that not only addressed Y2K issues but also involved a major revamp of application specifications and structure. The vendor intended to create a more standard product, allowing less customization than in previous installations. In the past, the opportunity for each facility to customize the application had caused difficulties when upgrades to the system were released. Since we represented the first multi-facility contract and installation for this vendor, our informatics nurses were able to play an integral role in the development and design of the new version of the application. The result was that a significant number of our design needs and ideas became a part of the system that was ultimately installed at our facilities. For example, protocols from the Emergency Nurses Association were incorporated into the triage module of the application, at the suggestion of the project team. The fact that the informatics nurses were ED nurses made them invaluable in giving input to the team about work flow and processes in each ED. The creation of these positions, which at first were non-budgeted, turned out to be a critical decision that had a huge positive effect on the project’s outcome.

**Hardware and Software Procurement**

In this project, hardware and software procurement took place simultaneously with contract development and agreements. This format was probably atypical, but was necessary to maintain the timeline that had been established for implementation. As mentioned, the vendor was on the verge of a major version upgrade and there was much discussion in the project team and steering committee meetings regarding the choice between going with the current
version or waiting for the upgrade. Waiting for the upgrade would result in timeline revisions and delay implementation of the system by several months. Ultimately, however, we decided to accept these consequences and go with the new version, because of the inherent advantages of our involvement with the design of the new version and the Y2K compatibility issues.

Because of the delayed go-live date, the renovations were completed at the smaller ED and the department moved into their new, larger space without the advantage of having the new tracking system. The new department was built around a "zone" concept, and face-to-face communication as well as patient tracking were difficult without the planned EDIS. However, the department resurrected the old grease-pencil board, mounted it on a temporary stand and, with the help of security, used a camera pointed at the board to communicate to personnel elsewhere in the department where the patients were at any given time.

Guidance for procurement of hardware and software was provided by the IS project manager and the appropriate personnel within the IS department. In our environment, five separate servers were required: one primary for each site, a "hot" backup server, a training server, and a "roll up" server that would provide database and archived data storage. The system required touch screen monitors and moveable carts for point of service installation, which were evaluated and selected by the project team. PC requirements were evaluated by comparing an inventory of existing machines against the machines needed according to the workflow diagram established during the design phase. Most of this work was done by the IS department in conjunction with the informatics nurses. For obvious reasons, the vendor was also integral to this part of the process and provided software, patches, and installation advice as necessary. This involved both onsite and long-distance communication by the vendor.

**Installation, Coding, and Testing**

The project manager's role was especially critical during the phase of installation, coding, and testing, and she directed the appropriate IS department resources to accomplish these tasks. Throughout this phase she also acted as the primary liaison to the vendor, addressing issues as they came up via frequent communications. Strict adherence to the timeline became paramount at this point, and was managed by establishing critical dates and deliverables from all resources within the organization and from the vendor. Some of the most challenging hurdles arose during this phase, in part because the facilities were in Ohio and the vendor was in Texas. Adequate verbal communications were maintained by phone, and the vendor was able to monitor system performance online via modem. However, the intricate setup of a five-server system interfaced to multiple other systems made required adjustments cumbersome, given the fact that the vendor system specialists were not physically present to make immediate changes as issues arose. Testing and coding
procedures on the two campuses were very different due to the fact that there were two different HISs, lab systems, and radiology systems. These differences resulted in eleven interfaces involving six additional vendors.

Implementation

Approximately eight weeks prior to go-live, the final steps to place the EDIS into production were initiated. To ensure availability of adequate IS and vendor support staff, staggered go-live dates were scheduled, two weeks apart. We decided to implement the EDIS on the smaller campus first. Not only would the lower volume of patients be easier to manage during the initial learning curve, but there were also fewer interface issues on that campus. Hardware installation was completed on each campus by separate IS teams. Both EDs continued to be fully operational throughout the project. Since the hardware installation called for PCs to be placed in each patient room, as well as in staff work areas, it was necessary to be both creative and flexible with scheduling the installations. Much of the work was accomplished during the night shift and early morning hours, the less busy periods in the EDs. Minute-to-minute accommodations by the IS team were necessary.

