



Trends in Clinical Informatics: Supporting Patient Care, Innovation and Transformation – Poster Presentation

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Implementing an eMAR Through the Use of an eTesting Team Created from Front-Line Staff

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Background: The use of electronic medication administration records has been set forth as an industry standard to improve patient safety. Yet many of these efforts miss their mark on a number of measures. Without a deliberative process in both development and training, technology may merely automate a flawed system. At worst, flawed electronic systems and inadequate staff training and preparation may increase the risk of harm to patients.

Process: We involved front-line staff in every stage of the project. They helped inform our initial steps; analyzing current workflow, defining key principles, and reviewing available electronic products. We concluded that none would meet all of our requirements and launched a process to create a home-grown product (eMAR) that would increase safety and efficiency of the medication administration process and provide real-time, accurate information to clinicians and patients about medications.

Development occurred over many months, in a dynamic iterative fashion. As the eMAR emerged, we convened an “eTesting Team,” composed of clinical nurses and pharmacists who met with the development team during weekly all-day sessions. They used current clinical experiences, practice standards, and knowledge of workflow to test and re-test the application, making recommendations for enhanced usability.

The eTesters also developed classroom training and worked with project leads to design and implement a broad training plan for all users. They supported each of the go-lives during a phased roll-out, helping to ensure that there were no disruptions in medication administration and that all staff felt comfortable with the new process.

Results: To date, we have had fifteen successful unit rollouts. The participation of the eTesting Team has been key to the project’s success. Nursing time motion studies show that, following implementation, nurses spent more time at the bedside, even while actual time to administer medications remained flat. We have achieved a consistent rate of 96% or more for bar-code scanning, including for the high risk areas of the Emergency Department and PACU.

Conclusions and Recommendations: We believe deployment of front-line staff in testing and support roles during a practice change has multiple advantages and broad applicability. Not only does it help ensure a user-friendly, functional product, but it also provides built-in leadership and development opportunities for clinical staff. This improvement project demonstrates that using our team of eTesters plays an important role in bringing electronic medication administration to the hospital environment.

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Simulation as a Development Tool in the Creation of an Electronic Medication Administration Record for the Emergency Department

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Introduction/Background: Emergency Department (ED) nursing care is frequently provided in a fast-paced, high-acuity environment. During a single visit it is not uncommon for a patient to receive a number of medications; these may also include medications considered to be high risk. EDs are often excluded from barcode medication administration (BCMA) system roll-outs because of the complexity and pace of patient care.¹ When the ED has been included, critical care scenarios are omitted due to the urgency of the situation and lack of medication orders prior to administration.²

Methods: The goal was to develop an electronic medication administration record (eMAR) that incorporated BCMA without disrupting the workflow in the emergency department. Initial development covered general medication administration scenarios; second phase development targeted critical event scenarios. We adapted a version of eMAR that was used in the Post-Anesthesia Care Unit; the critical event module required new development. We augmented standard development tools with simulation in the clinical space. Observation and mapping of ED medication administration workflows plus computerized testing with patient scenarios guided initial development. Multiple simulated critical event scenarios in the ED critical zone as well as rapid response events occurring elsewhere in the ED provided invaluable insight into how well the critical event module did or did not mesh into the ED workflow and identified additional hardware needs. These simulation scenarios included nurses, physicians, and technicians as actors with programmers and eMAR clinical team as observers.

Results: Workflow and ED eMAR that was developed based on patient test scenarios worked as expected for general use cases, but needed significant modification for critical event scenarios. Feedback from the simulation scenarios directed future program development and identified the need for additional equipment, workflow adjustments for documentation, and modifications to the ED version of provider order entry (POE) to support implementation. Following a six-month development process, BCMA went live in the ED for general use scenarios. Staff adoption is high, with 95.2% of all medication administrations documented via BCMA. Development continues on a critical event process, with implementation anticipated spring 2015.

Discussion: Simulation in the clinical area identified unanticipated gaps in the current system, workflow and equipment. Feedback from both simulation observers and participants was invaluable and provided insights that might not even be revealed until well into deployment. The ability to collect and incorporate end user feedback and suggestions is critical to end product development before live deployment. Staged implementation allows for early benefits while time is given to development of more complex functionality.

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MyICU: An Electronic Patient Engagement Portal for ICU Patients and Families

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Veronica Kelly, RN, BSN**

Introduction/Background: The ICU environment can be overwhelming to patients and families, leaving them vulnerable to physical and psychological harm. Up to 35% of ICU patients have symptoms of post-traumatic stress disorder after their ICU experience.¹ Psychological trauma and the potential for physical harm can be mitigated by communication-focused, patient-centered care that promotes patient and family engagement and honors individuals' values and priorities. We intend to implement *MyICU*, an electronic patient portal to foster meaningful engagement between patients, families, and providers, in order to improve physical and emotional outcomes of an ICU stay.

Process: Team members conducted 2600 surveys and 3 focus groups with patients, families, and providers to understand stakeholder interest in an electronic communication portal. Our multidisciplinary team, including members from BIDMC, Intermountain Health, Aptima, Inc., and the BIDMC Patient Family Advisory Council developed the *MyICU* application content over 15 months in an iterative process. Human factors experts from Aptima, Inc. are providing ongoing software development and testing. Our efforts to attain accurate interface and data feeds between *MyICU* and other interacting systems continue. We worked to achieve appropriate privacy and security safeguards. Patient instructional videos are in development. Plans are in progress to implement strategies for end-user orientation, pilot testing, and rollout. A tool to measure the impact of *MyICU* on patient/family satisfaction, communication and psychological harm is in development.

Results: Survey participants confirmed a strong interest in utilizing a portal for daily medical updates, access to medical information, educational resources, information about providers, and sharing information about themselves with their care team. ICU providers endorsed the use of a portal to enhance bi-directional patient/family communication with the care team, to hear questions and concerns, to provide educational materials, and to get to know patients better.

Version 1 of *MyICU* is near completion and will be ready for pilot testing in the spring, 2015 in one surgical and one medical ICU. Features of the portal include a daily plan of care, "Get to Know Me" information for patients and families to share, an ICU journal, a family meeting scheduler, and mechanisms to invite family participation in care and report information and concerns. Patients and families can access educational materials about tests, procedures, conditions and ICU equipment, and link to professional websites with patient-focused content.

