Evaluation of Clinical Metrics
Medication Reconciliation, Problem List and Discharge Instructions

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EXECUTIVE MANDATE FOR ELECTRONIC HEALTH RECORDS

Florence Nightingale’s pioneering work during the Crimean War significantly decreased mortality caused by unsanitary conditions. An advocate of research, data analysis and statistics, Nightingale wrote, “It may seem a strange principle to enunciate as the very first requirement in a Hospital that it should do the sick no harm.”

More than a century later, the Institute of Medicine (IOM) called for a national effort to improve the quality of healthcare. The IOM report, To Err is Human: Building a Safer Health System found that between 44,000-98,000 patients die each year from preventable medical errors in US hospitals.

Their report advocates the implementation of electronic health records and other health information technology to reduce medical errors and improve the quality of healthcare.

Response to the IOM report from leaders in healthcare and government was immediate. Improving the quality of health care is now a national priority and public policy issue. The Agency for Healthcare Research and Quality (AHRQ) established a plan to set national safety goals and track progress in meeting them.

In 2004, President Bush mandated the widespread implementation of electronic health records by 2014, and created a new agency to lead this effort, the Office of the National Coordinator for Health Information Technology (ONCHIT). Five years later, President Obama set a new goal for the creation of a personal health record for every American.

Healthcare leaders agree that health IT is key to improving the quality of care. In 2009, passage of ARRA provided economic stimulus, as well as an investment of $19 billion to advance health IT; the Health Information Technology for Economic and Clinical Health (HITECH) Act provides incentives for hospitals.
and physicians who demonstrate “meaningful use” of electronic health records.

**RUSH TRANSFORMATION**

Rush University Medical Center (Rush) is an academic medical center located in Chicago. The Rush system includes a 671-bed acute care hospital serving adults and children, the 61-bed Johnston R. Bowman Health Center and Rush University.

In 2006, Rush began a 10-year project, the Rush Transformation, to build new facilities and implement an integrated EHR. Rush leaders recognized that use of the EHR would significantly improve the quality of patient care.

Implementation occurred over several phases. In 2007, the first phase of implementation included electronic registration, billing, partial clinical documentation (vital signs and flow sheets), order entry, surgical scheduling, medication verification and medication administration.

In 2008, the next implementation phase included ambulatory documentation and appointment scheduling, emergency department documentation and radiology procedure documentation and health information management for chart tracking and deficiencies. Progress notes, history and physicals and other unit-specific documentation remained in the paper chart during this transition to an EHR.

However, in 2009, EHR implementation was expanded to include additional ambulatory offices, as well as progress notes and most inpatient documentation, with a few select exceptions. Also implemented at this time were improvements in documentation of medication reconciliation and discharge instructions and bar-coded medication administration for respiratory therapists. In 2010, the roll-out of ambulatory EHR continued in addition to electronic prescribing and integrated careplans.

**LITERATURE SEARCH**

Much has been written about the expected benefits of electronic health records. However, Chailken, Christian and Johnson note inconsistent results including the potential for failed deployments, poor clinician adoption, increased medical errors due to poor design and unclear effect on outcomes. Chaudhry, et al. adds this caution:

> While the benefits of health information technology are clear in theory, adapting new information systems to health care has proven difficult and the rates of use have been limited. Most information technology applications have centered on administrative and financial transactions rather than on delivering care.

At the request of the AHRQ, Chaudhry, et al., conducted a systematic review of the evidence on the quality and cost benefits associated with the use of health information technology. Quality of care benefits were evaluated within the framework of the Institute of Medicine’s six aims for improvement in healthcare delivery: safe, effective, patient-centered, timely, efficient and equitable.

Four benchmark institutions were included in this review including Regenstrief Institute, Brigham and Women’s Hospital/Partners Health Care, the Department of Veterans Affairs and LDS Hospital/Intermountain Health Care.

Researchers identified five improvement themes from these four benchmark institutions: increased delivery of care in adherence to guidelines and protocols, enhanced capacity to perform surveillance and monitoring for disease conditions and care delivery, reductions in medication error rates, decreased utilization of care and mixed effects on time utilization. These benchmark institutions demonstrated real benefits from health information technology by using an internally designed system that was incrementally developed, led by academic champions and implemented over many years. The more common process undertaken by health care organizations is to select a commercially developed system; little evidence is available on the benefits of these systems to improve the quality of patient care.