The two informatics nurses worked with the end users on each campus to review newly developed policies, procedures, and work-flow processes. The culmination of this work was a training manual and the subsequent recruitment of staff trainers. The trainers were more or less self-selected based on interest and comfort with computers. Whereas all were intimately familiar with ED processes, teaching skills were difficult to evaluate. The methodology for system training, for more than four hundred staff members between the two campuses, was a four-hour hands-on classroom session. In addition to the ED staff, employees from respiratory therapy, patient relations, and social services were trained to use the system. Both EDs had been using computerized order entry for several years; however, for many of the employees, expanding the use of computers in their daily work routines resulted in them being very nervous about the go-live. Training sessions were conducted with groups of up to ten staff members. Because the staff possessed such a wide range of comfort and skills in using computers, and because the trainers varied so much in their abilities to conduct the group sessions, a great deal of one-on-one coaching was required during go-live on both campuses. Timing was critical to ensure retention of training and familiarity with the system. However, the coordination required to schedule so many staff members and trainers in a relatively short period of time, with limited classroom space and computers, while still providing sufficient staff for patient care in the EDs was particularly complicated and challenging.

The ED physician interaction with the system is quite different from that of the staff. For that reason, the physicians did not attend the training sessions with the rest of the staff. The informatics nurses conducted one-on-one
sessions for each physician, and again scheduled time around the physicians’ scheduled shifts in the ED. The physician group members had not been active participants in the design of the system. Only the medical director of each campus, and one other physician, had much input into decisions as they had been made. The physicians had been invited to participate when demonstrations of the final two systems under consideration were provided on one of the hospital campuses, but those situations afforded only limited interactions with the systems. Consequently, many of the physicians experienced a considerable amount of trepidation regarding the implemented system.

One of the keys to a successful go-live is the management of the human aspect of the planned change. The around-the-clock presence and support from the vendor, the IS department, and the informatics nurses was critical to the success of the implementation. In addition, the administrative director on each campus maintained a strong presence, working alongside the designated trainers and the ED staff. Double coverage—regularly assigned staff, plus a trainer—was provided in triage and certain other areas of the EDs for several shifts immediately after go-live. In addition, trainers or informatics nurses had to be scheduled to coincide with the first shift worked by each physician after the go-live, so that someone could work with each of them individually.

Transition Phase

Once the system was up and running on both campuses, a user group was established on each campus, with the two informatics nurses acting as chairpersons. Following a thirty-day moratorium, customizations were suggested and revisions made. The IS help desk became a partner to assist in answering staff questions and troubleshooting systems issues. Note pads were placed at each work station, which served as “wish lists” to gather ideas and questions for review by the user groups. Downtime packets were compiled, and the grease-pencil boards, previously used for patient tracking in the EDs, were kept readily accessible for periods of downtime.

Hospital attending and resident physicians were the first staff outside of the EDs to request access to the EDIS. Their “need to know” the clinical information about patients in the ED was evaluated, and with help from the IS expert on security and confidentiality, we decided that some members of the resident and attending medical staff should be given access to the system (subsequently, a training schedule was established).

Postimplementation Review

Throughout all phases of the project, we were aware that the lack of an integrated system was not an ideal situation. The EDIS is not available to other caregivers in the hospital environment despite the fact that we value coordination and continuity of care. With this system, as with all decisions
regarding system selections, the decision to support niche vendors and “best of breed” systems is constantly weighed against the advantages of having an integrated HIS. The identified needs of two busy EDs—the front doors to our hospital—including the capability to gather necessary data to support process change and operational improvements, were balanced against the ideal of an integrated system.

One of the application features valued by the clinicians is that required tasks are displayed in separate columns for nurses, physicians, clerical staff, lab, radiology, and discharge. Each task that has been interfaced to the system is timed so that team members know how long a request has been pending. As the EDs have become larger, busier and more noisy, lessening the dependence on the spoken word has increased the efficiency of the department.

A less-popular feature of the system is the additional time required to enter the triage clinical information. During busy periods, however, this information can be abbreviated and then updated in more detail later in the patient’s stay.

