APPENDIX 1 – METHODS

Our organization employs nearly all of our physicians, and it is uncommon for someone outside of our organization to have admitting privileges. We have a significant number of house staff and students, with 5 residency programs and 1 fellowship program. We function as the Western Clinic Campus for the University of Wisconsin Schools of Medicine and Nursing. Our implementation was guided heavily by end-user input and build, with most clinical decisions requiring approval by the respective physician or nursing champion and/or leadership teams. End users had the opportunity to attend "Usability Labs" during the build phase where they could provide feedback to the implementation team before go live. Communication about this project to end users was layered, with the physician champion and implementation coordination providing face-to-face discussions 4 times before go live and 1 time after go live with every individual department. In regards to training, providers were required to have 8 hours of classroom training before EHR go live, and an additional 4 hours before CPOE go live. Nursing staff were required to have 16 hours of classroom training before EHR go live and an additional 4 hours before CPOE go live. Pharmacists were required to have 16 hours of classroom training before EHR go live and an additional 2 hours before CPOE go live. Completion of a proficiency examination immediately after training was required to gain access to the EHR to provide care. A "Playground" environment was available after training for end users to practice workflows using mock patients. Full use of the EHR with CPOE was mandatory.

In order to improve the ability of end user to find and correctly place orders, several strategies were used. First of all, over 400 order sets were created, most of which were translated from paper order sets that were already in use before EHR implementation. The order sets guided best practice by having certain orders preselected and free text instructions defaulted when appropriate. This allowed the majority of the general admission, discharge, and disease-specific orders to be easily entered. Synonyms for individual orders were created and end users could request additional synonyms for ease of finding orders (e.g. "K" for "potassium"). Common misspellings were also included as synonyms (e.g. "flouroscopy" for "fluoroscopy"). Preference lists were created which presented the most commonly used orders so end users did not have to sort through less relevant selections. Finally, if end users

could not find a particular order, each order category had a generic selection called "Other", (e.g. Medication Other, Laboratory Other, X-Ray Other), so free text could be entered and the respective receiving department (e.g. Pharmacy, Laboratory, or Radiology) could locate and discretely enter that particular order. With the exception of decision support embedded within order sets, no other decision support rules were implemented at go live to guide end users to the appropriate order.

During and after go live for both the EHR and CPOE implementations, a "super user" strategy was implemented. Each role (e.g. provider, nursing, etc) had a defined number of peers who provided "shoulder to shoulder" support during the first several weeks following go live. As time progressed the super users devoted more time to patient care and less to peer support. In addition, a call-in command center was in place and assistance was deployed as needed to end users needing additional assistance.

Length of stay, readmission within 30 days, case mix index,[1] and risk-adjusted mortality[2] were calculated according to predefined industry standards.

Laboratory test data were gathered weekly for all hospitalized patients and averaged by dividing by the total number of laboratory tests performed by the number of patients. A duplicate alert system for laboratory tests was set up, such that an alert appeared if the same laboratory test had been ordered within 4 hours. Data for alert frequency or response to the alert were not collected. No such duplicate alert system was used for radiology orders; however, if duplicate orders were discovered by radiology staff, they were cancelled prior to the examination being performed.

In all time periods, a radiology examination was defined as *ordered* when it was entered into the computer system via clerk order entry or CPOE. A *cancelled* radiology examination was defined as an examination that was ordered but not completed. Radiology examinations completed per hospitalization were quantified, as were the number of examinations ordered and then cancelled, and the reasons for cancellation. For both laboratory tests and radiology examinations, comparisons were made among the 1-year pre-EHR period, the 3-month post-EHR but pre-CPOE period, and the 9-month post-CPOE period.

Our documentation strategy included partial dictation, which allows the user to dictate a section of unique text, such as the History of Present Illness or Plan, and have that

section automatically inserted into the note. This provided a way to leverage the automation of the EHR, such as pulling past history and medications from a database into the note, while avoiding large amounts of keyboard entry for discrete narratives. Prior to EHR implementation, providers used full dictation for History & Physicals, Consultations, Operative Notes, and Discharge Summaries. Progress Notes were written on paper. After EHR implementation, providers had the option of full dictation, partial dictation with automated documentation tools, and direct keyboard entry with automated documentation tools. They were required to use direct keyboard entry with automated documentation tools for Progress Notes. Voice recognition was not used. Total transcription was measured in minutes, then converted to a cost in dollars per minute. Cost per minute did not change from 1 study period to another.

Cost of copy paper for hospital use was quantified. It was assumed that paper ordering occurred in parallel with paper consumption. We also determined the number of paper forms eliminated consequent to EHR implementation, as well as the cost for these forms in the pre-EHR period. Paper order sets used in the pre-EHR period were not included in the analysis because they were printed in a different area of our organization and their use could not be quantified.

Medication events were studied as a measure of safety. A *medication event* was defined as either a medication error or a near miss. A *medication error* was defined as a mistake in the medication process that was not caught and corrected before it reached the patient. This included failure to administer a medication that was ordered. A *near miss* was defined as a mistake in the medication process that is detected and corrected before actual medication administration. Medication events were self reported, mainly by nurses and pharmacists, via a paper-based incident reporting mechanism. Medication events were not independently validated.

REFERENCES

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