Discussion/Conclusion: End-user feedback throughout the development process has been essential to building the *MyICU* portal. Input from our Patient Family Advisory Council and family surveys has helped us prioritize our design elements. Clinical nurses on the team have focused on designing the tool to minimize disruption to the daily workflow of front-line staff. We anticipate that our attention to engaging all key stakeholders will enhance its usability and achieve better buy-in as we begin to roll out *MyICU* to patients and families.

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RNSAFE: A Remote Way to Witness High Risk Medications

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Introduction/Background: Medications errors (wrong drug, dose, route, concentration, and/or rate) are the largest source of errors within the hospital. The administration of certain high-risk medications requires an independent double check for verification. According to Bataille et al, (2015), **high-alert medications** are **those** that are associated with high risk of serious harm if administered improperly. This witness/double check requires engaging a second nurse to independently calculate dose and volume, visually inspect the label, review pump settings and reconcile lines, which can be very time consuming and takes the second nurse away from patient care. It is often difficult to find an additional nurse during busy medication administration times. These issues have led to inconsistency in the quality of double checks. As a result, medication errors, including wrong dose, wrong rate, and wrong medication have happened. Stavroudis et al, (2010) state that “a large number of administering errors that occur in the NICU show that human factors surface as the most frequent cause and contributory factor to medication errors.” Medication/fluid errors continue to be the largest type of errors seen. During Morbidity and Mortality Rounds at our hospital in 2013, a team peer-reviewed a case in which a patient received the incorrect medicine, despite a process that required two nurses to conduct safety checks.

Methods: This error inspired a group of nurses to develop RNSafe, a telehealth-based solution. Using a “fast-track” Innovation Technology Grant from Boston Children’s the team developed an application using a camera-equipped, tablet-like device for nurses to use at the bedside that allows another nurse to remotely conduct the second safety check. RNSAFE (Remote Nurse Witness Supporting Medication Administration For Efficient Care) allows the administering nurse the ability to consult with a remote nurse to carry out the visualization and double check using a webcam or mobile device. This would provide the administering nurse with a second nurse immediately, without having to pull a colleague from the bedside. Additional safety benefits of having a remote nurse include lack of interruption and/or distraction for the witnessing nurse. The application uses an Apple iPod for the bedside nurse and a Microsoft Surface for the witnessing nurse and provides bedside nurses access to Microsoft Lync 2013.

Results: Testing of this prototype has begun with the design team. Educational materials are being created to assist the bedside nurse. Testing has indicated that a focused, detailed camera for the iPods is required in order to see small volume (e.g., 1mL or smaller) syringes. Testing has also suggested that verbal communication between nurses is still needed. While RNSafe is a telehealth solution, it does not take away the importance of verbal nurse-to-nurse communication. The project aims to decrease time to medication administration and provide more time at the bedside for Nurses as well as to increase patient safety by decreasing adverse drug events.

Discussion/Conclusion: The team foresees that having a remote nurse available will be useful in situations in which an in-person nurse is not immediately available or when there are many distractions near the bedside. The team is building options for scheduled remote checks as well as emergent cases. Emergent cases will move to the top of the request queue.

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Retirement of a Custom Legacy Application While Promoting the Enterprise EHR Solution

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Introduction/Background: Prior to the hospital's Electronic Health Record (EHR) implementation in the 2000s, there was a home grown product implemented in the 1990s, Electronic Clinical Documentation (ECD). ECD was used to document electronic notes by way of dictation or direct typing while allowing for multi-contributor notes, custom templates, and distribution of authenticated notes to outside providers. Once the hospital implemented the current EHR, ECD was enhanced to pull discrete data from the EHR into notes and have authenticated ECD notes viewable within the EHR. The EHR and ECD were accessed separately; with duplicate log ins. Hospital leadership identified a need to retire ECD. Hospital resources needed to maintain and further enhance the application were limited. Hospital leadership desired streamlined documentation in one single EHR, which in turn would promote the use and future enhancements of the current EHR.

Methods: The retirement of ECD involved multiple teams including a steering committee, various ISD support staff, clinical education staff, and members of medical records. ECD integrated with many systems; therefore, an assessment occurred to identify the potential impact of ECD retirement. Clinic workflows were assessed, which influenced the note authentication process that varied based on clinical position. Standardization of documentation was led by guiding principles. Education provided to groups and individuals included documentation, authentication, and new non-ECD functionality. Education was supplemented with printed and web based education material. Ongoing support post-live continues in order to sustain clinician engagement.

Results: The transition led to positive engagement of the full EHR user community. Wide variations in user knowledge and skill level within the enterprise EHR were identified. Some end users had suboptimal access, which prevented them from completing documentation required by their job. End users questioned the internal and external distribution of provider documents. The enterprise EHR relies on a more cumbersome electronic distribution versus ECD which was not well liked. However, clinic based decision making models were established related to the use of the EHR which led to improved buy-in of the end users. The project allowed for the standardization of provider documentation in terms of quality and consistency while not removing the ability for user-level individuality.

Discussion/Conclusion/Lessons Learned: A clear project launch must be coordinated including the Executive Leadership team. A comprehensive analysis should be performed to capture the unique workflows of both the current state and systems that have the potential to be impacted. The assessment and analysis phase of the project should be completed prior to confirming a go live (or targeted go live) date. Much of these previous items are achieved through a more clearly defined role and thus greater expectations of all team members. Part of this is having a clear scope and goal identified and maintaining the focus on that goal for a timely and successful implementation. There needs to be improved transparency to the end users throughout the entire process, and the project team should maintain ongoing engagement of the end-users to ensure the trust in their new system.

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Using the EMR to Address the Needs of At-Risk Patients and Improve Safety

Cheri Sinclair, BSN, RN-BC

Introduction/Background : Boston Children's Hospital established a Behavioral Subject Matter Expert group to respond to growing concerns of workplace violence and develop strategies to identify patients at risk for agitation and aggressive behaviors. A workgroup was charged with finding a solution to 'Flagging and/or communication of potential behavioral issues in order to meet the needs of child/family'. Workgroup goals were to assess feasibility of using the EMR to identify at-risk patients, develop an implementation plan, and to determine who will own upkeep of the systematized flagging. A search of other facilities indicates that while some do not flag at risk patients due to concerns of stigmatizing patients, others are using 'FYI' flags to draw attention to high risk care plans or using other means to identify patients at risk for 'Disruptive Behavior'.

