Automating Workflow in the ED and Beyond

Tri-City Medical Center streamlines processes despite growing ED demands

In March 2004, Tri-City Medical Center implemented an integrated electronic medical record, including 16 coordinated applications, across most hospital departments. Tri-City's emergency department has since proven to be an ideal environment for full automation. The inherent visibility of the ED and its success with automation has contributed to further physician and staff buy-in house-wide.

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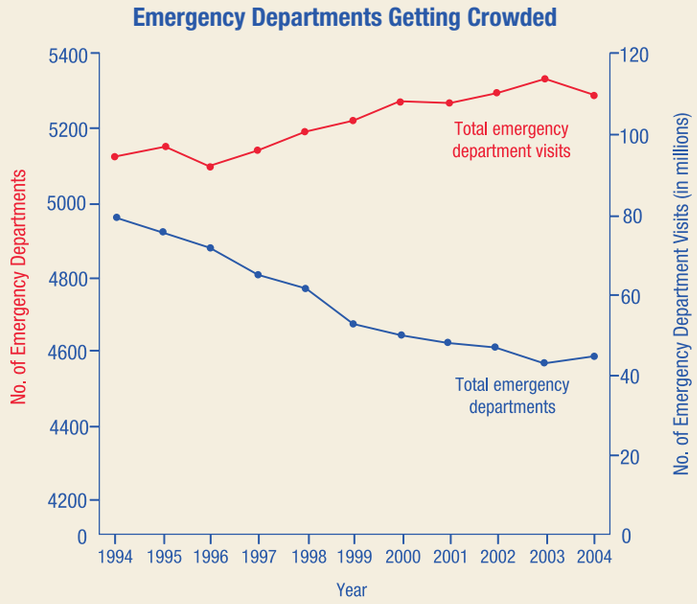
Emergency departments (EDs) in the United States are in crisis. They face an array of challenges with staffing shortages, mounting case loads and uninsured patients who depend on them for primary care. EDs are increasingly overcrowded as they cope with this rising demand. As the second busiest ED in San Diego County, treating more than 65,000 patients per year, we at Tri-City Medical Center (TCMC) have first-hand experience with many of the challenges facing America's EDs and healthcare organizations today. Our district hospital, which serves the residents of San Diego's North County, is licensed for 397 acute care beds and provides a full-range of primary care and medical-surgical services.

We realized implementing an integrated clinical information system was key to combating organizational challenges. We needed a system that reached across departments, enhancing our workflow processes and giving all providers—both hospital- and community-based—access to the same information. In 2004, TCMC implemented an integrated information system, which allowed all disciplines access to up-to-the-minute clinical data. In total, we implemented 16 solutions simultaneously. We knew the ED had the potential to be a major beneficiary of our organization-wide automation. The compressed timeline and high-acuity patient population made the time-saving benefits of the electronic medical record (EMR) and computerized physician order entry (CPOE) more visible than in many other departments.



From 1994 to 2004, the number of emergency room visits increased from 93.4 million to 110.2 million visits annually while the number of emergency departments fell almost 10 percent.

The ED is the ideal department to implement CPOE because it is an encapsulated environment of presenting problems and providers alike. It has a relatively brief patient-care timeline, coupled with high acuity patients—a combination that makes efficiency improvements high-yield and extremely visible. Because of this transparency to consulting physicians and other hospital staff, success of CPOE in the ED can lead to further physician and staff buy-in house-wide, improving your chances for overall institutional CPOE success. We quickly bring new physicians up-to-speed with CPOE after they come on board. One reason for their rapid success is our ED physician home folder, which includes more than 4,000 orders, organized into subfolders and more than 100 order sets, many of which are chief complaint-based or process driven. We've tailored our home folder to our department's needs by cultivating our more than three years of experience with CPOE. We believe the physician CPOE home folder is a pillar of any build, and organizations should extensively develop one prior to implementing CPOE.

