Design and Implementation of a Clinical Rule Editor for Chronic Disease Reminders in an Electronic Medical Record

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Abstract: Clinical reminders have well-documented benefits in improving quality of care. Once clinicians approve evidence-based rules, they should be quickly implemented. However, most of the reminders in our home-grown EMR historically were hard-coded, making it difficult to maintain old rules and implement new ones. We designed a web-based editor to make rule logic readable and editable by non-programmers. We hope to decrease the turnaround time of reminder authoring and maintenance, thereby improving quality of care.

Problem Description: Historically, most of the clinical reminders in our electronic medical record were hard-coded in the Caché environment. Adding new rules or editing existing ones entailed changing computer code by a Caché programmer. The time lag from placing a request, modifying and testing a reminder until it went into production extended over few months depending upon the complexity of the rule. The code changes were also tied to product releases. Thus, recommendations from the reminders were often out of synch with established guidelines. In addition, whenever a clinician expressed a concern about a rule, the developer had to review source code to determine whether it's due to out-of-date rules, data integrity, or programming errors.

Project Goals: To address these issues, the medical informatics team at Partners Information System decided to develop an editor and a corresponding governance structure that will offer greater control over the reminder modification process, decrease the turnaround time for modifying rules, and make the logic transparent to the non-programmers.

Design and Methodology: We discovered at the beginning of the project that the documentation for the clinical reminders has gone out of synch with the computer code. Therefore, we first embarked on a code review exercise to externalize the set of rules that were hard-coded in Caché. We then developed a generalized model for the current set of reminders and developed a rule editor with a graphical user interface to allow users to directly visualize the logic for each reminder, edit existing rules and author new rules. To validate the design of our generalized model, we reviewed the externalized rules with subject matter experts. Old rules that need to be updated were retired and new versions were authored in the rules editor. Similarly, specialists in areas that had poor rules coverage (e.g. pediatrics, chronic renal disease) identified new reminders, which we authored in the new editor.

Parallel to the effort to design and implement a rule editor, we developed a cross-institutional governance model for clinical reminders and created expert panels to review existing reminders and to suggest new reminders based on enterprise goals

Generalized Reminder Model:

If {Patient is in risk group} AND
{Reminder is overdue} AND
{Is not suppressed by a clinician when the reminder previously fired}AND
{Reminder not suppressed by another reminder about to fire} AND
{Clinicians belonging to a practice that has activated the reminder}
THEN {reminder fires}

Findings from Implementation: We prototyped this generalized reminders model using an Access Database to represent a full set of 39 reminder rules. The Access Database became a good resource for defining the logic for new rules, and generating reports for subject matter experts to review existing rules. It also allowed us to identify 10 primitives that were needed to define the logic for rules. We then developed, using the Access Database as a model, a browser-based editor that allowed users to visualize reminder logic in production and author new rules directly by knowledge engineers. The editor is now entering its testing phase and we plan to author 14 new reminders targeting pediatric patients during the first phase of deployment.

Conclusion: Externalization of hard-coded knowledge and establishment of a strong governance model yield immediate benefits to an integrated delivery network. In addition, a browser-based editor could decrease turnaround time for maintaining and modifying rules. These strategies show significant promise to decrease the cost of EMR knowledge maintenance and improve the quality of care.