RAND researchers agree that the broad adoption of electronic health records will reduce medical errors and improve health; however actual progress to improve the quality of health care has been limited. The RAND Health Information Technology Project team studied the impact of electronic health records on healthcare quality.

Using the HIMSS survey of health IT adoption and a literature search of the evidence of health IT effects, researchers estimated the potential benefits of what could happen with widespread implementation. The most significant efficiency gains were projected from reducing utilization, nursing administrative time, inpatient drug usage and outpatient drug and radiology usage. Safety benefits were primarily expected from computerized order entry alerts and reminders that can reduce adverse drug events.

Nurses play an important role as designers and users of electronic documentation systems. Deese and Stein quote Carol Bickford, American Nurses Association Senior Policy Fellow, to explain the role of nurses as technology consumers who use data from the electronic health record to tell the patient story:

> Nurses are the largest consumers of health IT, and they are not looking at bits and pieces of data- they are looking at the big picture. They are not just entering numbers into a patient chart, they are writing a story about that patient.

The Advisory Board’s 2008 survey of nurse executives found streamlining documentation and optimizing workflows a top ranking issue. As healthcare organizations implement technology solutions, nurse leaders recommend that system design ensures availability of better (not less) documentation, nursing alerts to promote...
evidence-based practice and matched hardware investment to desired timeliness of documentation. Although the incentives for meaningful use were unknown at the time, these visionary nurse executives recognized the challenges and importance of measuring how electronic health record systems improve care.

**SCOPE OF PROJECT**

Rush University Medical Center (Rush) selected a commercially developed electronic health record. Rush leaders identified clinical metrics to evaluate elements of the electronic health record tied to quality improvement.

However, a process was needed for the data collection, analysis and reporting of these metrics. The purpose of this project was to create a process for ongoing evaluation of clinical metrics and to pilot this process by evaluating three clinical metrics. These data will provide evidence of the impact of the commercially developed electronic health record on the quality of patient care.

**ACTION PLAN**

Meyer identifies four basic steps to create process measures: define critical factors, map cross-functional processes, identify critical tasks and design measures to track critical factors. Rush leaders considered critical factors related to process improvement, patient experience, quality outcomes and fiscal responsibility. Within this strategic framework, the critical factors for clinical aspects of the EHR included medication reconciliation, nursing assessment, diagnosis documentation, discharge instructions, clinician satisfaction, timely care delivery, timely documentation, screening for prior to admission conditions and patient satisfaction.

Three of these critical factors were identified as high priority by Rush leaders and were selected for pilot testing the clinical metrics evaluation process: medication reconciliation, diagnosis documentation and patient satisfaction with discharge instructions. (see Table 1)

Spath outlines seven steps in the outcomes management process: Define objectives, identify performance measures, select measurement tools, define measurement methods, collect data, transform data into information (data analysis) and use the information to improve performance. These and three additional steps were used in the process of evaluating EHR metrics: determine data significance, create report templates and identify gaps between designed workflows and actual practice:

1. Define objectives.
2. Identify performance measures.
3. Select measurement tools/data sources.
4. Define measurement methods.
5. Collect and analyze data.
6. Determine data significance by use of confidence intervals.
7. Create report templates to present data.
8. Use information to improve performance/meet with key stakeholders to review reports.
9. Identify gaps between designed workflows and actual practice.

**PROCESS TO EVALUATE CLINICAL METRICS**

The objective of the EHR metrics project was to evaluate the impact of the electronic health record on critical tasks closely related to high quality and safe care by developing an evaluation process and piloting this process with three metrics: medication reconciliation, problem list documentation and discharge instructions.

Performance measures selected for this project were high priority outcomes identified by Rush clinical leaders. Data sources included EHR system generated reports and Press Ganey patient satisfaction reports. The project director met with Rush leaders to determine measurement methods for each metric.