Streamlining workflow with EMR integration and CPOE

Prior to implementing an integrated system in our ED, we frequently ran into problems of system stability and order-entry delays with our unit secretary serving as a middleman between physicians and nurses. Data collection of sub processes, such as patient arrival to bed assignment interval or lab and radiology turnaround times, was not a possibility. Paper-based charting and inefficient processes bogged down our workflow from triage through discharge. Nurses completed triage notes and all documentation on paper. Physicians entered patients' orders into the tracking system. Our unit secretary then transferred the orders into our house-wide system, and results were returned on paper. Physicians documented patient visits through a separate dictation and transcription archiving system and hand-wrote all prescriptions.

Because our ED system did not communicate with other systems in the organization, we had communication breakdowns, which presented the possibility of jeopardizing patient safety. Now, through our integrated system with CPOE, order-events integration and patient-tracking, we have immensely improved our ED patient flow efficiency, facilitated safer and more effective provider communication, and ultimately, provided critical data to support institutional change and process improvement.

Physicians now have immediate access to information, which allows them to review patients' prior records before they even meet. Physicians are able to more effectively facilitate care by looking at past documentation and records. For example, a physician could uncover the fact that the patient had a recent abnormal stress test that did not receive follow-up services. This real-time access to information allows us to enhance communication throughout the organization as well. All clinicians have access to the patient's electronic chart and can see exactly what has been done for the individual. For instance, nurses can see immediately when physicians place medication orders, which means patients receive their medications quicker. House-wide, we have cut the time needed for medication processing from order transcription to administration to 12 minutes from more than one hour.

We also have improved our discharge and referral process through automation. We work closely with a local clinic and refer many of our uninsured or underinsured ED patients to receive follow up care there. It is less expensive for the patients, and the clinic depends on the referrals. Our patients also benefit because they get connected to the primary care system at the clinic. The next time they visit the ED, they often have received preventative care since their last visit. In addition, many have established some type of insurance through the clinic's administrative assistance. With our paper-based referral process, the clinic would see 40 to 50 referrals a month out of the 200 patients per day who visited our ED. Our integrated system allows us to automatically build a custom referral report that pulls patients' information such as name, demographics, clinical information, discharge summary and prescriptions. TCMC

Causes of Emergency Department Overcrowding

- Increased ED patient volumes
- Increased ED patient acuity
- Increased complexity of diseases and associated evaluations
- Lack of inpatient hospital beds and related resources
- Nursing shortage
- Physician shortage

Source: Committee on Pediatric Emergency Medicine, Pediatrics 2004; 114:878-888

generates the report completely in the background. It's a transparent process to the provider, requiring minimal referral action by the physician. We then download that information and securely transfer it to the clinic providers daily. Literally overnight, with the activation of this report, our clinic referral count skyrocketed from 40 to 50 referrals per month to more than 500.

With CPOE, we eliminate the unit secretary as a "middleman" in the medication ordering process. We place orders, and the system immediately notifies the technician, nurse or ancillary staff responsible for executing the orders. This saves anywhere from 5 minutes to 20 minutes and minimizes the chance for error. The unit secretary no longer needs to decipher physicians' handwriting to process their order. The order goes directly to the nurse or technician, and because it is electronic, we have no legibility issues. This is a substantial patient safety improvement. Furthermore, CPOE provides TCMC ED physicians the opportunity to embed decision support at the point of care in the ordering process. For example, specific antibiotic use decision support has proven beneficial to our physicians in the care of community acquired pneumonia core measures patients. Furthermore, our facility reimbursement for Medicare patient transports rose appropriately with the aid of decision support embedded in our patient transport care set.

Faster emergency response

The outcomes of ED patients are often dependent on the quality of care they receive before they step foot in our department. By participating in D2B: An Alliance for Quality, a program launched by the American College of Cardiology (ACC) to help save time and lives in U.S. hospitals performing primary percutaneous coronary intervention (PCI), coupled with the use of our EMR, we are able to greatly reduce our door-to-balloon times. National guidelines developed by the ACC and the American Heart Association (AHA) state that hospitals treating ST segment elevation myocardial infarction (STEMI), patients—those who have had a severe heart attack caused by the sudden, total blockage of an artery—with emergency PCI, should reliably achieve a door-to-balloon time of 90 minutes or less. However, accomplishing this level of performance is an organizational challenge. To meet the D2B initiative, TCMC trained approximately 300 paramedics in Oceanside, Vista and Carlsbad emergency response agencies to deploy field transmitted electrocardiograms (EKGs). Paramedics and our ED physicians execute the following activities prior to patients' arrivals at TCMC:

