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## Successful Introduction of an Emergency Department Electronic Health Record

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Our emergency department had always relied on a paper-based infrastructure. Our goal was to convert to a paperless, efficient, easily accessible, technologically advanced system to support optimal care. We outline our sequential successful transformation, and describe the resistance, costs, incentives and benefits of the change. Critical factors contributing to the significant change included physician leadership, training and the rate of the endorsed change. We outline various tactics, tools, challenges and unintended benefits and problems. [West J Emerg Med. 2012;13(4):358-361.]

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### INTRODUCTION

In our suburban, academic, emergency department (ED) with 60,000 annual visits, our clinicians had always relied on a paper medical record. The ED has 31 beds, including 3 resuscitation suites. We are a Level I Trauma Center, admitting 30% of our patients; approximately one fourth are under the age of 16. The catalyst for our Electronic Health Record (EHR) adoption was a desire to be “state of the art” with the latest technology, enhanced efficiency for the clinicians and improved documentation, while providing high quality patient care.<sup>1-2</sup> We were invited to be the first site within the hospital with a fully integrated EHR. The financial costs for EHR implementation were assumed by the hospital, which sponsored the new enterprise-wide information system (Cerner FirstNet) rather than an ED-niche application alternative. All of our clinicians (physicians, nurse practitioners, nurses) use the EHR beginning with the initial nursing triage assessment and note. The focus of this article is how our emergency physicians (EP) assimilated this technology and process improvement into their customary work flow.

### DISCUSSION

#### Planning for the Change

Our vision was to implement an efficient, easily accessible, real time, patient centric, technologically advanced, legible resource for optimizing emergency care by clinicians. This vision was consistent with the need to improve workflow with reduced errors and enhanced quality and safety, while promoting documentation of the most important information in the least amount of time.

Many tactics were used to positively impact the tool adoption (Table). Based on their unique attributes, 3 physicians were provided protected time to participate in the extensive design process. One was the department chair, who was ultimately accountable for successful implementation. A second physician was familiar with information technology (IT), based on software design experience that preceded his medical career, while the third was a senior opinion leader whose buy-in from the beginning of the project was felt to be critically important. The design took nearly a year with frequent collaborative meetings with our IT colleagues. The 3 physicians spent approximately 140 hours planning, designing and customizing the tool.

#### Implementation of the Change

Tiered physician education and corresponding roll out were used to lengthen the adoption time and lessen the slope of the change gradient. For example, the ED chair conducted 2 two-hour computer laboratory classes, separated by approximately 4 weeks, to teach the EPs how to navigate through the tool, do computerized physician order entry (CPOE), and familiarize them with how to create macros, favorite orders and basic precompleted notes. These classes were followed by 90-minute one-on-one tutoring sessions with an IT expert who assisted the EPs in creating their own macros and precompleted notes. Subsequently, one-on-one bedside mentoring was assigned during four-hour clinical shifts, covering only 3 patient rooms during the last phase of implementation when EHR documentation was finally introduced. After implementation, our physicians discussed improvements and nuances at monthly department meetings.

For several weeks after the roll out, the department chair sent e-mail updates to share tips, improvements and plans to address any concerns raised, while maintaining group focus and alignment.

Several weeks ensued between sequential roll out of CPOE, use of the tracking board, departure instructions and prescription writing, voice recognition (Nuance Dragon 10 Medical) and finally integrated, complete electronic documentation. The intent was to permit a hybrid period where the EPs could continue to handwrite some charts as they assimilated computer documentation skills; however, once the system was activated, our EPs physicians rapidly migrated to all-electronic documentation. Once completely implemented, it took approximately 4 months to regain physician productivity of just over 2 patients per physician hour worked. After achieving the new steady state there was virtually no deterioration in various process metrics, such as overall average patient length of stay (225 minutes), patients leaving without being seen (1.2%) or overall Press Ganey patient satisfaction (75%).

Consensus department order sets were created to speed and standardize commonly related orders, such as blood tests, ECG, radiographs, and advanced imaging. Examples included order sets selected by the physicians for chest pain, abdominal pain, TIA/CVA, first trimester vaginal bleeding, lumbar puncture tests, trauma, and pediatric sepsis. In addition, the multiple required fields for the orders, such as reason for the examination, priority of the request (all STAT), transport mode, etc., were precompleted to save the EPs' time.

