

Monitoring Intensification of Treatment for Hyperglycemia and Hyperlipidemia

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Organization:	Brigham and Women's Hospital
Mechanism:	RFA: HS07-002: Ambulatory and Safety Quality Program: Enabling Quality Measurement through Health Information Technology (EQM)
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Summary Status as of:	December 2010, Conclusion of Grant

Target Population: Adults, Chronic Care*, Diabetes

Summary: Diabetes quality-of-care measurement is increasingly used to evaluate quality improvement programs and to compare physicians and health plans. Therefore, it is important to know which measures are best associated with clinical outcomes. The most widely used process measures for diabetes quality-of-care, hemoglobin (HbA1c), and low-density lipoprotein (LDL) screening rates have multiple limitations. This project tested the sensitivity and specificity of new informatics tools on improving diabetes quality-of-care measurement.

Poor control of elevated blood pressure and glycosylated HbA1c have been linked to low frequency of treatment intensification. Treatment intensification is defined as an increase in the total daily dose of any anti-hyperglycemic medication and includes either the initiation of a new medication or an increase in the dose of an existing medication. Dr. Turchin and his team developed a physician performance process measure using both structured and unstructured data on the frequency of treatment intensification in managing hyperglycemia and hyperlipidemia. Two informatics tools were developed to determine, based on data from the patient's electronic health record (EHR), if treatment medication was increased. The first tool extracts structured data from the EHR. The second is a natural language processing tool that assesses whether accurate measures of treatment intensification can be obtained through computational analysis of unstructured text in physician notes.

This project applied the informatics tools to retrospective data generated from an internally-developed EHR, the Longitudinal Medical Record, which was collected in Partners Healthcare System's proprietary Research Patient Data Registry. The data collected were based on patient visits to primary care practices affiliated with Massachusetts General Hospital and Brigham and Women's Hospital. By testing the sensitivity and specificity of the measures in a manual review of the electronic patient records, the project determined if the treatment measures obtained through the informatics tools were clinically valid. This research was done by two independent reviewers who did not participate in the tool development. The project used a variety of statistical analyses to demonstrate a relationship between HbA1c and LDL cholesterol levels and two measures of treatment intensification: frequency of treatment intensification, and time to treatment intensification.

Specific Aims:

- Test the hypothesis that an accurate measure of treatment intensification in the management of hyperglycemia and hyperlipidemia can be obtained through computational analysis of the text of physician notes in the EHR. **(Achieved)**
- Test the hypothesis that the measure of treatment intensification developed in the first aim is related to glucose and lipid control. **(Achieved)**
- Identify specific patient and visit characteristics that affect the probability of anti-hyperglycemic and anti-hyperlipidemic treatment intensification at a given visit. **(Achieved)**
- Test the hypothesis that case mix-adjusted measure of intensification for treating hyperglycemia and hyperlipidemia is more strongly associated with clinical outcomes than currently used process measures of diabetes care. **(Achieved)**

2010 Activities: Activities focused upon ongoing data analysis and preparation of manuscripts of reported outcomes.

Grantee's Most Recent Self-Reported Quarterly Status (as of December 2010): The project is complete with all major milestones achieved.

Impact and Findings: The team designed high-fidelity natural language processing tools for identification of treatment intensification in narrative text. Analysis established that narrative and structured data sources provide complementary information about treatment intensification. Data confirm that treatment intensification is strongly associated with faster achievement of both HgA1c and LDL control. High HgA1c and LDL levels were associated with higher probability of treatment intensification while government insurance and female gender were associated with lower rates of intensification. Higher treatment intensification rate and higher HgA1c/LDL testing frequency were associated with higher probability of HgA1c control. The software achieved high accuracy of extraction of medication intensification information from narrative text. The team found that narrative and structured records represented complementary data sources, approximately one third of all intensification records were shared between the two sources, while the rest were unique to either one of them.

In univariate analysis, median time to HgA1c normalization gradually decreased from 1,708 days for patients whose anti-hyperglycemic treatment was intensified less than once every 12 months to 147 days for patients whose anti-hypertensive treatment was intensified more than once every 3 months ($p < 0.0001$). Similarly, median time to LDL cholesterol normalization decreased from 1,408 days for patients whose anti-hyperlipidemic treatment was intensified less than once a year to 89 days for patients whose anti-hyperlipidemic treatment was intensified more than once every 3 months ($p < 0.0001$). In a multivariable analysis that adjusted for patient age, gender, race, health insurance, median income by zip code, treatment with insulin, initial HgA1c, and frequency of encounters with the primary care physician, an increase in one anti-hyperglycemic treatment intensification per month was associated with a hazard ratio of 44.9 (95 percent confidence interval [CI] 36.3 to 55.6; $p < 0.0001$) for reaching HgA1c target. Similarly, multivariable analysis adjusted for patient age, gender, race, health insurance, median income by zip code, initial LDL cholesterol level, and frequency of encounters with the primary care physician showed that an increase in one anti-hypercholesterolemic treatment intensification per month was associated with a hazard ratio of 50.2 (95 percent CI 23.1 to 109.4; $p < 0.0001$) for reaching LDL target.

In multivariable analysis of the factors associated with anti-hyperglycemic treatment intensification for patients with HgA1c \geq 7.0 percent, the study found that treatment with insulin and higher HgA1c levels were strongly associated with increased probability of intensification while government insurance and female gender were associated with lower probability of intensification. Race and median income by zip code were not significantly associated with anti-hyperglycemic treatment intensification. In multivariable analysis of the factors associated with anti-hyperlipidemic treatment intensification for patients with LDL cholesterol greater than or equal to 100 mg/dL, higher LDL, non-white race, older age, and higher income were strongly associated with increased probability of intensification while having a government insurance, speaking English as the primary language, and female gender were associated with lower probability of intensification.

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decision making through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* *AHRQ Priority Population*