Implementation of the system produced several unanticipated events as a result of the human elements involved. Access to the bedside computers, a necessity for the staff, was also a temptation for some patients and families while they occupied the patient rooms. After memory had been removed from at least three PCs, the IS department and informatics nurses created a lock-down system to prevent further tampering with the equipment. In another example of an untoward effect, a contingent nurse resigned from her position in the ED because she had difficulty working with the system. Because she worked on a sporadic basis, she did not have continued and repeated opportunities to learn to use the system, and decided that it would be easier to remove herself from the situation. In addition, it was not until after the implementation that it became apparent that physicians who cannot type are disadvantaged when situations call for them to enter free text on patient charts. When this was discovered, physicians were offered automated tutorial packages to help them learn to type and, hopefully, decrease their frustration with the system. It is unclear whether any of the physicians took advantage of this offer.

Hospital-Wide Issues Affecting the Project

In the course of our system development life cycle, there were a number of continuous threads or issues that had both positive and negative influences on the project. One of the positive threads was the commitment of the project steering committee. Despite the fact that we were surrounded by continuous change (of “white water” proportions), there was very little change in either the membership or the resolve of our project steering committee. From the conception of the group until after the go-live, the only members that left the group were the physicians from the larger campus. In addition to being surrounded by constant change, the project steering committee was often confronted by others within the organization that were not enthusiastic about
proceeding with the project. There were budget issues, the constant argument against niche vendors (and for an integrated system), the inevitability of changes in the physician groups, and the usual contract negotiation sparring, which caused some people in the organization to think that the project should be put on hold or aborted. Just the fact that we would be the first multi-facility installation for the chosen vendor led some to believe that we should not proceed. The project steering committee members understood why other parties had reservations, but held onto the underlying objectives of the project and worked within the organization to continue to move forward.

The issue of standardization between the two campuses of the merged hospital was another thread that permeated the entire system development life cycle. Although the two hospitals had merged a couple of years earlier, there were continual struggles regarding the standardization of policies, procedures, protocols, chart forms, and supply and systems issues. Both hospitals had been in existence for a century prior to the merger, and the medical staffs of the two hospitals remained two separate entities, despite the merger of the hospitals from a business and administrative standpoint. Proposed changes meant to standardize policies, procedures, and processes in the EDs were also met with resistance in some cases. Implementing an information system—the same system, with the same vendor—with the requirement that we begin to populate a combined database and run combined as well as parallel reports, necessitated some standardization between the two departments. The fact that there was an external force driving the standardization seemed to facilitate the process. We could sometimes avoid lengthy discussions regarding the relative merits of each department’s process, because the functionality of the system helped make the decision for us. In the process of designing the system we standardized charge codes, patient acuity levels, triage protocols, and discharge instruction forms. All would agree that the need for standardization brought on by the design and implementation of the EDIS was a positive theme in that it helped to depersonalize, or deinstitutionalize, a process of change that needed to happen anyway.

The instability, both real and imagined, perceived by the ED physician groups on both campuses was a factor that strongly influenced the success of our project. With increasing pressure to reduce costs by eliminating management fees, to bring about improvements in quality and service, and to be able to negotiate as a single entity in managed care contracts, the hospital had communicated an agenda for change to both ED physician groups. Negotiations concerning a new arrangement between the two physician groups as well as a new contract with the hospital were occurring at the same time as the design and implementation of the EDIS. The result was that the EDIS went live just a few weeks after the effective date of the new contract between the hospital and a newly formed joint venture ED physician group on both campuses. The new contract and new company resulted in the appointment of a new medical director on each campus, neither of whom had any involvement with the selection or design of the EDIS. Fortunately, the overall medical director for
the two campuses, a newly created position, was someone who had been involved in the process. Needless to say, with the physicians unsure whether they would still be employed, and how they would be affected by the new joint venture, the details of implementing an EDIS were not high on their list of priorities. For that reason, there are many issues that are only now being addressed from the physician standpoint that ideally should have been addressed earlier in the process.

Another variable that complicated the entire process of choosing and implementing an EDIS was the physical renovation work that was occurring on both campuses. The smaller ED was part of a multimillion-dollar hospital renovation project that had started a couple of years prior to the implementation of the EDIS. The “new” ED had opened its doors just six months prior to the go-live date. As with any new facility, adjustments were still being made, and details were still being addressed up until the time of the go-live.

