

Health Information Technology and Improving Medication Use

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Organization:	Brigham and Women's Hospital
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Summary: The Centers for Education and Research on Therapeutics (CERTs) program is a national initiative that uses education and research to increase awareness of the benefits and risks of new, existing, or combined uses of therapeutics. Each CERT supports multiple research projects under the direction of a lead principal investigator.

In 2007, recognizing that health information technology (IT) has great potential to reduce medication errors and improve patient safety, the Agency for Healthcare Research and Quality funded the Brigham and Women's Hospital Health IT CERT program. The CERT-Health IT team is comprised of a methodology and data resources core and a translation and dissemination core. These cross-disciplinary cores supported projects soliciting information from patients about adverse medication events, using clinical decision support (CDS), evaluating new processes for medication reconciliation post-hospital discharge, and assessing the impact of regional health information exchange on medication safety.

Specific Aims:

- Evaluate the impact of using telephony to ask outpatients identified from electronic health record (EHR) data if they are experiencing adverse effects related to specific medications. **(Achieved)**
- Evaluate the impact of clinical decision support and automated telephone outreach on antihypertensive and lipid-lowering therapy in ambulatory care. **(Achieved)**
- Evaluate errors arising from implementation of electronic prescribing. **(Achieved)**
- Evaluate the impact of implementing a post-discharge ambulatory medication reconciliation intervention. **(Achieved)**
- Evaluate effects of multiple vendor-based prescribing systems on medication safety among six Regional Health Information Organizations in New York and Massachusetts. **(Achieved)**
- Development of a Clinical Decision Support Roadmap with identification of a set clinical decision support rules that can be used in multiple settings. **(Achieved)**

2012 Activities: *Project 1: e-Pharmaco-vigilance: Integrating Patient Reports of Side Effects with Electronic Health Records for Surveillance of Recently Approved Drugs.* The goal of this project was to increase surveillance evidence for recently-released Food and Drug Administration-approved drugs. Interactive voice response is linked to a patient EHR to monitor patients taking these medications by

calling and asking them about their progress using a medication and if they are having any problems. The project team completed the project in 2011, and in 2012 focused on project results dissemination.

Project 2: A Multi-Modal Intervention to Improve Antihypertensive and Lipid-Lowering Therapy. This project compares the impact of CDS with and without automated telephone outreach to patients on the use of antihypertensive and lipid-lowering medications. The team recruited one intervention site in Brockton, MA, which received EHR-based alerts, and two control sites in New York where patients received generic automated telephone interactive voice response (ATIVR) messages. The project completed the intervention of EHR hypertension alerts in 2012 and data analysis continued past the end of the grant period.

Project 3: Unintended Consequences of e-Prescribing. This project focused on identifying unintended consequences of electronic prescribing (e-prescribing) and developing recommendations to prevent them. Prescriptions from commercial pharmacies were reviewed to identify the frequency and character of errors in e-prescribing. An expert panel reviewed unintended consequences and evaluated their impact on pharmacy workflow. A qualitative study of the unintended consequences in the outpatient pharmacy setting, including workflow implications, was conducted. Recommendations for minimizing e-prescribing errors and their unintended consequences were developed. In 2012, the project focused on disseminating its findings and recommendations.

Project 4: Ambulatory Medication Reconciliation Following Hospital Discharge. The objective of this research was to assess the use of a medication reconciliation module in ambulatory EHRs to reduce post-discharge medication discrepancies and adverse drug events (ADEs). The use of the reconciliation module was low when it was first made available in the EHR, so the project team created an active reminder (“pop up”) in the EHR medication screen and a passive reminder in the EHR summary screen. The team compared use of the reconciliation module before and after the reminders were developed. During the enrollment and followup period, the project team monitored the uptake of the medication reconciliation module and observed an increase in its use over time. The project team conducted a secondary analysis of the accuracy of medication lists 1 month after discharge compared with patient-reported lists. The project team completed a manuscript describing their findings on the impact of the post-discharge ambulatory medication reconciliation intervention.