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On a monthly basis, EHR technical support (TS) staff and a Rush patient satisfaction manager provided the project director with data for each of the metrics. The project director removed unnecessary data elements.

For example, the general care nursery and hospital service departments were removed from the medication reconciliation data. The project director then calculated monthly totals for each metric and created graphs to trend results over time. Findings were analyzed by comparing baseline data from January, February and March 2009, with data post implementation from April 2009 through April 2010.

An important step included in this process was to determine data significance by the use of confidence intervals. Observation data for each metric were entered into an Excel worksheet with formulas built in for p-value, s-value, upper and lower confidence intervals and the standard error. These data were displayed in graphs to determine the confidence interval for the population mean at a 95-percent confidence level, where the probability of observing a value outside of this area is less than 0.05.

Validity for the medication reconciliation reports was confirmed when the report results were supported by manual chart review of medication reconciliation documentation; pharmacists reviewed the electronic charts of currently admitted patients to determine if medication reconciliation was done. System generated reports for problem list documentation included the patient name and medical record number, allowing review of the electronic chart to validate the report data. Press Ganey patient satisfaction data were available for patient satisfaction with discharge information. Validity and reliability of Press Ganey data has been previously established by Rush and is widely accepted. All reports yielded consistent results over time.

Report templates were created to trend results over time and support the use of information to improve performance. Meetings
were held with key stakeholders to review these reports and identify where gaps existed between designed workflows and actual practice. Multi-disciplinary analysis of data and workflow process lead to the design of action plans to improve performance.

**MEDICATION RECONCILIATION**

Medication reconciliation is a key initiative in the Institute for Healthcare Improvement’s (IHI) 100,000 Lives Campaign. The Joint Commission’s National Patient Safety Goal #8 is to “accurately and completely reconcile medications across the continuum of care.” The Joint Commission identifies five steps in medication reconciliation. Each of these steps must be done for complete medication reconciliation: 1. Develop a list of current medications. 2. Develop a list of medications to be prescribed. 3. Compare the medications on the two lists. 4. Make clinical decisions based on the comparison. 5. Communicate the new list to appropriate caregivers and to the patient.

The project director analyzed data from system generated reports to determine the percentage of patients that had partial medication reconciliation, meaning at least one hospital medication was reconciled at discharge. Medications were considered reconciled if there was a clinical decision to prescribe or not to prescribe based on comparison of medication lists. The project director also analyzed data to determine the percentage of patients that had full medication reconciliation, meaning all hospital medications were reconciled at discharge.

Partial medication reconciliation increased from 88.9 percent to 94.6 percent and improvements were sustained for the entire study period. Full medication reconciliation increased from 75.1 percent to 80.2 percent, but improvements were not sustained. Results fell within a 95-percent confidence interval. The project director presented these findings to key stakeholders in nursing and medicine and to the Medication Reconciliation Task Force.

The task force identified three factors that contributed to incomplete medication reconciliation: patients do not have complete information on home medications; clinicians enter duplicate medications when using both brand and generic names; and clinicians lack full knowledge of designed workflows.

The task force developed an action plan to achieve 100-percent compliance with medication reconciliation. Task force members evaluated emergency department workflows and factors impacting documentation of home medications, use of a pharmacist to document home meds and strategies to sustain change.

**DISCHARGE INSTRUCTIONS**

The Joint Commission standard for discharge instructions requires that there is clear documentation that a copy of the written instructions, including discharge medication list, was given to the patient/caregiver and that all instructions were given to the patient/caregiver in writing at discharge. Rush leaders identified discharge instructions as a high priority clinical metric because of this Joint Commission requirement and the impact that discharge instructions have on safe medication practices.

The Press Ganey patient satisfaction survey was selected as the data source for the outcome measure of patient satisfaction with discharge instructions. Patients were asked to respond very poor, poor, fair, good or very good to the survey item, “Satisfaction with instructions given about how to care for yourself at home.”

Patients selected one of five ratings, and then the score was converted to a 100-point scale by assigning point values to each response level. Analysis of survey results found that patient satisfaction with discharge instructions did not significantly change after EHR implementation. Results fell within a 95-percent confidence interval. Key stakeholders from nursing operations speculated this metric was evaluated too early as the new discharge process was complex and required more time for clinicians to learn. They expected that over time clinicians would become more familiar with the discharge process and patient satisfaction would increase. This metric will be evaluated again in six to 12 months.

