Electronic Prescribing and Electronic Transmission of Discharge Medication Lists

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Target Population: Adults

Summary: This project consists of three studies assessing the impact of health information technology (IT) on patient safety in the ambulatory setting. The first is a multi-center before-and-after study measuring the impact on medication errors of switching from one electronic prescribing (e-prescribing) system to another, in this case from a home-grown to a vendor-based system. The second is a qualitative study of physicians using one-on-one-interviews and direct observation to understand variations in human-computer interactions with this new e-prescribing system and how user patterns or system features may influence medication errors. The third is a randomized, controlled trial evaluating the effect of electronically transmitting discharge medication lists from the hospital to the ambulatory setting using: 1) medication discrepancies at the first ambulatory visit following discharge; and 2) adverse drug events (ADEs) 30 days post-discharge as outcome measures.

These studies are important because they have the potential to substantially add to the knowledge of ambulatory medication safety as it relates to the value of vendor-based electronic prescribing systems for medication management in the ambulatory setting, and the impact of health information exchanges on patient safety at a critical time of transition. In addition, by including a qualitative component on human-computer interactions, this project has the potential to yield critical insights to why certain health IT interventions do or do not work, and how future interventions should be designed to better align themselves with physicians' workflow. The studies also have implications for the many institutions and practices that are transitioning from one electronic health record (EHR) to another. If rates of errors vary greatly between commercial systems there are potential policy implications for more stringent certification criteria of e-prescribing to ensure medication safety.

Specific Aims:

- Measure the effects on medication errors of transitioning from one e-prescribing system to another in the ambulatory setting. **(Ongoing)**
- Measure the effects on human-computer interactions of transitioning from one e-prescribing system to another in the ambulatory setting. **(Ongoing)**
- Evaluate the impact on medication discrepancies of electronic transmission of medication lists at discharge from the hospital to the ambulatory setting at the first ambulatory visit following discharge. **(Ongoing)**

- Evaluate the impact on ADEs 30 days post-discharge of electronic transmission of medication lists at discharge from the hospital to the ambulatory setting. **(Ongoing)**

2010 Activities: The first study, measuring the effects on medication errors and data collection of transitioning from one electronic prescribing system to another, is nearly complete. Data have been collected for all four time periods (baseline, 3 months, 1 year, and 2 years post-implementation). Data cleaning and analysis are complete for the first three periods and in progress for the fourth. One manuscript has been submitted for publication and a second has been started.

The second study, a qualitative study measuring the effects on human-computer interaction of this same transition, is also near completion. The team completed two sets of interviews, the first with 15 providers and the second with 13 providers. Data from the first set of interviews have been analyzed and a manuscript has been submitted. Data from the second round of interviews are being assessed and a manuscript will be developed.

The third study evaluates the impact on medication discrepancies and ADEs of electronic transmission of medication lists at discharge. The chief medical information officer and the medical director of information services for Weill Cornell Physician Organization (the investigators) developed an application to electronically transmit discharge information, including medication lists from the inpatient setting to the outpatient setting. This tool has been implemented at New York-Presbyterian Hospital. Dr. Kaushal's team, in collaboration with Dr. Jeffrey Schnipper from Brigham and Women's Hospital and Harvard Medical School, also developed data collection tools to identify and characterize medication discrepancies, including a patient background form that obtains demographic and health status information from patients in the hospital, and a patient medication survey that collects medication data and ADEs at approximately 30 days post-discharge. The team further developed a medication error and adverse drug event tool. An experienced research nurse will use the tool to identify medication errors in the data and ADEs experienced by the patient. All medication errors will be reviewed by two experienced physicians who will use this tool to rate the severity of the medication errors and ADEs. The data collection period has been extended to attain a large enough sample size to reach the statistical power necessary for analysis. Data cleaning is concurrent with data collection. Analysis and manuscript preparation will follow.

Grantee's Most Recent Self-Reported Quarterly Status (as of December 2010): The project is making good progress and spending is roughly on target. Data collection in complete for the first two studies and in progress nearing completion for the third study. Data cleaning and analysis is in progress for all three studies.

Preliminary Impact and Findings: For the quantitative study, the rates and types of prescribing errors made by physicians were assessed at three time periods: baseline (when physicians were using the locally developed EHR with minimal clinical decision support for e-prescribing); 3 months post-implementation of a commercial EHR with more advanced clinical decision support for e-prescribing; and 1 year post-implementation. The research team found that error rates were highest at baseline and lowest at 1 year. Improvements were primarily attributed to reducing inappropriate abbreviation errors. Other error types increased and remained elevated at 1 year post-implementation suggesting that transitioning from a locally developed EHR to a commercial EHR for e-prescribing can reduce certain errors; however, important safety threats remain. Overall, despite intensive efforts to ease the transition, most providers found transitioning extremely difficult. The commercial system was not

perceived as improving medication safety, despite the more advanced clinical decision support. Additionally, physicians felt the commercial system was too complex and therefore reduced efficiency. This has important implications for the design and implementation of commercial systems with advanced clinical decision support for e-prescribing.

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use