The larger ED has been long overdue for a complete renovation. However, a major renovation is only now in the planning stages. With the impending implementation of an EDIS, certain facility issues had to be addressed immediately, long before a multimillion-dollar renovation project could be launched. For example, knowing that many more employees, as well as the physicians, would need access to computers, it was necessary to redesign the central workstation. The fact that the selected EDIS uses touch screen technology partially dictated the kinds of spaces that had to be created. The hospital’s management engineering department was called upon to analyze traffic flow and space utilization and to design a new central station for the department. Unfortunately, the construction work started later than expected and took slightly longer than planned, which caused the system implementation to occur amidst the confusion of construction workers, temporary work stations, and plastic and wires hanging from the ceiling. When the realization set in that the renovation work would not be completed prior to the go-live on this campus, we considered delaying the go-live. Training had already occurred, however, and people’s schedules, the vendors’ as well as hospital personnel’s, had already been arranged; therefore it was determined that it would be even more difficult to delay the go-live.

Renovation projects on both campuses undoubtedly made it more difficult to devote hospital resources to the many tasks associated with the EDIS development. However, it has become increasingly obvious that there are no “good” times to develop and implement a new system. Hospitals everywhere are struggling to adapt to constant change; it seems that the only way to survive is to learn how to do a variety of things all at once, all the time.

**Conclusion**

The EDIS has been in use in our EDs for almost six months. We continue to run both custom and canned reports, and to improve our ability to interpret and use the reports. Additional education for the informatics nurses with
regard to creating reports is underway, utilizing an informatics nurse who has had extensive experience with relational databases and with this specific EDIS. Currently, the reports include overall length of stay and average times for individual tasks (such as registration and laboratory testing), as well as length of stay by area, chief complaint, and physician. These reports are being used to support staffing levels and projects such as process improvement for length of stay.

The informatics nurses maintain the system (software and hardware), provide training, and retrieve data; however, these nurses are actually ED systems coordinators and are involved with much more than the maintenance of the EDIS. They are heavily involved in other department processes, such as the implementation of cardiac, lab, registration, and radiology systems as well.

Work continues on accountability measures for consistent compliance with the policies established for the use of the EDIS. Failure to enter specific information into the system has a negative impact on patient flow, and ultimately on the generation of reports; therefore, it has become a new performance issue that the directors have had to address. In the initial positive feedback about the system, it was noted that the parts of the medical record that are produced by the system are legible, complete, and consistently dated and timed, which was frequently not the case before automation. Not only did the medical records department appreciate the improvements to the patient charts, but the staff on the inpatient units commented positively as well. Because of the printed prescriptions, the number of verification phone calls from pharmacies (due to illegibility) has noticeably decreased on both campuses. Printed discharge instructions for patients and families are more informative, more user friendly, and (again) more legible than handwritten instructions.

The EDIS included a component for autofaxing information about ED visits to the patient’s primary care physician. A lack of communication to the referring physicians had long been a source of concern on both campuses. The implementation of the autofax feature was therefore expected to be an answer to those concerns. On the smaller campus, the new practice of sending a synopsis of the patient’s ED visit to the referring physician has indeed been positively received. However, on the larger campus, even though the communication about patients’ ED visits was sporadic, (which was the source of the concern), the referring physicians were accustomed to receiving the entire ED record when they did receive information. Therefore, even though the autofax feature has improved the consistency of communication to the physicians, the record that they receive is less detailed than in the past. It has been interesting to note that some physicians have actually asked that information not be sent to them about patients that are being referred to them, due to a lack of follow-through on the part of some patients.

The tracking system, the desire for which had been the impetus for purchasing an EDIS in the first place, has met or exceeded our initial expectations.
Physicians, ED staff members, and ancillary staff members have all adapted very well to the concept of an electronic chart rack. It truly has improved everyone's ability to locate patients without having to interrupt someone else to ask questions. Because the EDs consist of triage, main treatment areas, ED observation areas, urgent care areas, chest pain units, and waiting rooms, it is now possible for staff members to visualize the activity and patient acuity of the entire department at a single glance. The department directors also appreciate the ability to continuously monitor each patient's current length of stay in the department, even when they are not physically in the department. Long lengths of stay in the waiting room, for example, serve as a cue to the director or the charge nurse to reallocate additional resources to triage to deal with the backlog.

It has been an extremely interesting and worthwhile, albeit challenging, endeavor to implement an EDIS in this two-campus hospital environment. Increased availability of information, one of the tools that we needed to help standardize practices between the two campuses, has been one of the most valuable benefits of the project, and is only now beginning to be utilized to its full advantage.

Reference

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