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Development of an Electronic Tool to Facilitate the Medication Reconciliation Process and Improve Prescribing Practices

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Abstract

Medication discrepancies occur frequently at hospital admission and discharge. Medication reconciliation is recognized as an essential process to reduce medication discrepancies and improve prescribing practices.

The University Health Network has developed an electronic tool that is integrated with the electronic patient record (EPR) and facilitates the medication reconciliation process. The tool was developed by first creating a structured, multi-disciplinary medication reconciliation strategy.

The Electronic Medication Information Transfer Tool (EMITT) is populated with patient demographics, allergies and medications from the patient chart. The tool facilitates medication reconciliation documentation as well as the coding of medication discrepancies. EMITT is integrated with the electronic discharge summary application and is able to generate an electronic prescription upon discharge. The tool also generates a medication letter, a patient medication grid and a medication wallet card.

The success of this project is attributed to the high degree of clinical leadership and involvement throughout the entire design and development of the electronic tool. It is anticipated that similar electronic models can be easily adopted at other healthcare institutions.

Keywords:

medication reconciliation, electronic prescription, preventing medication discrepancies, electronic medication reconciliation tool, medication safety

Introduction

The Canadian "Safer Healthcare Now!" initiative and the Institute for Healthcare Improvement "100K Lives" campaign have both identified medication reconciliation as an essential process to prevent medication discrepancies. The Institute for Healthcare Improvement defines medication reconciliation as "a formal process of obtaining a complete and accurate list of each patient's current home medications - including name, dosage, frequency and route - and comparing the physician's admission, transfer, and/or discharge orders to that list. Discrepancies are brought to the attention of the prescriber and, if appropriate, changes are made to the orders. Any resulting changes in orders are documented" [1].

The Canadian Council on Health Services Accreditation (CCHSA) has also recognized the importance of medication reconciliation by including it as part of the Patient Safety Goals and Required Organizational Practices (ROPs). As part of the accreditation process healthcare organization in Canada are required to:

- "Reconcile the patient's medication upon admission to the organization, and with the involvement of the patient." [2]
- "Reconcile medications with the patient at referral or transfer, and communicate the patient's medications to the next provider of service at referral or transfer to another setting, service, service provider, or level of care within or outside the organization." [2]

Canadian hospitals must meet the CCHSA requirements to be considered an accredited healthcare organization. Passing the accreditation process indicates that "the organization was assessed by its peers, met or exceeded national standards of excellence, and continues to strive for high quality health care" [3].

Many healthcare organizations are now faced with the challenge of incorporating the medication reconciliation process with current workflow practices. Some of the challenges that organizations may face include [4]:

- How to integrate reconciling meds with current workflow and prescribing practices?
- How to standardize the collection of data?
- The amount of time required to reconcile medications.

To address challenges with reconciling medications, the University Health Network has developed an electronic

tool that is integrated with the electronic patient record (EPR) to facilitate the medication reconciliation process.

Methods

Project Objectives

This project worked towards developing a web-based tool that is integrated with the hospital's electronic EPR and can facilitate the medication reconciliation process. The tool must be able to facilitate medication reconciliation throughout the entire inpatient stay and capture the Best Possible Medication History (BPMH), admission medication reconciliation, and discharge medication reconciliation. It is also essential that the tool is able to generate the best possible discharge medication list, electronic prescription, a medication letter for community clinicians and a medication grid and wallet card for the patient.

Requirements Gathering

A multi-disciplinary team comprised of pharmacists, physicians and IT professionals worked closely together to decide upon the functional requirements for the web-based application. The team was involved with a separate project that conducted a literature review, needs assessment and a baseline measurement of discharge prescription medication discrepancies to develop a structured medication reconciliation strategy [5, 6]. The results of the structured medication reconciliation strategy would provide direction of the requirements needed for an electronic medication reconciliation tool.

Technical Development and Testing

The Medication Reconciliation application known as the Electronic Medication Information Transfer Tool (EMITT) was built in-house by developers in the hospital's IT department. All required database and user interface work was also completed by the same technical team.

The application was thoroughly tested by both the technical team and pharmacists who were involved with the project. The application also underwent additional usability testing by the Human Factors team in the labs located on site at the Centre for Global eHealth Innovation.

Results

Technical Specifications

The EMITT web-based application was built using PHP, Javascript, and AJAX; it resides on an Apache server and has an Oracle database. The application is integrated with the EPR and is pre-populated with patient demographics, allergies and medications. The application is also integrated with the electronic discharge summary. Figure 1 is an example of how EMITT is integrated with the EPR and the discharge summary application.

