

Enabling Medication Management Through Utilization of Health Information Technology

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Target Population: General

Summary: McMaster University has produced the third evidence report in the series of reports on the strategic goals of the Agency for Healthcare Research and Quality's (AHRQ's) health information technology (IT) Portfolio. The report focuses on improving medication management through health IT applications. Because of the diversity of health IT applications being developed and the different ways that impact can be measured, the review includes peer-reviewed scientific literature, conference proceedings, and grey literature. Many health IT applications are considered in the report, including e-prescribing applications, computerized provider order entry, clinical decision support, bar-coded medication administration, pharmacy-based health IT applications, electronic medication administration records, and other IT-based medication management tools.

The report synthesizes the evidence on health IT use and medication management to understand health IT's impact and set future direction for the field. Medication management involves many actors and interactions, starting with the prescribing or ordering of medications by clinicians, interactions between clinicians and pharmacists to perfect the pharmacists' dispensing of medications, administering of the medications, and the clinical monitoring of the effects of the medications. The report also assesses the use of health IT for medication reconciliation and for educational activities. Studying the integration and utilization of medication management and IT systems will lead to a better understanding of how health IT improves, or could improve, the quality and safety of medication management and other issues related to sustainability, usefulness of feature sets, and communication.

Project Objective:

- Summarize evidence on the extent to which health IT enables improved quality and safety in the medication management phases, which include but are not limited to: 1) accurate and timely prescribing of medication in response to a specific patient, 2) correct first-fill and refill dispensing of medications, 3) appropriate administering of medication, and 4) patients' taking of the pharmaceutical treatment regimen as prescribed. **(Achieved)**

2010 Activities: Activity in 2010 focused on completing the report. This included updating database searches in June using MEDLINE, Cochrane Database of Systematic Reviews, Excerpta Medica Database/EMBASE, Cumulative Index to Nursing and Allied Health Literature, and PsycInfo. Research staff extracted data from selected articles to produce summary evidence tables with key data and important findings. A draft of the report was sent for peer review in July. The document was revised

based on the feedback of peer reviewers and AHRQ staff. A final version was submitted in December 2010 and is now available on the AHRQ National Resource Center for Health IT Web site: [“Enabling Medication Management Through Health Information Technology”](#).

Preliminary Impact and Findings: The literature search retrieved 40,582 articles which were screened using titles and abstracts. From a full-text screen of 4,356 articles, 428 articles were summarized in the report. Another 361 articles on topic but with limited data were included in a bibliography.

Evidence for evaluating medication management health IT (MMIT) is strong for prescribing and monitoring (Table 1), especially for hospitals and primary care settings (Table 2). The evidence from these studies indicates process improvements, often measured as improvements in medication orders during the prescribing and monitoring phases. The bulk of this evidence of improvement is shown in studies set in hospitals. Improvements in use, knowledge, skills, and attitudes were also found to be associated with MMIT systems. These cumulated changes can, but may not always, lead to efficiency and cost gains. In contrast, little work has been done on other phases of medication management that use integrated health IT. Some IT applications used in dispensing and administering are stand-alone technologies and, by definition, are not included in this report.

Little evidence was found of significant improvement in clinical outcomes with MMIT. Possible reasons include the small number of events, the outcomes being far removed from the application of the technology, and that the clinical aspects were often not the studies’ main endpoints. It is not known whether MMIT applications are clinical- or even cost-effective because of a lack of sound economic data. User groups (e.g., nurses and pharmacists) evaluate systems and features differently and have needs and preferences that sometimes are in conflict with other groups of health professionals. The qualitative literature highlighted positive and negative perceptions and differing levels of satisfaction with the integrated health IT applications, supporting the importance of carefully assessing the effects of the health IT on workflow and the working relationships of the users.

Table 1. Research Design Across the Phases of Medication Management and Education and Reconciliation. Note that some studies cross more than one phase.

Design	Number of Studies						
	Prescribing	Order Communication	Dispensing	Administering	Monitoring	Education	Reconciliation/ Other
RCT	69	1	2	2	37	1	1
Cohort	13	2	2	1	6	0	1
Observational	144	18	10	26	29	2	4
Qualitative	37	5	3	10	5	0	0
Total	263	26	17	39	77	3	6

RCT = randomized controlled trial.

Table 2. Settings for the Phases of Medication Management and Reconciliation and Education. Note that some studies cross more than one phase or setting.

Setting	Number of Studies						
	Prescribing	Order Communication	Dispensing	Administering	Monitoring	Education	Reconciliation/ Other
Ambulatory care (e.g., clinic, doctors office)	94	6	2	1	40	2	0
Community (e.g., school, community centre)	0	0	0	0	1	0	0
Home	2	0	0	2	5	0	0
Hospital	164	12	9	34	36	1	6
Long-term care	4	0	2	3	1	0	0
Pharmacy	11	13	10	2	4	0	1

A number of areas of study are poorly addressed in the literature, most notably order communication, dispensing, administration, reconciliation, and education. Inpatient care is the most studied setting, followed by ambulatory care, whereas few studies assessed long-term care and pharmacies, especially those outside hospitals. Regarding technology, most of the studies evaluated computerized decision support systems or computerized provider order entry systems, but other MMIT applications were not often evaluated. The report identified gaps in the evidence of the effects of MMIT applications in the domain of patient and informal caregiver access to MMIT applications. These gaps are especially true for applications that are integrated with existing clinical applications, such as electronic medical and personal health record systems. A patient-centered focus for MMITs promises a new and exciting domain of study. One other important gap is in the assessment of MMIT tools that are used by non-physicians.

Most of the studies in this evidence report are quantitative observational assessments, often using historical controls. Randomized controlled trials and other methodologies with controlled populations and multi-centered demonstration studies are lacking. Those that exist often have inadequate details or weak methods, which result in only incremental additions to the evidence base for the use of MMIT. Sustainability studies, strengthened study methods, fuller descriptions of MMIT applications and settings, and reporting standards are still needed.

The value of MMIT systems needs to be assessed across financial, clinical, and organizational components. The values proposition for each stakeholder will be different based on his or her value set. Individual and group values have not been well studied. For example, what is important to nurses and pharmacists may

not be viewed similarly by physicians or patients. Although some evidence suggests positive financial and organizational gains, these gains are not universal and depend on the technology, the setting, and the impact on the stakeholders using them. Clinical benefit is not assessed well in the literature. What evidence exists seems to indicate no or very small clinical benefit from MMIT applications. Rigorous studies are needed to truly assess economic and other values.

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