1. Paramedics perform 12-lead EKGs to patients in the Tri-City Medical Center district who present clinical symptoms of heart attacks.
2. Paramedics transmit EKGs to the TCMC ED through a cellular connection from the EKG machine.
3. Upon receiving the EKG transmissions, via a dedicated receiving station, the emergency room physicians verify the presence of a STEMI and utilize the EMR to access previous EKGs for clinical comparison.

These actions have enabled us to reduce door-to-balloon time from an average of 121 minutes to 76 minutes. Specifically, if a physician confirms the presence of a STEMI from the EKG transmission, all essential clinical personnel prepare for the patient before he or she enters the ED. It is this combination of clinical expertise and electronic record access that enables us to reduce myocardial damage in our patients and improve timeliness of care. Programs like D2B, combined with the power of HIT, provides organizations like TCMC the ability to directly affect patient care beyond the walls of their facilities. Then, when the patients arrive in our ED, we are equipped with the tools we need to provide effective and safe care. For example, order-events integration, a valuable tool in patient tracking that ties order types to various icons and time-stamped event records, has significantly helped us improve processes. When we place an order through CPOE, it appears on an orders tab within a patient's chart and also as a specific notification icon on the tracking board, facilitating immediate communication among staff. With order-event integration, we can capture data on a broad array of clinical event intervals in the ED—ranging from arrival to discharge, consultant contact to admission orders received, and transport request to departure interval. Access to this type of information makes departmental and institutional change possible.

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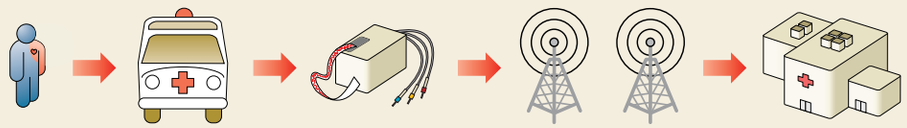
Another frequent contributor to delayed patient care was oral contrast administration for computed tomography (CT) scans. The bottleneck occurred after physicians placed the orders; the nurses would not see that orders were present until they checked the orders tab within patients' electronic records. To solve this problem, we created an oral-contrast icon. Immediately after physicians place a CT scan of the abdomen that requires oral contrast, the icon appears on the tracking board. Nurses receive an instant visual cue to administer oral contrast. Additionally, after the icon disappears, physicians can see what time it was administered and no longer have to follow up with the nurse. This communication extends beyond the ED. A CT scan technologist, for example, now is notified when the contrast is complete, so he or she can more efficiently schedule an exam. With order-events integration, immediate non-verbal

TCMC is an active participant in the American College of Cardiology's D2B program for myocardial infarction patients. The hospitals involvement in the alliance, coupled with the use of electronic medical records has helped it reduce door-to-balloon times by 37 percent for affected patients.

Combining D2B Guidelines and the EMR Significantly Reduces Door-to-Balloon Times



Source: Tri-City Medical Center

communication is achieved between ED staff. This leads to more rapid and safer patient care. Moreover, time stamping functions of events allows us to examine retrospectively how our clinicians complete a process, such as oral contrast administration, medication administration, or bed-to-doctor exam intervals. Armed with this data, it is possible for us to identify where we can focus process improvement efforts.

CPOE with medications allows for rapid initiation of complex patient evaluations. CPOE combined with automated ancillary communications, such as auto-paging of EKG technicians and respiratory therapists and immediate notification of phlebotomy and radiology technologists, jump starts patient orders and data acquisition for physicians. For even the most complex of patients, such as an elderly male with chest pain and syncope resulting in a head injury as well as a wrist fracture, we can quickly enter a complete set of orders using a combination of one of our 100-plus ED care sets and supplementary order subfolders. Physicians can place orders from their desktop workstations, or on the go, at patients' bedsides using wireless tablet PCs.