Methods: Input from BCH Ethics Committee, legal department and family advisory committee clarified the need to link the notification to a behavior plan to better meet the needs of the patient, family and staff. Some of the challenges faced were identifying a work flow which would function with two EMR systems that do not have a bidirectional interface, so that information could be seen by clinical and administrative staff. Workgroup representation was expanded to include stakeholders who offered specific expertise to advance the project which included quality improvement consultation and input from the clinical informatics team. Final approval from Medical Staff Executive Committee assured institutional support.

A workflow was identified to place an order for 'Precautions: B' which is viewed on the patient level demographic Banner Bar. The order opens a form which is completed by a clinician with the patient/family to identify triggers, interventions and special accommodations.

Results: The order and form have been created in the EMR and are currently in testing with plans for rollout within the next few months. Plans are in place to finalize guidelines and develop strategies for education and enterprise wide implementation. Monitoring after implementation will include number of patients with plans in place and outcomes of number safety events reports , patient and family satisfaction and staff feedback.

Discussion/Conclusion: The goal for our project was to use the EMR to alert administrative and clinical staff to patients with specific behavioral needs and link the alert to a plan to better meet the needs of the patient. A project of this magnitude required networking across the enterprise in order to have the right skill mix to complete the project and assure institutional support. Since we have not completed our implementation, outcomes are not yet available. Our poster will display the behavior plan form as well screen shots of the notification in the EMR.

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User-Centered Design of MySafeCare Patient Safety Reporting System

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Introduction/Background: A major problem facing patient safety research is our limited understanding of threats to patient safety as patients experience them. Innovative technology may aid in overcoming barriers that prevent identification of safety threats experienced by patients.^{1,2} Published recommendations for consumer safety reporting systems provide a critical foundation.^{3,4} Yet, we know of no system designed specifically to capture in real time patient perceived threats to safety while in the hospital for use at an organizational level in a learning health system to mitigate risks before safety incidents occur. We are developing MySafeCare (MSC), a web-based/mobile enabled application that provides patients and their families a quick, electronic, real-time way to report and communicate their safety concerns to appropriate clinical staff according to their preferences. MSC includes a clinical dashboard for staff to view and trend safety concerns reported by patients and document/communicate follow-up. This poster will describe our user-centered design requirements analysis for the MSC clinical dashboard version 1.

Methods: The targeted users of the MSC clinical dashboard version 1 are Nurse and Medical Directors at Brigham and Women's Hospital. We conducted 3 Interviews with Nurse Directors and 2 Interviews with Medical Directors of acute and critical care units. Each interview lasted 30-60 minutes and included topics such as dashboard layout, notification frequency/content, and follow up documentation. The research team analyzed notes from interviews to extract design requirements for the dashboard by turning them into user stories that described the functions Directors wished to see. We categorized user stories into minimally releasable features (MRFs) and prioritized them for version 1. Final prioritized requirements were documented in Jira Software (c).

Results: We defined 12 MRFs for Version 1. These are: access per unit, integration with login service, landing page view, status filter, patient narrative security, drill down to case, dashboard notifications, flag patient case, document follow up, close a concern, trending, and data export. Each MRF had 1-5 associated specific requirements. For example, Filter by Status allows the user to filter concerns by time, type, and severity level.

Discussion/Conclusion: The interview process with Nurse and Medical Directors provided much insight into how the expected use of MSC is perceived in the context of daily workflow. Directors commented on the ways they would like to view and be notified of submissions. Through probing questions about features such as frequency and content we determined specific functionality requirements consistently noted across directors. Editing and shuffling occurred between categories to account for priorities of the directors, the development team, and the technical team.

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Strategies for Managing Mobile Devices for Use by Hospitalized Inpatients

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Abstract: Despite the potential advantages, implementation of mobile devices and ongoing management pose challenges in the hospital environment. Our team implemented the PROSPECT (Promoting Respect and Ongoing Safety through Patient-centeredness, Engagement, Communication and Technology) project at Brigham and Women's Hospital. The goal of PROSPECT is to transform the hospital environment by providing a suite of e-tools to facilitate teamwork among nurses, physicians, and patients and to engage patients and care partners in their plan of care. In this poster, we describe the device-related decisions and challenges we faced. We relate the strategies that we used for managing mobile devices and lessons learned based on our experiences.

Introduction/Background: Many consumers are using technology to manage health and wellness, and there is a growing recognition of the need for patient engagement in healthcare. A key goal of meaningful use is to make consumers full partners in their care by providing e-health tools that increase access to health information, support activation (e.g., active involvement in their treatment plan), and that help consumers to gain control over their health and wellbeing.¹ There are limited examples in the literature that describe strategies and e-health tools to provide patients with access to their health information in hospital or inpatient settings. We partnered with our medical librarian to research strategies for ongoing operation and maintenance of bedside devices used by patients in hospital settings and found no peer reviewed literature on this topic. After implementing bedside mobile tablets at Brigham and Women's Hospital, we have learned some important lessons. In this poster, we focus on strategies for implementing and managing mobile devices in hospitals and lessons learned based on our experiences from the PROSPECT project.

Methods: We used a socio-technical systems approach to identify device requirements and to identify strategies for ongoing device management. We conducted workflow observations, interviews, and focus groups of care team members, patients, and care partners. Based on our evolving set of requirements and the concerns expressed by clinicians and patients, we scheduled meetings with hospital, health information management, information systems and infection control leadership to address the key questions that arose. We developed a list of device requirements that we implemented.

Results: We identified challenges in terms of device and accessory selection, user access, integration, information and device security, infection control, and ongoing operation and maintenance in the hospital environment. Despite the advantages, the process of implementing and managing mobile devices in the hospital setting poses multiple challenges. Strategies were identified to address each of these challenges and implemented before project go-live.

Discussion/Conclusion: Using a socio-technical approach, we identified a host of issues related to accessory selection, user access, integration, information and device security, infection control, ongoing operation and maintenance. Overall, the socio-technical approach has been useful for identifying and addressing device-related issues and concerns with stakeholders as part of the project planning process.

¹ CMS. CMS EHR Meaningful Use Overview. 2012; http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Meaningful_Use.html. Accessed March 6, 2015.