Fees paid to the vendor for software and licensing are \$258,000 per year. Bedside, wall-mounted computer terminals had been installed primarily for registrar use prior to the EHR implementation, but have not been embraced by the clinicians. Attempts at using tablet, hand-held computers were unsuccessful due to small screen size and absence of voice recognition accessibility. Only 1 of 25 EPs uses a workstation on wheels for bedside documentation, although several are available. The hospital added 33 desktop computers and several workstations on wheels at a cost of \$83,000, so that each clinician has a dedicated work station. These are the preferred EHR access tools. Voice recognition software added another \$62,000 in cost, and \$7,500 was spent on printers.

It was always assumed that the design and ongoing changes and enhancements would be an iterative process with continual improvement of the tool. Consensus improvements were regularly forwarded to IT, and many were implemented. For example, soon after our full roll out, a unique generic department template was created to merge the best aspects of voice recognition within the vendor's point and click/typed template. The EPs developed to varying degrees their own macros, precompleted notes and favorite orders, as they learned how to customize the application to facilitate their individual preferences. The software continues to improve with nuances introduced approximately every 4-6 months

based on both vendor-driven changes and user suggestions. Examples include tools to migrate more easily through the electronic data repository, as well as improved individual-driven, customized sorting on the electronic tracking board.

Various techniques were used to incentivize the physicians' adoption. For example, regular non-blinded peer comparisons in use of CPOE and electronic documentation were shared, which accelerated their adoption. Clinical examples of how the new electronic infrastructure assisted efficient, high quality care were regularly shared; this too had a significant positive impact. During the initial roll out, approximately 1% of physician yearly compensation was at risk per physician, based on relative adoption of the EHR technology. The department achieved its objective of 100% EHR adoption by its EPs. All of these efforts helped shorten the adoption time frame, ultimately defined by complete EHR utilization.

### LESSONS LEARNED

Given the challenge of migrating to a new department infrastructure, it would be wise to increase staffing to accommodate the expected slow down in patient care throughput for the first 2 to 3 weeks of implementation. Adding an extra physician shift per day during the afternoon-evening hours and having an on-call physician available would be advisable. Also, once we became reliant on our new electronic infrastructure, we recognized some of the challenges that could impede optimal performance.<sup>3</sup> The tool must be reliable and ideally have no unplanned downtimes. Planned downtimes should be infrequent and eventually eliminated. Concerns for secure access to the EHR need to be balanced with easy accessibility. Delays of computer response times of greater than a few seconds result in frustration by the user and the potential to lose cognitive focus. During the design process, the physicians requested that delays be limited to 2 to 3 seconds; this goal has been met with rare exception. All clicks should be value added. Unnecessary forced jumping between display screens should be eliminated. Decision support, a major reason to use the tool, should have contextual relevance and not be overbearing to avoid alert fatigue and unnecessarily interrupting the end user.<sup>4</sup> Our initial experience with too many non-clinically relevant alert interruptions caused us to raise the threshold for alerts. Although it would be ideal to have clinical decision support seamlessly push to the clinician, the current system relies on the end user to pull in needed information. Finally, with regular updates and improvements, we experienced the varied capacity of each user to assimilate changes in their use of the tool.

Using a sophisticated electronic tool also carries some risks that need to be acknowledged and managed. Given the ease that charting by exception can be accomplished within the EHR, one needs to ensure clinicians have performed everything they have documented when using their macros or precompleted notes. One also needs to avoid inappropriate cut

and paste (“copy forward”) functionality where inaccuracies from copying other notes can be propagated.<sup>5-7</sup> Ready access to historic information, which could lead to inserting old and inaccurate medication lists into a current note, must be avoided. Time spent in front of a computer screen can detract from the EP’s necessary departmental clinical vigilance and situational awareness. The focus on the computer could also be misinterpreted by patients and families as nonprofessional time spent by the provider. Finally, the focus on the computer to facilitate documentation and order completion can detract from that vital part of typical ED culture: the face-to-face provider team communication. For example, lack of appreciation for the prioritization of task completion, and absence of all team members being aware of important clinical information can occur in the absence of the random but meaningful verbal clinical information sharing potentially hindered by the computer focus. On the plus side, the physician CPOE- generated nursing icons on the tracking board provide easily accessible non-verbal task communication with the staff, while the nursing staff also has easy access to the physician’s clinical note and assessment.

