

A Systems Engineering Approach: Improving Medication Safety

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Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017020
Project Period:	September 2007 – November 2010, Including No-Cost Extension
AHRQ Funding Amount:	\$1,200,000
Summary Status as of:	November 2010, Completion of Grant

Target Population: Elderly*

Summary: Adverse Drug Events (ADEs), common in all settings, can frequently be prevented through identification and correction of underlying systemic vulnerabilities. Most methods for estimating health care vulnerabilities are retrospective, uncovering only the ‘tip of the iceberg’. These are fraught with difficulty due to various issues, including gross under-reporting of ADEs and lack of provision for understanding of the total primary care system. Dr. Singh and his team have developed a prospective bottom-up approach, invoking improvement science, adapted from the established failure modes and effects analysis method. This is known as the Safety Enhancement and Monitoring Instrument – Patient centered (SEMI-P) and is highly transferable. This project studied the impact of an information technology (IT)-based SEMI-P on medication safety in primary care practices serving older adults.

This project conducted an experimental design (single-blind randomized block cluster) of a site-level intervention. Outcome assessment focused on medication safety among geriatric patients, in addition to office staff use and application of the IT-based instrument. Participatory research methods assessed provider- and staff-identified barriers to implementation.

The goal of this study was to conduct and publish the results of an IT demonstration project using a human factors approach to geriatric medication safety in order to: 1) provide pilot data for larger confirmatory studies, and 2) possibly develop and market test the IT-based Crew Resource Management (CRM) software via small business innovation research mechanisms for eventual national release.

Specific Aims:

- Examine the impact of an IT-based CRM intervention on reducing selected ADEs among geriatric patients in primary care settings by evaluating changes in: 1) number of preventable ADEs that occur, 2) severity of those ADEs, and 3) stage of the medication use process in which they occur (i.e., diagnosis, prescribing, transcribing, dispensing, administration, and monitoring). **(Achieved)**
- Examine the impact of an IT-based CRM intervention on improving monitoring for geriatric patients who are on persistent medications in primary care settings by evaluating changes in monitoring rates for subjects age 65 and older on: 1) angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers, 2) digoxin, 3) diuretic, and 4) statins. **(Achieved)**
- Evaluate office staff use and application of the IT-based CRM tool for improving geriatric medication safety in primary care settings by examining use of the IT tool and any changes in safety attitude

constructs (safety climate, teamwork climate, stress recognition, working conditions, perceptions of management, and job satisfaction). **(Achieved)**

2010 Activities: All four sites completed implementation of practice changes in 2010 to address identified ADEs. Practices used the ACORNoffice tool, an IT-based quality improvement tool that supported the practice by prioritizing different methods for improving medication safety, assigning responsibility, and tracking their implementation. Examples include: incorporation of patient education brochures for high-risk medications; inclusion of diagnosis on prescriptions; patient reminders regarding followup; patient-carried medication lists; changes in the way that refill requests are handled; and formation of teams to address ongoing communication problems. The “Indicators” tool within the software was used to define specific measurable outcomes for each initiative and to track success at meeting these objectives over time.

Final interviews and surveys with key practice informants were conducted at completion of the intervention to ascertain barriers, facilitators, perceived benefits, and any potential unintended consequences of the intervention.

In June 2010 the team presented a talk on *Change Management* at the Agency for Healthcare Research and Quality Health IT Grantee and Contractor Meeting. Two papers have been published and another one is under review. An abstract has been submitted to the North American Primary Care Research Group 2011 Annual Meeting.

Grantee’s Most Recent Self-Reported Quarterly Status (as of November 2010): The project is completed, and all aims were achieved.

Impact and Findings: To measure the impact of the IT-based SEMI-P there are two main outcomes: 1) rate of ADEs in participating practices identified through the use of the trigger tool, and 2) compliance with the Healthcare Effectiveness and Data Information Set (HEDIS) guidelines for laboratory monitoring of patients taking a specified set of chronic medications (ACE inhibitor, diuretic, digoxin, statin, and anticonvulsants).

1) *ADEs:* In the intervention group, ADEs showed a downward trend from 25.8 per 100 patients per year to 18.3 ($p=.471$ by paired t-test), while the control group showed little change (24.3 to 24.8, $p=.899$). A two-way ANOVA examining the interaction between time (pre versus post) and group (intervention versus control) showed no significant interaction ($p=.407$). The intervention proved feasible and demonstrated potential for effectiveness in a variety of ambulatory settings. Future studies should test the intervention on a larger scale, over a longer period of time, and should explore methods for overcoming common barriers.

2) *HEDIS measure for lab monitoring for patients on chronic medications:* At baseline, ACE inhibitors, diuretics, and statins were used by a high proportion of patients, around 40 percent or more at most practices. At all practices, the majority of patients had appropriate laboratory monitoring for these medications. However, compliance was not complete and there was considerable variation between practices, especially for the statin group of medications. There were no statistically significant differences over time or between intervention and control groups. The team plans to publish three papers. The papers will focus on: 1) the barriers and facilitators for practices to improve safety using the CRM; 2) the impact

of the CRM on reducing adverse drug events; and 3) the changes in safety culture as a result of the CRM process.

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: Synthesis and Dissemination

* *AHRQ Priority Population*