The Nurse Informaticist Role in Preparing for Biomedical Device Integration in Partners eCare

Debra Furlong, RN, MS, Janet Kelly, RN

Introduction/Background: Brigham and Women's Hospital – BWH an Academic Medical Center in Boston is deploying Partners eCare (PeC), a Partners Healthcare customized version of an Electronic Health Record using the EPIC- Electronic Healthcare Record software. An integral part of that implementation will be an extensive network of interfaces to support biomedical device integration (BMDI). This integration will include the following devices: Physiologic Monitors, Ventilators, EKG machines, Fetal Monitors, Anesthesia Monitors and Cardiopulmonary Bypass Machines. BMDI has a profound impact on nursing documentation. The nurse informaticist has the responsibility to assure that the final product interfaces seamlessly into the nurse's workflow and that the biomedical device "BMD" documentation is appropriately displayed for users of the EHR.

Methods: The Production Readiness process involved a multidisciplinary task force that tested every BMD at the BWH that will be interfaced to the Partners eCare "PeC". This task involved testing over 1,000 devices. The team included representatives from BWH and PeC biomedical engineering, as well as representatives from the build and test team from PeC.

A Nursing Informatics Project Manager was assigned to the team as the Deployment Champion. The responsibilities of the Deployment Champion included communication and coordination with the clinical areas as well as identifying issues and impacts that would affect nursing implementation. The nurse Informaticist brought the clinical skills identifying workflows and knowledge of the clinical environment and the use of interfaced data.

Production readiness work included the following: 1) A physical review of every device was required to assure a DEV record was available. The DEV record is a unique number to identify and link the device in the interface to PeC. 2) Confirming that every device with the unique identifier for the biomedical device is mapped correctly. 3) Visually verifying that the physical mounting and connections are complete. 4) Confirming that each data variable has successfully been transmitted to the PeC test environment for two consecutive minutes. In addition the role required coordinating with PeC application teams, biomed vendors and information services to resolve issues.

Results: During Production Readiness the Nurse Informatician was able to identify issues that would affect nursing workflow and documentation. Since these issues were identified early in the testing, corrections to PeC were made before final training and implementation. Primary impacts included those that affected the training and education plans as well as workflow changes required for correct association of the devices. Other impacts that were identified were setup issues which affected associating the device to the flowsheet and planning for support of the device integration.

Discussion/Conclusion: Participation in BMDI Production readiness resulted in the identification of impacts that will result in better planning for the successful implementation of Partners eCare. Training tools for education have been developed to assure the acquisition of information from the biomedical devices. Troubleshooting tips and FAQs were developed for the nursing staff as well as the support staff. The NI Project Manager worked to communicate with the Nursing Directors and Nursing staff to assure that the testers had access to all of the biomedical devices with a minimum disruption to the patients.

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Evaluation of Use of Electronic Patient Controlled Analgesia Pumps to Improve Patient Safety in an Academic Medical Center

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Introduction and Background: Patient controlled analgesia (PCA) and Patient-controlled epidural analgesia (PCEA) pumps are methods of pain control with complex smart infusion devices and are widely used in hospitals. Smart PCA/PCEA pumps can be programmed with the dose and rate of medications within pre-set ranges. However, adverse effects have been reported associated with these pumps' use. In this paper, we describe a prevalence observational study where observers used an electronic data collection tool to record pump settings and medications with PCA pumps, and compared them with their corresponding medication orders to identify errors.

Methods: We iteratively developed a web-based data collection tool (Redcap) to capture IV medication errors using a participatory design approach with interdisciplinary experts. Using the tool, a prevalence study was then conducted at a 793-bed tertiary care academic medical center in Boston, Massachusetts. Three inpatients units were recruited to participate in the study. Two trained nurses collected data on the Redcap tool and compared the infusing medication, dose, and infusion rate on the pump with the prescribed medication, dose, and rate in the medical record. All orders were obtained from electronic medical records. Tubing and labeling of the infusing medication according to hospital policies were also assessed. Each error was rated by NCC MERP INDEX by observers; all data was entered on the Redcap data collection tool. A safety intervention plan for improving PCA practice to support safe and effective pain management was developed after the first data collection and implemented for one year period. After the intervention period, a second data collection was conducted to evaluate effectiveness of intervention plans.

Results: The results showed that there were many labeling and tubing change tag errors, which were a violation of hospital policy. A few potential harmful medication errors were identified but no critical errors. Study results suggest the importance of a standard process of PCA pump use. In addition, results from the second data collection showed a reduction in error rates.

Discussion: Although there were not many high-risk medication errors, violations of hospital policy for tubing tags and labeling on IV were identified. Information from this study can be used to help to improve safety of administration process, identify areas where improvements in policy and practice are needed. Collecting the same data using the electronic data collection form will allow us to compare these findings across a broad range of hospitals. Our developed intervention plan contributed to eliminate potential harmful medication errors.

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Using Rapid Cycle Testing to Implement In Room Documentation

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Introduction/Background: Due to the impending implementation of Partner's eCare at Brigham and Women's Faulkner Hospital in 2015, computers were installed in every patient room to facilitate just-in-time documentation of patient care. The need to have both staff and patient buy-in for successful transition to in-room documentation were priorities for this project.

Methods: Engaging nursing unit councils, every inpatient unit and several outpatient areas were asked to start using the in-room devices in small rapid cycle tests, documenting the issues they encountered and meeting with staff that were charged with resolving them. Rapid cycle testing involves using short testing cycles to evaluate a process or practice change to make rapid assessment and change in the process prior to moving on to the next unit, or staff member, to institute a change. From September 2014 through February 2015 all 130 inpatient rooms and two outpatient units were engaged in testing cycles. Using a patient satisfaction survey we monitored the impact on patients. Staff was asked to fill out an assessment on the amount of time it took them to complete documentation of shift assessment and AM medication distribution. The overall goal of this project was to enable staff to complete assessment documentation and medication administration in the first 4 hours of their shift so that information could be shared with other disciplines. This is the intended process in our future electronic documentation system that will be initiated in May 2015. Staff were given handouts to assist them with the transition. These included tip sheets on the placement of furniture as well as how to position the device for ergonomics and patient engagement. Staff were oriented to the workstations through images of do's and don'ts and a training video prior to starting each pilot. A nurse-patient based article was also distributed to help the staff in the best process for engaging patients.

Results: During a 2 month period the first unit tested this process through a total of 30 staff members moving to the next unit. Initially several issues were identified including making sure that the bedside barcode scanners were associated with each computer as well as mapping to an appropriate printer. Seventeen staff completed the time documentation on how long it was taking them to complete both their initial assessment as well as medication administration. This was for a full 4 patient assignment. The average completion of documentation fell between 9:30 am and 1:00pm, and there was one at 2:00 pm. As the cycle went on the time to completion shortened.