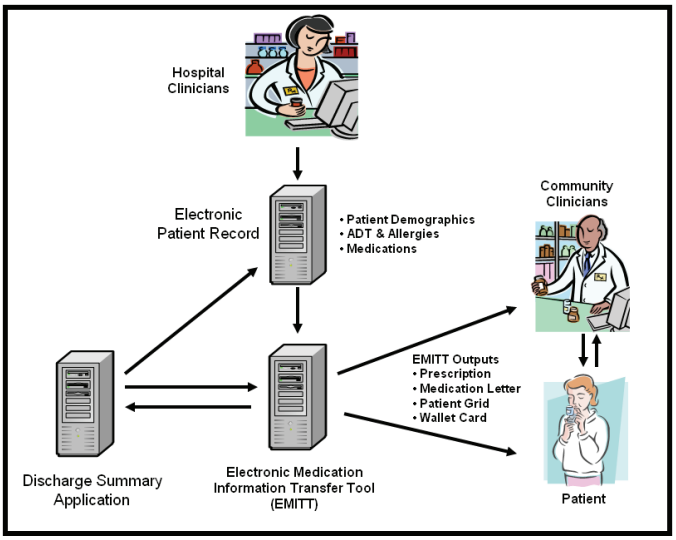

Figure 1: EMITT dataflow diagram

Application Design

The EMITT application was built to facilitate the medication reconciliation process from admission to discharge and to improve prescribing practices. The application is sub-divided into seven pages that guide a user through the Medication Reconciliation process:

Allergies and BPMH – This page allows a clinician to document and print the BPMH for both prescription and non-prescription medications. The clinician is also able to document the sources of information used to obtain the BPMH. Allergies are automatically populated from the patient's chart if available in the EPR. Figure 2 is an example of how the BPMH is documented.

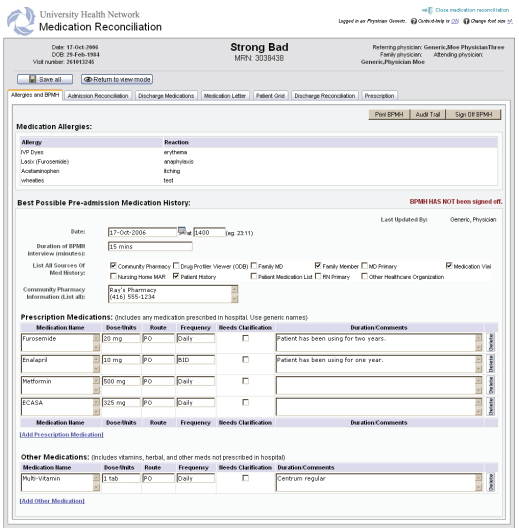

Figure 2 - Screen capture of the allergies and BPMH page

1. Admission Reconciliation – This page allows clinicians to compare the BPMH to admission orders and reconcile the medications. The BPMH medications are automatically pulled across from the previous tab and the medication admission orders are automatically populated from the EPR. On this tab the clinician is required to reconcile admissions orders and code any discrepancies according to the Safer Healthcare Now! recommendations. This tab also allows clinicians to document any issues that require follow-up. Figure 3 is an example of how clinicians would reconcile admission medications.

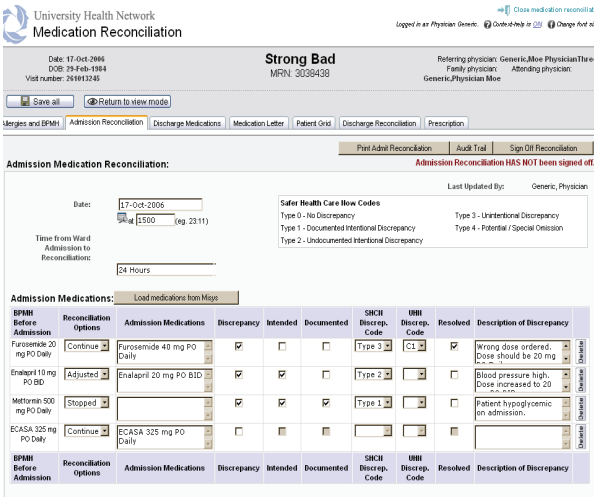

Figure 3 - Screen capture of the admission reconciliation page

2. Discharge Medications – This page allows clinicians to reconcile the BPMH with the current active in-hospital medication list. This process generates the best possible discharge list and an electronic prescription. The discharge medication list is also used to populate the medication letter and patient grid. This page is integrated with the discharge summary application and provides physicians with a recommended discharge medication list if available.
3. Medication Letter - This page is used to generate a medication letter for the patient and/or community clinicians. All of the reconciled medications on the medication letter are automatically populated from the discharge medication page. The medication letter contains a list of the patient's current medication regimen and any adjustments (with rationale) that have been made since the patient was admitted to the hospital. The medication letter also contains a description of any outstanding medication related issues to be followed up in the community.
4. Patient Grid – This page allows clinicians to generate a medication grid that outlines why a patient is taking a medication and when s/he should be taking it. All of the instructions on the patient grid are in lay terms to ensure that patients understand their medication regimen. The patient grid medications are automatically populated from the discharge medication page.

5. Prescription – The electronic prescription is generated from the reconciled medication on the Discharge medication page. This page allows the clinician to view and print out the prescription. The electronic prescription not only contains the medications that are to be dispensed, it also includes a summary of any new, adjusted, discontinued, and medications to be continued. Figure 4 is an example of how a completed ePrescription will appear.