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<thead>
<tr>
<th>Critical Factors</th>
<th>Cross-functional Processes</th>
<th>Critical Tasks</th>
<th>Evaluation Measures</th>
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<tbody>
<tr>
<td>Medication Reconciliation at Discharge</td>
<td>1) Document home medications</td>
<td>1) Mark home medications as reviewed</td>
<td>1) At least one medication reconciled</td>
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<td></td>
<td>2) Reconcile when discharging patient</td>
<td>2) Indicate “Prescribe” or “Don’t Prescribe” for inpatient medication when placing discharge orders and indicate “Order” or “Don’t Order” for home medications.</td>
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<tr>
<td>Diagnosis Documentation in Problem List</td>
<td>1) Physicians document patient diagnosis</td>
<td>1) Document new diagnosis upon admission</td>
<td>2) Encounters with at least one diagnosis</td>
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<tr>
<td></td>
<td>2) Best Practice Alerts triggered by diagnosis</td>
<td>2) Update problem list with new or resolved diagnosis</td>
<td>2) Encounters with updated diagnosis</td>
</tr>
<tr>
<td>Patient Satisfaction with Discharge Instructions</td>
<td>1) Physician places discharge orders with home instructions</td>
<td>1) Review After Visit Summary with physician for completeness and clarity.</td>
<td>1) Patient satisfaction with discharge instructions</td>
</tr>
<tr>
<td></td>
<td>2) Nurse prints After Visit Summary and gives to patient</td>
<td>2) Review After Visit Summary with patient and provide discharge instructions</td>
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**Table 1: Process Measures for Epic Metrics.**
**PROBLEM LIST**

Physicians document the patient diagnosis for an inpatient admission in the electronic problem list. Once documented, a diagnosis remains active for the current and subsequent admissions until it is resolved. Documentation of the patient diagnosis in the problem list is important because best practice alerts (BPA) and drug interaction alerts are triggered by the patient diagnosis. Data for problem list documentation were available from system reports by measuring in two different ways:

1. The number of inpatient admissions with at least one diagnosis documented.
2. The number of inpatient admissions with at least one diagnosis updated.

Both measurements are important to evaluate whether problem list documentation is current. A diagnosis may be documented in the problem list from a previous admission yet may not be relevant to the current admission.

An update to the problem list during an admission may indicate that the problem list is current. Data analysis found that the percentage of inpatient admissions with at least one diagnosis in the problem list increased from 63.8 percent to 78.3 percent, and was sustained for most of the study period. The percentage of inpatient admissions with at least one diagnosis updated in the problem list increased from 71 percent to 74.4 percent, but was not sustained for the entire study period. Results fell within a 95-percent confidence interval. Key stakeholders from medicine found that compliance with problem list documentation would be improved by making problem list diagnosis a required field in the EHR. Before making this change, these data will be evaluated by service and the findings will be presented to residents and clinical chairmen.

**CONCLUSION**

Implementation of the electronic health record at Rush was a significant step in the Rush Transformation to provide high quality, patient-centered healthcare. This project, to design and implement an ongoing process to evaluate clinical metrics, will help validate the impact of the EHR on the quality of healthcare.

A process was developed and piloted to evaluate clinical EHR metrics:

1. Define objectives.
2. Identify performance measures.
3. Select measurement tools/data sources.
4. Define measurement methods.
5. Collect and analyze data.
6. Determine data significance by use of confidence intervals.
7. Create report templates to present data.
8. Use information to improve performance.
9. Identify gaps between designed workflows and actual practice.

The process was piloted with three clinical metrics and validated significant changes following implementation in March, 2009:

1. An increase in partial medication reconciliation at discharge sustained for six months.
2. An increase in full medication reconciliation at discharge not sustained during the study period.
3. No increase in patient satisfaction with discharge instructions.
4. An increase in documentation of at least one diagnosis in the problem list sustained for five months.
5. An increase in updates to problem list documentation not sustained during the study period.

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**REFERENCES**