Patients were also given a small survey to understand the impact of using in-room devices to document their care. As of this writing we received 48 patient surveys. The results were overwhelmingly positive with greater than 95% stating that they felt engaged.

	1	2	3	4	5
On a scale of 1 to 5 please rate your interaction with the nurse while he/she was completing documentation in the room.		3		1	44

Discussion/Conclusion: The process of rapid cycle testing for large scale implementation was successful. Staff engagement was the single most effective measure used to ensure success. Knowing that they had control of the environment surrounding the use of these devices was perhaps the key factor in the success of this process. Patient engagement was also reviewed and found to be overwhelmingly positive.

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Documentation and Tracking of Assets Throughout the Clinical Decision Support Lifecycle

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Introduction/Background: At Partners Healthcare the Knowledge Management (KM) team authors Clinical Decision Support (CDS) interventions used in a vendor based enterprise Electronic Health Record (EHR). The CDS interventions consist of various types of CDS and target a variety of intended recipients. The aim of this project was to develop standard processes to manage the different CDS development phases from request to implementation, known as the “CDS lifecycle.” Modeling of a CDS asset management process to accommodate the different lifecycle phases is challenging due to the varied documentation needs for each specific phase.¹ CDS creation follows a consistent development lifecycle, starting with a request and moving to the prioritization, design and implementation phases.² The different phases of the lifecycle have differing documentation needs as well as different participants with complementary roles. Likewise, it is possible for a CDS asset to circle back to a previous lifecycle phase for refinement.

Methods: We implemented a CDS asset management process utilizing an existing asset tracking software tool called JIRA.³ Clinical Informaticians, Knowledge Engineers, and Business Analysts were involved in defining the operational business requirements of the process. Software Engineers were also involved and guided the process design to align with the available functionality and constraints of the software tool.

Results: The process was designed to accommodate the separation of each lifecycle phase and to allow for unique data needs. The design also accounts for the ability to link the distinct assets across each phase, allowing participants to follow the trajectory, statuses, and content details within each phase. The disposition and status of each phase is captured to allow for a consistent and searchable handoff and communication to all participants. Consistency, reusability, and transparency, including dynamic reports and dashboards, were paramount in designing the process, along with ease of use and flexibility of the software tool. We are currently managing over 600 CDS interventions using the process.

Discussion/Conclusion: Designing a process to capture knowledge asset details, tracking, and handoff across each phase of the CDS lifecycle was challenging. We continue to make process and tool enhancements, including more detailed asset dependencies, intervention groupings, and a mechanism to capture enhancement requests. The CDS asset management process has been implemented and is serving its intended purpose. However, the adoption of a generic asset tracking software tool has resulted in some limitations that do not fully align with the optimal design of a knowledge management tool.

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From Capstone Project to Production: The Return of Clinical Decision Support for Operating Room Nurses

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Introduction/Background: Peripheral nerve injuries (PNIs) are an adverse complication from surgery. PNI's are defined as the interruption of electrical activity that affects either the motor, or sensory, or both nerve functions. The causes of a PNI are considered multifactorial. Risk factors play a significant role in increasing a patient's susceptibility¹. This quality improvement project aim was to introduce operating room nurses to a decision support screen that helped the nurses identify patients who were at higher risk of developing a PNI, offer evidence-based nursing interventions, and provide a reminder to document. The post-project results and surveys indicated that the OR nurses wanted to continue using the decision support screen. The opportunity to have this return for the OR nurses appeared when the organization decided to go to one electronic health record (EHR).

Aim: The purpose of this best practice advisory is to raise awareness of PNI and improve documentation. It will also help to raise the OR nurses awareness on this important patient safety issue by appearing for the nurse if patient has two or more risk factors for PNI. This was given final approval from the organization's CDS Committee to be built for the OR nurses.

Challenges: The build team worked with the designer to ensure that this advisory screen will assist, and not interrupt the OR nurses workflow. This was important to ensure the OR nurses will continue to use the advisory. The advisory is directed for OR nurses to appear within the Best Practice section of the OR record. Due to system limitation, this advisory may appear for all nurses during the patient's perioperative phase but will not interrupt their work.

Discussion: Although this advisory will appear for other perioperative nurses, it is intended for OR nurses to reposition the patient four hours after incision. This is stated in the display text of the advisory. It is hoped that this will encourage dialogue among the nurses that the patient has been identified as a PNI risk, and to plan accordingly with patient positioning. In the capstone project, the risk factors were entered manually by the OR nurse. The new EHR will bring forward these risk factors based upon the patient's preadmission assessment. The advisory is set as a recommendation therefore a response is not required from the nurse. If the nurse responds with "Action done" or "See Comments", the advisory disappears for four hours and then reappears to remind the nurse the patient is at risk for PNI. The nurse can choose to disregard the advisory and will not interfere with their workflow. The time element was determined upon the literature research². There will be an opportunity, once implemented, to run a report to see how many nurses use the screen, what response was used, and if the application increased their documentation.

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Nursing Informatics Competencies for Nurse Leaders/Managers

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Introduction/Background: In today's high-tech environment, all leaders in the healthcare field encounter decisions related to health information technology (HIT) in their organizations. Nurse leaders' ability to make informed strategic and operational decisions related to HIT adoption, implementation, and innovation is critical, necessitating the attainment of informatics competencies relevant to their work.^[1] The purpose of this Delphi Study was to expand on prior related work^[2,3] to capture nursing informatics competencies perceived as relevant and required by today's nursing leader/manager.

Methods: The Organization of Nurse Leaders (MA&RI) Board, Council structure and membership were queried for their opinion on the relevance of 108 informatics competencies using a three round Delphi survey.^[2] Quantitative analysis used the Content Validity Index (CVI) with criteria >0.80 to retain.^[4] Qualitative content analysis of participants' comments was used to review items classified as 'borderline' to retained based on the CVI criteria.

Results: There were three rounds of survey's (Round 1: n=34, Round 2: n=26, Round 3: n=41). Most participants were from an Academic Medical Center (26-34% per round) or a Community Hospital (36-50% per round). Many participants were in an Executive role (31-52% per round), had completed at least a Master's degree (56-80% per round), and had an average or above average knowledge of HIT compared to their peers (85-96% per round). Most participants HIT training was 'on the job' (84-97% per round). Round 3 results included 74 competencies and 15 categories.