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This is exactly the reason organizations should move forward with CPOE in the ED. After experiencing the many benefits of CPOE with medications for more than three years, we cannot imagine practicing in an environment without an integrated electronic medical record. Existing technology has been proven to elegantly support these applications. CPOE in the emergency department is quickly becoming the gold standard for a safe and efficient patient care delivery system.

Automating ED ordering processes

The success of our integrated system and CPOE is largely due to our departmental ED physician home folder. Consisting of pre-built ED orders, the home folder contains subfolders that we divided into various order types, such as medications, consultations and laboratory, to name a few. If a patient has a complex case of abdominal pain, a headache and a sprained wrist, we can place a comprehensive set of orders in under 20 seconds, including about 20 to 25 orders across the board, with medications, laboratory, radiology and nursing. This wouldn't be possible without the combination of well developed care sets and the home folder containing thousands of orders.

Our medication orders subfolders contain approximately 800 to 1,000 medications that TCMC organized based on the medication type (e.g. antiemetic or analgesic). By accessing the home folder, we can quickly navigate, locate and order almost any emergency department medication, usually in just two to three mouse clicks. If we need more than one medication order, we can access 40 of the ED's most commonly used care sets. In the last three years, we have independently created nearly 100 detailed ED care sets, including those based on chief complaint and condition, but also those to drive processes, such as triage standing orders or core measures care sets. The ability to easily place one-time orders for frequent medications commonly ordered, such as Tylenol, is another beneficial feature of the home folder. We have 100 to 150 such one-time orders. For these medications often ordered in the middle of a patient's stay, we don't have to click multiple times to get the order—it's right there on page one. If we have a patient who complains of abdominal pain, we can talk with him and document our notes electronically. To place our orders, we would open the physician home folder and access the ED abdominal pain care set. The care set contains some 15 pre-selected orders and nearly 50 additional accessible orders of varied nature that we might order for an abdominal pain patient, such as an EKG or a chest X-ray.

In the ED, we treat patients quickly and efficiently. With CPOE, we can include decision support in the fundamental care set design. We have found this to be useful in multiple areas, including our achievement of Joint Commission Stroke Center designation and core measures performance excellence. After the implementation of CPOE with medications in March of 2004, our ED physicians further realized the dividends of an automated ED system and became intimately involved in the system design. Our IT analysts, Cindy Melden and Nadine Honeycutt, also played a critical role working with the clinical team to build a system that is intuitive to the way our clinicians work. Regular solution team meetings, which include clinicians, department administrators and IT staff, continue today and enable the ongoing and coordinated enhancement of our system.

Achieving National Patient Safety Goals

Joint Commission has identified standardized patient "hand offs" as a National Patient Safety Goal. According to the Joint Commission, to meet this goal, hospitals are to "implement a standardized approach to hand off communications, including an opportunity to ask and respond to questions." Integration of our EMR on an institutional level makes this type of communication possible, no matter which two locations are involved in the transition of care. ICU nurses, for example, are able to access the patient's chart they are receiving a report for in real time. Telephone discussion occurs in conjunction with joint access to patient data such as lab results, medications given, patient allergies and real-time physician documentation of the plan of care. This type of communication allows our clinicians to appropriately dialogue, which directly benefits patient care.

ED physicians must be able to quickly order labs, X-rays, CT scans and nursing interventions. Rapid input and completion of these orders through CPOE and integration is key to providing the best patient care. Furthermore, the immediate visibility of these actions and results to other providers throughout the institution provides a level of care only afforded by this type of

TCMC Successes

Joint Commission's Gold Seal of Approval and reaccreditation for three-year period

Certification by the San Diego County Office of Emergency Services as a STEMI Receiving Center for the treatment of acute heart attack patients

Gold Seal of Approval and certification by the Joint Commission as a primary stroke center, one of only five in San Diego County

integrated healthcare delivery system. With our system's visual icons, clinicians across TCMC's departments know the status of patient tests and what needs to occur next. If a patient has to be transferred from the ED to the intensive care unit, the ICU charge nurse notices this ED tracking board indicator and prompts the ICU nurse to review the patient history, allergies, X-rays, vital signs, labs and nurse and physician documentation, even prior to receiving the report from the ED nurse. The ICU nurse, as well as clinicians in other departments, can use a chart summary tab we developed to receive a quick view of key patient information, including both active orders and documentation. This tab enhances hand offs between departments and units, enabling TCMC to meet the patient hand offs National Patient Safety Goal. Access to this information showcases the true benefit of an integrated patient record.