Project 5: Impact of Vendor Systems on Ambulatory Medication Safety. This project compared the impact of different vendor-based e-prescribing systems on medication safety. It also compared the impact of e-prescribing by users in the short term (less than 6 months) and the longer term (greater than 1 year). Enrollment of 20 providers was completed in rural Hudson Valley, New York, and 17 providers in New York City. The team finished two manuscripts of their findings and focused on project dissemination.

Project 6: Identification of a Common Set of Clinical Decision Support Rules. This project convened a panel of expert clinical informaticians, providers, and regulatory agencies to identify high-value CDS rules. The review team assessed a list of “best practices” decision rules in the areas of preventive care reminders and medication decision-support rules related to drug-drug interactions and therapeutic duplications. Criteria for review of the rules was based on the Institute of Medicine’s Crossing the Quality Chasm report improving quality features including safety, timeliness, patient-centeredness, effectiveness, efficiency, and equity.

A 1-year no-cost extension was used to analyze data and develop manuscripts for five of the six projects. Project 2, A Multi-Modal Intervention to Improve Antihypertensive and Lipid-Lowering Therapy continued its intervention through 2012. The original practice sites identified changed their organizational affiliation, which delayed identification of participating practice sites.

Impact and Findings: Findings for each project are described below.

Project 1: Pharmacovigilance provides important information related to the patient perspective on ADEs. Significant differences in medication cessation were reported by patients when compared with documentation in the EHR. The project tracked the percentage of calls that triggered an email response to the provider and, for those emails, the percentage that resulted in direct followup through a phone call, office visit, or discontinuation of the medication. Of participants, 50.2 percent reported greater than one symptom; of these, 22.0 percent thought the symptom was medication-related. Analysis identified that pharmacovigilance is associated with increased use of specialty services but is not associated with EHR-documented medication cessation, use of acute services, death, or use of primary care services. The results indicate the value of innovative ways to collect information on ADEs from patients.

Project 2: Interviews with physicians found that they have different perspectives on reaching the treatment goals from recognized evidenced-based guidelines for hypertension and hyperlipidemia. Some physicians thought that it was critical to reach the treatment goals while others felt that the unique circumstances of the patient determined the importance of reaching them. The analysis of the intervention to improve treatment through CDS compared to automated telephone outreach will be completed in 2013.

Project 3: Prescribing errors vary significantly depending on the computerized prescribing system used, indicating that most errors are amenable to modification of systems. Informatics strategies can be used to minimize errors, including the following: 1) CDS with maximum dose checkers; 2) automating amount to be dispensed to prevent inconsistent quantity errors by eliminating the redundant entry of the final medication quantity; and 3) use of dispense forcing functions, which create constraints in data entry to prevent errors such as structured data entry with mandatory data fields to prevent omitted information. The findings will inform the design and implementation of e-prescribing systems within retail pharmacies.

Project 4: This study found the accuracy of documented medication regimens 30 days after hospital discharge is, at 22 percent, poor. Although primary care providers are in the best position to identify and correct errors, the results on use of the medication reconciliation module found a modest impact on patient safety. This project found that active use of the reconciliation module was low without additional support such as provider education and electronic reminders to use the module. The tool led to small improvements in documentation of medications as compared to usual care practices, and a modest decrease in serious medication errors. The project identified several recommended improvements to increase the usability of the tool and improve patient safety in the future.

Project 5: This project found no difference in prescription error rates 3 months after implementation

of the e-prescribing system compared to prescriptions made 1 year after implementation. Relatively low error rates were found, both during implementation and during sustained use among practices with support for use of a new e-prescribing system. Support for providers before, during, and after implementation may help mitigate potential safety threats resulting from implementation of an e-prescribing system and might lead to sustained safety benefits over the long term.

Project 6: This project developed a starter set of clinically significant rules on medication-related decision support that could be implemented in clinical information systems across health care settings. These findings have been disseminated in articles in *Health Affairs*, *BMJ Quality & Safety*, *the Journal of the American Informatics Association*, and *the Journal of Patient Safety*.

Target Population: General

Strategic Goal: Develop and disseminate health information technology (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: Knowledge Creation