Figure 1. Nursing Informatics Competencies for the Nurse Leaders/Managers

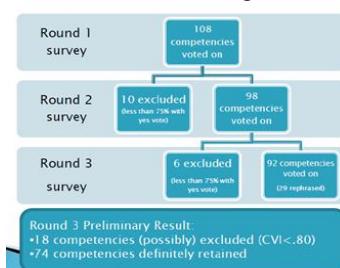


Figure 2. Categories of Competencies Retained in Round 3 Results (CVI >.80)

Category	Competencies Retained
Management Concepts	9
Requirements and System Selection	9
Ethical/Legal Concepts	8
Information Systems Concepts	7
Advances Software Applications	6
Executive Leadership	5
Financial	5
Implementation/Management	5
Patient Related Applications	5
Data Issues	4
Technical knowledge	4
Collaboration	2
Electronic Communications	2
HIT Selection	2
Standardization	1

Discussion/Conclusion: The competencies identified as relevant to Nurse leaders and Nurse managers may be useful to support on-going professional education for nurse leaders involved in HIT related projects who are "learning on the job". Ongoing work includes development and validation of a NI competency self-assessment tool.

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Preservation of Clinical Decision Support during a Conversion to Vendor EHR: Performing a Gap Analysis

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Introduction/Background: In an effort to preserve extensive current state Clinical Decision Support (CDS) at a large academic healthcare system during a major conversion to a vendor EHR, the Knowledge Management (KM) team, a subgroup of Clinical Informatics, was tasked with performing an evaluation of several of its key CDS knowledgebases. The purpose of this evaluation was to identify content and functionality gaps between the CDS knowledgebases in the homegrown EHR system and vendor EHR. Based on the result of each gap analysis, CDS build options for the vendor EHR system were presented to the voting committee.

Methods: Members of the Knowledge Management team identified key CDS knowledgebases to be analyzed, which included renal and geriatric medication dosing decision support, drug-drug interactions (DDIs), duplicate therapy alerts and drug pregnancy alerts. Knowledge Engineers who are intimately familiar with these CDS knowledgebases worked with vendor EHR experts and consultants to perform gap analyses of the legacy CDS tools in comparison with CDS of the vendor EHR. Content and functionality gaps of each CDS knowledgebase were carefully identified and analyzed in terms of content creation, vetting, deployment and maintenance; as well as how these clinical contents are leveraged by CDS functionalities. Size and characteristics of each gap were described in terms of clinical relevance. Options to preserve current state CDS along with estimated work effort and time were summarized and presented to an enterprise clinical decision support voting committee.

Results: For each CDS knowledgebase evaluated, a summary of important content and functionality gaps along with all available options to preserve legacy CDS were presented to the voting committee. The advantages and disadvantages of each of these options, along with customization work effort in the new EHR system were also presented to the CDS Committee for voting. The result of this gap analysis served as a prioritization tool for planning and resource allocation in our systematic effort of preserving significant current state CDS.

Discussion/Conclusion: For a large academic hospital system with a longstanding history of CDS research and well known practices for developing CDS within a homegrown EHR system, preservation of its CDS becomes very important during a conversion to a vendor EHR. Many lessons were learned during this challenging process. It is essential that enterprise subject matter experts (SMEs) and Clinical Decision Support committees be informed of significant functionality differences to prioritize work efforts for preservation of valued clinical decision support. Doing so required the engagement of SMEs, voting committees, KM, and consultants from the vendor EHR.

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Clinical Decision Support (CDS) Testing Process

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Introduction/Background: Clinical decision support (CDS) has become the hallmark of an electronic health record (EHR). There is an increasing priority on rule and alert implementation in the setting of Meaningful Use, clinical safety, mitigation of complex practice decisions, and other organizational initiatives. At Partners Healthcare, the Knowledge Management (KM) team, a subgroup of Clinical informatics, was tasked with authoring test procedures to ensure that the design intentions of customized CDS interventions to be used in a vendor-based enterprise EHR were preserved. The aim of this project was to create a process to facilitate and standardize authoring of test procedures based on design/build specifications and track pass/fail progress of CDS requirements.

Methods: We developed a process to author, test, and track the status of CDS requirements by leveraging Microsoft Visual Studio¹ testing tools. CDS interventions design and build specifications were tracked in Jira² and programmatically uploaded as requirements within Team Foundation Server (TFS)³. Workflow demonstrations were provided by Application Teams. A library of reusable shared testing steps was created within the Microsoft Test Manager (MTM)⁴ testing tool based on validated provider workflows established within the vendor based enterprise EHR. Test case parameters including test patient’s instances were defined within each test case’s iteration. Test script authoring and execution was carried out by separate Knowledge Engineers (KEs) in MTM. A QA process was established in MTM for independent review of test scripts prior to testing execution to decrease script bias.

Results: The goal was to perform testing of approximately 500 CDS interventions. Each of the CDS interventions contained approximately 3 test scripts and 1-6 iterations per script. Shared test steps helped streamline authorship and decreased fragmented testing language. Testing efficiency was optimized by performing in-depth configuration testing first, followed by shallow testing and iterations through different parameters values of the build. We assigned a one-time-use reserved test patient to each test case/iteration to avoid testing bias. Testing progress was captured through the standardized use of testing statuses at the individual requirements level and related bugs level when failure occurred. Additionally, the process was designed to accommodate searchable handoff between test planners, test executors and the application team(s) involved in troubleshooting build when testing failure occurred.

Discussion/Conclusion: Designing a testing process for CDS was challenging. In an effort to ensure thorough testing and validation of CDS interventions, it is key to establish a structured process to plan, test, and track the progress of CDS requirements, associated test cases, and progress on bug remediation in the instances where failures occurred. We are continuing to work towards further developing testing processes and testing best practices for CDS.

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Consistency of Structured Data Elements: Challenges and Approaches

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Introduction/Background: A lack of consistent shared data definitions across electronic health record (EHR) applications and clinical settings prevent reuse and interoperability of healthcare data. EHR data collection forms defined without reference models compromise information consistency and completeness. Many EHR implementation projects are quite large with limited interaction between individuals responsible for distinct applications within the EHR system.¹ These limited interactions may lead to decreased sharing of data definitions and an increase in the number of distinct data elements defined to represent similar topics.² In order to increase consistency of data definitions within similar topics, it is necessary to define a set of standard data elements to be shared across the organization. This poster will describe our process for defining a standard set of data elements (Reference Model) for the Clinical Topic of Pain.