Additionally, we are better able to meet the requirements of the National Patient Safety Goals by documenting critical values. If patient's labs are of critical value, lab clinicians validate the abnormal values and the times. They notify a physician who documents the treatment. Complete documentation allows us to pull data to show we are meeting our policy on critical values turnaround time. Our system enables us to better audit documentation completeness by requiring fields and forms. This approach helps us see who is completing or not completing required fields, and we can hold staff accountable. More complete documentation enabled us to increase our ED facility charges by 60 percent per patient visit.

Facilitating core measures

The Joint Commission requires accredited hospitals to collect and submit performance data on such core measure sets as:

- Acute myocardial infarction
- Congestive heart failure
- Community acquired pneumonia

Prior to our integrated system, TCMC's core measures in the ED were below where we wanted them to be. We relied on practice habits, reminders and provider education to complete ED core measures, which was inefficient. By combining the power of CPOE, core measures-specific care sets, core measures-specific events/icons and related reporting functions, we have significantly improved our performance. Automation has given us the opportunity to set rules in place that automatically execute specific orders once we identify a core measures patient.

Using CPOE with medications, including integrated decision support and order-events integration, we developed tools to optimize compliance not just in the ED, but throughout the institution. Our alert functionality, which was designed to improve patient care and optimize regulatory compliance, proved to be a powerful tool. By identifying a core measures patient in the ED, we are also able to hard-code required inpatient documentation and hospital discharge instructions. For example, in regard to acute myocardial infarction, indicators of optimal cardiac care include administering aspirin and beta blocker medications upon arrival. TCMC has reached 100 percent compliance for each for the past six months (see Figure 1). This is in comparison with only average performance prior to our implementation of CPOE and our core measures practice tools.

The Physician Quality Reporting Initiative (PQRI), which takes effect July 2007, rings in the true arrival of Pay-for-Performance. The PQRI is the current means by which the Centers for Medicare and Medicaid has chosen to incentivize physicians to adhere to and report best practices. The initiative includes a 1.5 percent bonus of total Medicare payments—which has caught providers' attentions. Having core measures and National Patient Safety Goals reporting tools constructed already, as well as the availability of additional custom reporting tools, we are able to facilitate PQRI reporting, further demonstrating the value of an EMR and an integrated system.

TCMC Acute Myocardial Infarction Core Measures Data

Measure	2005	2006	Q1 2007*
Aspirin at arrival	97%	98.1%	100%
Aspirin Prescribed at discharge	93%	97.5%	100%
Angiotensin converting enzyme inhibitor or Angiotensin receptor blockers for left ventricular systolic dysfunction	72%	92.7%	100%
Adult smoking cessation advice/counseling	98%	100%	100%
Beta Blocker prescribed at discharge	90%	97.3%	98.3%
Beta Blocker at arrival	96%	96.6%	98.1%
Thrombolytic agent received within 30 minutes of hospital arrival	18%	50%	100%
Percutaneous coronary intervention received within 120/90 minutes of hospital arrival**	40%	60.4%	100%

Source: Tri-City Medical Center, Comparative data from 05Q2-07Q1
*Preliminary data
**Jan-Jun: 120 minutes, Jul-Dec: 90 minutes

Figure 1

Connecting community-based physicians

Tri-City Medical Center is a district hospital and has served the community for more than 45 years. Our community physicians and their patients recently gained great benefit from the implementation of an integrated health information technology system. Over the past three and a half years, since the implementation of integrated software, physicians can better care for their patients because they have access to the most up-to-date clinical information available. Hospital-based physicians such as hospitalists, radiologists and emergency physicians are not the only group dependent on the EMR; our community physicians are also gaining ground by tapping into the TCMC EMR through remote access technology. This technology allows the affiliated community physicians to access patient records and results from the convenience of their own offices or other remote locations. In turn, providers can facilitate the transfer and communication of information among each other like never before.