We have also seen the overall time spent on documentation increase, although it varies based on the individual clinician’s preference for using time-saving macros, pre-completed notes, and voice recognition. Our markedly improved legible and more comprehensive charts have driven an almost 6% increase in our billable worked RVUs per patient. Some physicians attempt to complete their documentation at 1 sitting while others add entries to their charts sequentially as they get more information during the patient’s visit. Although we request chart completion soon after the patient’s discharge from the ED, several physicians spend an extra hour charting at the end of their shifts while a

few prefer to use portal access to complete their charting from home. Consequently, our timely chart completion compliance is good.

We have also experienced some unexpected challenges with the tool. The greater the dependence on the new technology, the more difficult it becomes to do without it. In addition, paper documentation may still have a defined role. Although our legacy paper chart and clipboard still exist and typically hold the patient labels and the initial triage vital signs(which are also in the EHR), bedside paper orders and documentation are still necessary in our ED for time-sensitive care related to STEMI, procedural sedation and trauma resuscitations where data entry into the computer may delay critical clinical care. Given the availability and ease of electronic documentation, clicking momentum may lead to spending too much time over documenting an encounter. Further, it only takes 1 inadvertent click for orders and documentation to be done on the wrong patient. Additionally, some form of back up, such as a shadow tracking board to keep the clinicians aware of ED activities, must be available during downtime. We have a scheduled two- to three-hour regular monthly downtime typically occurring early on a Sunday morning. These downtimes can result from lack of reliability or an upgrade in any of the software that interfaces with the clinical portion of the EHR, such as laboratory results, X-ray, or ADT (admission/discharge/transfer) applications.

The unexpected benefits of EHR have also been illustrative. Time consuming serial-based processing has been transformed to parallel-based processing due to simultaneous access and use of the EHR by many clinicians. Allergy and duplicate order alerts (integrated in the order process), as well as ready access to standardized, clinically correlated protocols

**Table.** Key Tactics and value for implementation.

Tactics	Cost	Payoff
Enlist physician leaders to participate in design	Moderate	Large
Tiered new skill acquisition and roll out	Low-Moderate	Large
Frequent and regular updates to physicians	Low	Moderate
Consensus department order sets	Low	Large
Voice recognition	Moderate	Large
Financial incentives for adoption	Low	Moderate
Shared peer adoption progress	Low	Moderate
Dedicated personal computers for each clinician	Moderate-High	Large
Consensus department discharge medication favorites	Low	Large
Portal Access to electronic health record	Low	Moderate

(e.g., recommended Antibiotics or Pressors), have improved care. Favorite individual physician orders, department order sets and discharge medications have also been well received as time savers. Having disparate data (labs, radiograph readings, etc.) available for inclusion in the summary EHR provides a focused opportunity to enhance the physician's decision making and documentation. Unfortunately, at this time we are not able to import photos or electronic images such as electrocardiograms. Once the ED encounter was digitized in the EHR, portal access has not only allowed for remote completion of documentation but also continued access to the admitted patient's in-house clinical status, thus enhancing the EP's knowledge base. Our documentation is available to providers outside the ED once they are saved, even before signing.

Of all the tools provided to facilitate the change, 2 stand out in surpassing physician expectations. First, each clinician was assigned a wide screen personal computer formatted to avoid the need for either horizontal or vertical scrolling. Secondly, sign-on only occurs at the beginning of a clinical shift as regular interaction with the computer eliminated the need for recurrent log-ins. In addition, the availability of voice recognition, integrated within EHR documentation allowed rapid and accurate transcription, far exceeding the speed of typing. Training of the voice recognition software takes no longer than 5 minutes. It accommodates most accents and is accurate. Noise cancelling microphones do an excellent job at excluding ambient noise. Finally, each physician has his/her own designated work station.

## CONCLUSION

Since migrating to our integrated EHR over 2 years ago, we have received positive Medical Staff acknowledgement of the legibility, easy access and robust nature of our documentation. Our EPs say they would never go back to our prior non-electronic system. We have been invited to share our model of design and implementation with other ED leaders seeking to emulate our success. Although billing and patient satisfaction have both improved, other simultaneous changes that were implemented confound our ability to unilaterally credit the EHR. We continue to make regular improvements in the tool based on both requests from the clinicians and updates from the vendor. Our medical director manages the requests for improvements and serves as the liaison with the IT support staff.

No matter how conscientious you are with EHR design and roll out you will immediately appreciate the need for modifications once you go live, given the ongoing feedback from stakeholders. Your steady state will thus be time limited as the tool continues to evolve while your colleagues and the vendor work to continuously improve it. In summary, our adoption of the EHR has dramatically improved our ED work product.

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