Methods: We convened a workgroup of informaticians, project analysts, and clinical subject matter experts (SME) to analyze the consistency of structured data element definitions for a set of clinical topics across our Partners eCare EHR configuration project. Our analysis included: 1) literature review, 2) development of a draft reference model based on literature review findings, 3) evaluation of downstream data dependencies for draft reference model, 4) modified Delphi voting by SMEs using eRoom^(c) collaboration software to validate reference model, and 5) prioritization of changes to the system to align with validated reference model.

Results: Literature review retrieved relevant LOINC models, Intermountain Healthcare's Clinical Element Model (<http://www.clinicalelement.com/#/>), and two peer-reviewed publications.^{3,4} The draft Pain Reference Model included 21 data elements. Round 1 SME voting resulted in the removal of 4 data elements, addition of 6, and modification to 11 data elements. Validated model results will be included in the printed poster.

Discussion/Conclusion: Defining reference models is resource intensive but delivers value in achieving data consistency.² A lack of consistent data definitions will have downstream implications on EHR features such as clinical decision support and reporting.⁵ Pain is one example of a topic ripe for standardization of data capture. We see the definition of Reference Models for clinical topics and prioritization of changes to the existing system as a continuous process for EHR optimization. This work will be continued for other prioritized clinical topics that are used across diverse settings of care and specialties and with significant downstream data dependencies.

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Gap Analysis of Geriatric Nursing Clinical Decision Support: An Application of the Fulmer SPICES Tool

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Introduction/Background: Due to the rising geriatric population, hospitals such as Massachusetts General Hospital (MGH)¹ and Brigham and Women's Hospital (BWH)² have begun to establish a geriatric nursing specialty. One aspect of this effort has been the implementation of the Fulmer SPICES tool on nursing units. The tool is used by nursing to perform geriatric focused assessments and execute interventions to improve the quality of care among these patients.³ The Fulmer SPICES tool is an acronym for its criteria: Sleep, Problems Eating or Feeding, Incontinence, Confusion, Evidence of Falls and Skin Breakdown.⁴ At both hospitals, the assessment has been in a paper format or called out in the nursing notes. Partners Healthcare, the parent company of MGH and BWH, through the Partners eCare project (PeC) is in the process of converting to a vendor-based electronic medical record. To continue the geriatric nursing specialty efforts that have already been implemented within the clinical sites within Partners, it is necessary to discover the geriatric nursing specific criteria and interventions and use them to evaluate the current CDS intervention build using the Fulmer SPICES tool as criteria. Despite the fact that other hospitals have used data in the electronic medical record to improve the quality of care for the geriatric population,⁵ there has been no published evidence that geriatric-specific nursing CDS interventions have been designed. The goal of this assessment is a gap analysis of what already exists in current state for nursing CDS and what needs to be recommended for build to meet the requirements of the SPICES tool.

Methods: The Fulmer SPICES tool was reviewed and the criteria were specified. Each category was then used to assess what CDS is present in the current build. If a patient is being assessed for incontinence then it was necessary to review the current build to see if there was a CDS available that would meet the specified incontinence criterion. JIRA, a tool utilized by Partners eCare to track CDS was searched using the key words, "Sleep", "Eating", "Feeding", "Incontinence", "Confusion", "Falls", "Breakdown" and associated synonyms such as "mental status", "nutrition" and "ulcer". The CDS specifications were then reviewed to determine if they met the criteria.

Results: Twelve Best Practice Advisories met the criteria defined in the SPICES tool. The criteria that had the highest frequency related to skin breakdown. The criteria for Sleep had no CDS interventions that met its requirements. However, the criteria and interventions were not specific to the geriatric population but general inpatient adult population.

Discussion/Conclusion: Although the CDS that is currently built meets the criteria, it is geared towards a broader patient population. Geriatric nursing has defined certain criteria and interventions that have been proven to increase positive outcomes among hospitalized geriatric patients.⁶ It is necessary to propose a set of geriatric-specific CDS interventions. Like pediatrics, geriatric patients require a different set of interventions especially when the patient suffers from multiple medical problems and dementia. Allowing a CDS focused on this population will continue the work that is already being done at Partners and allow for a more streamlined method of documentation of interventions and their outcomes.

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The Evolution of a Clinical Decision Support Request Form

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Introduction/Background: A large academic hospital organization with seven affiliates decided to transition from multiple home grown and commercial systems to one commercial electronic health record (EHR). The task to develop a standardized request form that would capture necessary elements of clinical decision support (CDS) was essential to inventory current state CDS, to migrate current state CDS into the new system, to evaluate new CDS requests and to maintain consistency among CDS of different origins.

Methods: We formed a group of clinical informaticians, knowledge Engineers (KEs), and clinical experts who decided on the necessary data elements for a CDS request form¹. The initial set of requested data resulted in a seven page word document with embedded macros. This form was significantly revised several times based upon the feedback from requestors, application teams, and clinical informatics team members. Revisions were further made based on CDS key element requirements, functional completeness, format and usability. The database where this information was kept also changed during this time. The result for managing requests for CDS interventions became a concise, portable, and useful Excel spreadsheet with the minimally necessary data elements that was easily loaded into an open source content management system (JIRA). Different artifacts were required to support other stages of the CDS life cycle.

Results: The CDS Request Form evolved from a large multi-purpose word document into an excel spreadsheet with more concise data element fields. The spreadsheet includes specific tabs that represent different stages of our CDS life cycle. We are working toward a requester-facing online form which prompts for all necessary elements of the CDS request without overwhelming the users.

Discussion: Our CDS transition process included creating an inventory of current state CDS, the transformation and migration of current state CDS into a new commercial EHR system, as well as tracking and evaluating new CDS requests. Satisfying all these different requirements within the short period of time allocated for the implementation of the new system posed a significant challenge for us. Another challenge was the relative unfamiliarity with the new system, so requirements remained a moving target. While we are still continuously making improvements to the CDS request process, we have learned many lessons during the evolution of the CDS request form so far. We have learned to organize and frame the required elements based on EHR functionality and workflow; we have also learned the impact of the request form has on different stages of the CDS life cycle.

