Integration of an NLP-based Application to Support Medication Management

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**Summary:** Having an accurate and complete medication history at the point of care is crucial to the delivery of high-quality care and prevention of prescribing and medication administration errors. To meet Stage 1 of the Centers for Medicare & Medicaid Services Electronic Health Records (EHR) Incentive Program Meaningful Use requirements, EHRs must be able to provide users with the ability to perform medication reconciliation—the process of comparing a patient’s medication order to all of the medications that the patient has been taking. While much work has been done to facilitate the medication reconciliation process at patient care transitions, most of it has taken place in inpatient settings. Medication reconciliation in the ambulatory setting is challenging because clinicians may be unaware of medications prescribed by other providers. Additionally, the medication reconciliation technology in use today provides support using data from the structured fields in an EHR, while critical medication information may exist in an unstructured format in the EHR’s free-text clinical notes.

This project builds upon a previous AHRQ-funded project, *Improving Outpatient Medication Lists Using Temporal Reasoning and Clinical Texts*, for which the project team developed a natural-language processing (NLP) system called the Medical Text Extraction, Reasoning and Mapping System (MTERMS) to extract and encode medication information from electronic clinical notes in a structured format. This study showed that 31 percent of the active medications mentioned in providers’ notes were missing from the EHR’s structured medication lists of patients. In addition, this study found that providers often needed information beyond the medication list to make clinical judgments, changes, and other decisions. The overall goal of this followup study is to use NLP and other technologies to develop novel ways to facilitate the medication reconciliation process in the ambulatory setting. The team hypothesizes that the approach and the system based on NLP and information retrieval tools will help providers conduct medication reconciliation and therefore improve the accuracy and completeness of medication lists.

**Specific Aims:**

- Identify the requirements, use cases, workflow issues, and barriers to and facilitators of using clinical notes and NLP in the medication reconciliation process. *(Achieved)*
- Design a generic system architecture and an application that integrates an NLP system and a Web-based user interface within an ambulatory EHR system. *(Ongoing)*
- Pilot this study in two primary care clinics and measure the utilization, usability, performance, and feasibility of the proposed methods and the tool in improving the process of medication
reconciliation in the outpatient setting. (Upcoming)

- Distribute methods and the tool so they are widely available to other researchers and health care institutions for non-commercial use. (Upcoming)

**2012 Activities:** Dr. Zhou and her research team conducted two focus groups with health care providers and one focus group with technical staff to identify the requirements, use cases, workflow issues, and barriers to and facilitators of using clinical notes and NLP in the medication reconciliation process. Health care providers who participated in the focus groups were from the two primary care sites where the NLP-based medication reconciliation tool will be implemented. The goal of the focus groups was to establish the current processes that various clinicians, including doctors, pharmacists, nurses, and physician assistants, undertake when conducting medication reconciliation. The providers agreed that the tool will help them identify missing medications found only in clinical notes and will aid them in updating patient medication list.

Through the focus groups, the research team also realized that providers often have to deal with extensive medication lists, which sometimes include discontinued medications that have not been retired. Health care providers would therefore find value in a tool that can help them identify discontinued medications from the medication list. The focus groups have also provided the team with insight into the preferred look of the user interface. Some of the suggestions have included highlighting the signifiers from which the system has made its references regarding a medication discrepancy, and then not only providing the link to the note, but also highlighting the extracted phrases within that note.

The technical focus group was conducted in November. The goal was to establish the requirements necessary for the tool’s implementation and to understand participants’ experience with medication reconciliation technology. A number of key issues, including the consideration of patients with multiple physician visits in one day, were discussed. The active medication lists for such patients will need to be loaded into the NLP program multiple times during the day to account for changes made during each visit. Currently, the NLP program is set up to analyze patient profiles once daily. Another issue dealt with multiple medication mentions within the same note. Manual review revealed that medications listed at the beginning of a provider note were not necessarily the medications with which the patient left at the end of the visit. This issue will be addressed by tagging section headings within each note and medication changes noted in the plan section of the note will be given priority. Additionally, rules deciphering the current status of the medication and whether it is being continued, discontinued, or newly started will also be implemented.

The preliminary Web page design for the medication reconciliation application has also been developed and will include sections for missing and discontinued medications, as well as an informational section referencing all medications mentioned within a patient’s note history. The exact layout of these headings will be decided upon after a few interface variations are tested and voted on by the project team.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are completely on track as is the project’s budget spending.

**Preliminary Impact and Findings:** This project has no findings to date.
**Target Population:** General

**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:** Knowledge Creation