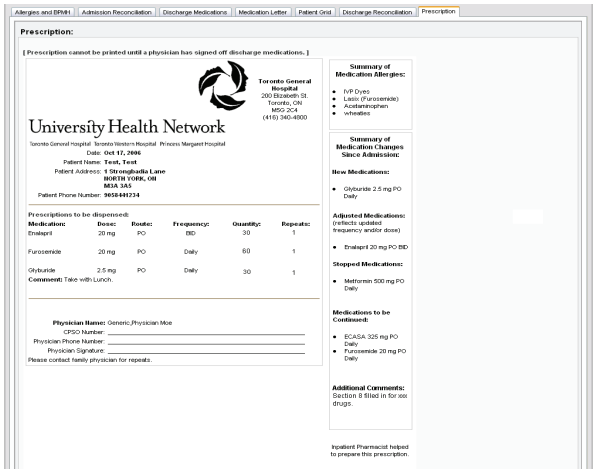

Figure 4 - Screen capture of the prescription page

6. Discharge Reconciliation – This page allows clinicians to reconcile the BPMH, the last day impatient medications and prescription medications. The BPMH and prescription medications are automatically populated from previous pages and the last day meds are populated from the EPR. This page also allows clinicians to document and code medication discrepancies.

Built into EMITT are several security features. Clinicians log into the application via the EPR which prevents an additional login and ensures that only the appropriate users have access to the application. A secondary authentication check is done on the application end to verify security. If a user does not have the appropriate security they are denied access to the application. In addition to the security checks, the application also keeps detailed audit logs of who accesses, edits and signs off on any of the pages within the application for each patient record. To improve the quality and accuracy of data within the application all fields that are currently available within the EPR are automatically populated.

Adoption and usage

The EMITT pilot has been well received and adopted by the General Internal Medicine (GIM) pharmacy team at Toronto General Hospital. Pharmacy is currently completing a study to validate and formally measure the impact of EMITT on medication reconciliation and prescribing practices. From January 2007 to March 2007, 135 patient discharge medication lists were created using EMITT in GIM at Toronto General Hospital.

The project team is currently working on a communication and education strategy to safely introduce EMITT to the other inpatient units at the University Health Network.

Conclusion

The University Health Network has developed a web-based tool that facilitates the medication reconciliation process. EMITT is integrated with the EPR and has been built to meet the medication reconciliation requirements of both the CCHSA and the Safer Healthcare Now! campaign.

EMITT is a single web-based platform that is integrated with the electronic discharge summary. The ability to populate EMITT with data from the EPR improves the accuracy and quality of data collection. EMITT is used to document the BPMH and reconcile medications at admission and upon discharge. EMITT is also used to generate an electronic prescription, medication letter, patient grid and medication wallet card.

Discussion

Healthcare organizations are constantly challenged to improve patient safety and the accuracy of medication orders. Throughout the development of EMITT the technical team worked very closely with a multi-disciplinary team of clinicians to understand the challenges with implementing a new workflow process. The ability to involve clinicians throughout the entire design, development, and implementation process allowed the technical team to develop a product that meets clinical needs and is minimally disruptive to current workflow practices.

One of the biggest strengths of this project is the amount of research and design work that went into the application before development even began. Before beginning discussions of what the application would look and how it would function, research was completed to identify what information clinicians would require to reconcile medications effectively. Additional research of UHN's current medication prescribing practices upon discharge was also completed to identify areas for improvement that could easily be incorporated into the application.

The ability to integrate EMITT with the hospital's current EPR allowed the application to leverage information that is electronically captured. This process alone minimized

the amount of duplicate documentation needed and decreased the amount of time required to reconcile medications.

The EMITT application is built on a web-based platform that could be adopted and implemented at another health-care institution. The application is fully functional even if information, such as medications, cannot be electronically leveraged from a separate data source.

EMITT provides an electronic framework for reconciling medications and guiding prescribing practices.

Acknowledgments

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References

[1] Institute for Healthcare Improvement, Getting Started Kit: Prevent Adverse Drug Events (Medication Reconciliation) Available at http://www.ihi.org.

[2] Canadian Council of Health Services Accreditation. CCHSA Patient/Client Safety Goals and required Organizational Practices (ROPs). Evaluation of Implementation and Evidence of Compliance. April 2006. Available at http://www.cchsa-ccass.ca.

[3] Canadian Council of Health Services Accreditation. *General Public*. Retrieved November 20, 2006 from the Canadian Council of Health Services Accreditation website: http://www.cchsa-ccass.ca.

[4] Safer Healthcare Now! Campaign, How-to Gide: Advrse Drug Events (Medication Recnciliation). Updated November 6, 2005. Available at https://www.saferhealthcarenow.ca.

[5] Wong, Jacqueline et al. [Abstract] Pharmacotherapy 2006; 26(10) p.e 106.

[6] Wong, Jacqueline et al. [Abstract] Pharmacotherapy 2006; 26(10) p.e 76.

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