Now that the TCMC ED has recently moved to real-time physician documentation, patients are discharged to follow-up with their primary care physician who may access their ED physician documentation electronically. This type of transition of care communication facilitates a far more efficient follow-up visit, eliminating inefficiencies and costly redundant testing.

What's next for the ED?

Tri-City Medical Center's emergency department is in the midst of implementing an innovative model combining electronic physician documentation with scribes. The electronic template-based charting system alone helps ED physicians gather pertinent patient-history data, as well as physical and medical decision-making information. The electronic system then enables physicians to effectively and efficiently organize this information in patient charts. TCMC has taken this data collection one step further and added a scribe as a physician extender.

A pre-medical student, who is trained as a scribe, accompanies the physician to the bedside with a tablet PC in hand. The scribe then records the patient information the physician collects during the interview and physical examination. This pioneering model combines the strengths of both real-time electronic physician documentation with the use of physician scribes. This paired solution allows the physician to focus on the patient interaction, spending more time at the bedside and less time behind a computer terminal. During our recent transitional phase of provider and scribe training and project launch, we have successfully trained more than 40 physicians and 40 scribes in the functionality and benefits of the physician documentation software, leveraging the strengths of real-time documentation with the teamwork of a physician and scribe.

This inventive approach to physician documentation is another example of how TCMC continues to raise the bar to provide our patients with the most efficient and highest quality care possible. With the safety features, alerts and preventive action items that we have built into our system, an integrated EMR strides far beyond the capabilities of any paper-based system. Clinicians will improve their practice routines by learning to depend on their integrated EMR for crucial clinical data and by allowing the system to work for them. TCQ

Dr. Reid F. Conant

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Dr. Reid Conant is a board certified emergency physician and chief medical information officer for Tri-City Emergency Medical Group in Oceanside, Calif. Conant provides medical direction and is physician champion for "Compass," Tri-City Medical Center's (TCMC) clinical information system and electronic medical record (EMR), which includes computerized physician order entry (CPOE) applications.

Conant led the emergency department (ED) solution design team through the initial implementation of CPOE in 2004, followed by numerous process improvement initiatives, leveraging the strengths of its ED solution and its electronic system's integrated architecture. These efforts resulted in an advanced ED environment and one of the most comprehensive emergency department CPOE order databanks in the country.

Conant is driving regulatory compliance improvement through the development of a novel Core Measures solution, as well as solutions surrounding Centers for Medicare & Medicaid Services and the Physician Quality Reporting Initiative. He has spoken nationally on medical informatics and process improvement. As a charter member since 2004, Conant contributes to Cerner's ED solution development and enhancement through its Emergency Medicine Solution Advisory Group. His current area of research and solution design focuses on process improvement through the use of advancing technologies. Recently, he led the successful design and implementation of an innovative model combining electronic physician documentation with physician scribes.

Conant attended Jefferson Medical College in Philadelphia, where he earned the William C. Davis Prize in Emergency Medicine. He then completed residency training in emergency medicine at Stanford University Medical Center.

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Kathy Topp is the director of clinical information and education at Tri-City Medical Center (TCMC), a 397-bed community district hospital serving the North County San Diego area. Topp participated in the selection process for TCMC's healthcare information technology system and directed the nursing clinical application design and build.

Topp is responsible for new clinical application design, implementation and training. She oversaw the clinical transformation to TCMC's electronic medical record and advocates for workforce enhancements based on informatics and process redesign. She has been involved in nursing management and informatics for more than 25 years, working both for healthcare facilities and a healthcare information systems company managing clinical implementations.

Topp has a bachelor's degree in nursing from Marquette University and a master's degree in management from Cardinal Stritch University in Milwaukee. She is a member of the Sigma Theta Tau International Nursing Honor Society, the Association of California Nurse Leaders and the American Nursing Informatics Association.