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From Paper to Electronic Nursing Documentation in the NICU

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Introduction/Background: Electronic documentation has become the standard for recording nursing care. South Shore Hospital had implemented electronic documentation in all of the inpatient units, including critical care using the Meditech 5.X platform. All nursing care was electronic with few exceptions, such as critical care infusions. The 30-bed Level III NICU was the last unit to document all care using a paper flowsheet. Electronic NICU provider documentation and CPOE were well established as was BMV (Bedside Medication Verification). Use of paper documentation was an issue when staff floated to the Newborn Nursery or Pediatrics and were unable to document. It was a challenge for Nursery and Pediatric staff floating to the NICU to use the paper flowsheet. NICU staff was very invested in having electronic documentation.

Methods: A small group of nurses from NICU, Clinical Informatics and management met to develop a pilot project. With a large Meditech upgrade due in the near future, it was decided to limit interventions (e.g. vital signs, I&O) to those already in use in the Parent Child Division. A group would convene after the upgrade to work on developing documentation specific to the NICU. A group of four NICU nurses, three nurse informaticists experienced in nursery, pediatrics, pediatric ICU and NICU with support from NICU management and education would meet for four hours biweekly for 5 months. A go live date was set for month six. Various resources were used including the paper documentation forms, documentation used in the hospital's other units (including critical care) and standards from professional organizations. The neonatal provider group was consulted. A Standard of Care which included all the interventions and outcomes necessary for electronic documentation of the NICU patient was developed.

Results: Staff was required to attend a four- hour documentation class. Ten classes were held over a 2-week period. Every staff nurse was able to attend a class and successfully complete the competency. Go-live 24-hour Super User support was provided during the first two weeks. After the first week, most staff were comfortable and did not need support. The group met after 3 months to evaluate the process and make some changes to the documentation for clarity.

Discussion/Conclusion: The initial rollout of only a few interventions caused difficulty as nurses had to switch back and forth between paper and the computer. Some staff documented their care in both places. The major implementation was much more successful. Some of the nursing documentation was made to flow onto the provider documentation. Electronic documentation has enhanced the already collaborative process between nursing and providers.

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How to Leverage Technology in Efforts to Decrease Urinary Catheter Time

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Background : Catheter associated urinary tract infections (CAUTI) account for 30-40% of hospital acquired infections each year.² Removal of indwelling urinary catheters is instrumental in improving CAUTI rates. The CNO at our hospital solicited clinical informatics assistance in utilizing technology to increase timely urinary catheter removal. After discussion with bedside nursing staff, it was determined that they found it difficult to easily identify the length of time a catheter has been in place. Clinical Informatics, Quality Management and Information Systems gathered a team to leverage our current technology to provide real time data to nurses in a format that would encourage timely removal.

Method : The workgroup met weekly to leverage the data repository to display to the nurses' homepage a calculation of the elapsed time a catheter was in place for a given patient. The display has come to be known as the 'Foley Clock'. The logic included the date and time of indwelling catheter insertion and the current date and time to calculate the days & hours a catheter was in place. Once a removal was documented, the clock stopped and "NA" populated the field. The logic included the possibility of a removal and re-insertion which would restart the clock. Validation of every patient who had a catheter over a period of several days was done while education of the nursing staff was carried out.. Then the "Foley Clock" was turned on for all to use.

Results: After running the logic for the first time during testing, we discovered an issue with a different date/time of insertion being recorded by multiple RNs over the course of a stay. This was corrected by adding a key that would automatically pull this information forward and only needed to be documented at the time of initial insertion. This change to documentation resulted in more accurate documentation of catheters. Nursing feedback has been tremendously positive both with the change in documentation and providing real time data on elapsed catheter time. Nurses are now requesting more orders for catheter removal from physicians. In the ten weeks since implementation we have seen our CAUTI incidence rate (per 1000 device days) dropped from 4.21 in November to 0.94 in January.

Conclusions and Recommendations: Pushing real time information to nurses in a format that is useful to daily practice, rather than requiring them to retrieve the information, assists nurses to achieve quality patient care. Nurses report that this has made it easier to identify the length of time catheters are in place, and they now have the tools to encourage providers to consider removal. Having an interdisciplinary team involving bedside care providers, clinical informatics, quality management and information system analysts working together allows for better understanding of the problem and potential solutions. Expect the unexpected. One hurdle we did not expect was that we would need to adjust the nursing documentation in order for this process to function properly.

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Provider Documentation Improvement – Do Scribes Impact Workflow?

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Background: Hospitalists have reported data entry challenges monopolizing the majority of their day. A high volume of patients are managed by the hospitalist group. With a constant influx of patients that require hospital admission evaluation by this group, as well as ongoing assessments for discharge, their productivity is instrumental to overall patient flow. The goal of the scribe trial was to examine hospitalists' workflow, determining if real-time documentation by a scribe would improve provider workflow, increasing productivity while providing high quality patient care. The research team consisted of Hospitalists and Nurse Informaticists.

Method: Initial shadowing with a hospitalist was completed for one shift prior to initiating scribing, going to the gemba(going to see the actual process and understand the work) to observe daily routine and pace. Workflow was observed and time studies related to task completion were recorded. Subsequent shifts included the provider rounding on admitted patients or admitting patients using a scribe. Both parties were present during the provider interaction with the patient. The scribe used a computer on wheels to document the encounter.

The sample included both physicians and advanced practice clinicians using a scribe with a randomized hospitalized patient population. The data was collected using real time studies and feedback from the providers. Collected data was gathered regarding the provider patient load with or without a medical scribe. At the completion of the scribe trial, time studies were performed to analyze the provider's workflow utilizing a computer on wheels independently.

Limitations included no order entry performed by the scribe. The scribe did have the ability to document, navigate the medical record, and send pages to contact other providers. The scribes were Nurse Informaticists who have the ability to educate the providers regarding system functionality and suggest workflow modifications.

Results: There was insufficient evidence to support promoting widespread use of scribes in our facility to improve workflow, but there were providers who reportedly preferred having a scribe. Some providers using a computer on wheels independently at the patient's bedside found that this was just as effective for time management and workflow improvements. There was no "one size fits all" model determined to improve workflow.

Conclusion: It was concluded that for clinicians, documenting in real time allowed well-organized progression through their assignment, and permitted time for additional admissions and discharge preparations for the next day. Also, nurses reported improved communication with providers as they coordinated the patient's plan in real – time. Benefits to this trial included improving knowledge of the computer systems among providers and identification for documentation template revision. This trial was the catalyst to several other trials launched to improve provider workflow.

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