Title: Improving Quality With Outpatient Decision Support

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Abstract

Increasingly, evidence-based guidelines are available to assist physicians in making decisions about diagnosis and management. However, despite growth in our evidence base, the gap between evidence and practice remains wide, for a multitude of reasons. These include system barriers such as inadequate resources, physician barriers such as lack of knowledge or lack of time, and patient barriers such as misunderstandings or noncompliance.

We seek to better understand reasons for these gaps between evidence and practice and to try to overcome these barriers through the use of computer-based decision support. We will focus on the ambulatory setting, where the pace is such that speed of access to decision support is especially critical. Our interventions will occur at the time of the patient visit in the workflow of the physician's practice. We will develop paper-based and electronic guidelines, reminders, and alerts for health maintenance, disease management, medication management, and ancillary test ordering. We then will focus on evaluating the impact of these alerts, reminders, and guidelines on physician compliance with evidence-based recommendations. In addition, we will evaluate the impact of electronic result tracking and follow-up systems on physician compliance with guidelines. Finally, patient, physician, and system barriers to compliance will be assessed in a diverse array of clinical settings. Because our integrated delivery system has a highly developed computer information system and outpatient electronic medical record, we are in an excellent position to implement computer-based interventions in the ambulatory setting. The results of the study will be important because they will accelerate the acceptance and implementation of such computer decision support systems in other settings.

Executive Summary

We reviewed medical records of hypertensive patients with 15,768 visits to 12 general internal medicine clinics during 7/1/01-6/30/02 to determine whether the visits were adherent to blood pressure management guidelines outlined in the Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC) by identifying medications selected for hypertension therapy. We compared JNC adherence, blood pressure control, and intensification of therapy by patient characteristics. JNC adherence was more frequent among Black patients (83.7%) and Latino patients (83%) than among White patients (78.4) (P<0.001).

Blood pressure was controlled most often among White patients (38.7% versus 34.8% for Black patients and 33.3% for Latino patients, P<0.001) and the privately insured (38.7% versus 34% non-privately insured, P=0.001). However, JNC adherence was not associated with blood pressure control. Black patients (81.5%) and White patients (80.9%) were more likely than Latino patients (70.8%) to have therapy intensified (P=0.02).

After adjustment for baseline blood pressure, intensifying therapy was associated with higher odds of subsequent blood pressure control (odds ratio [OR] 1.55; P<0.001) than not intensifying therapy. There were no significant interactions between race/ethnicity and intensification in predicting control, suggesting that the association between intensification of therapy and blood pressure did not differ by race/ethnicity. Latino patients with hypertension were less likely to have their antihypertensive therapy increased than other racial/ethnic groups were. Therapy intensification is associated with subsequent blood pressure control in all racial/ethnic groups. Interventions to reduce disparities in cardiovascular outcomes should consider the need to intensify drug therapy more aggressively among high-risk populations.

Final Report

What was accomplished during this reporting period? How did these accomplishments help reach the goals of the project?

We have completed the data collection of all the preintervention data and are analyzing the first year of data (7/1//01-6/31/02), which we will use to address specific aims 1,2, and 3 and to perform some additional analyses.

We have collected data from 13,818 hypertension (HTN)-related visits to affiliated clinics during that 1-year span. Preliminary analyses of data from 7/01-12/01 (6,484 visits) demonstrate that providers in our system adhere to prescribing the JNC-recommended class of medications for the appropriate types of patients about 80% of the time (much higher than the 40-45% demonstrated in other settings).

Surprisingly, preliminary analyses also show that visits in which the patient was non-Hispanic Black or Hispanic were more likely to be JNC adherent than were those in which the patient was classified as non-Hispanic White or other (82.6% each for Black patients and Hispanic patients vs. 77.9% for White patients and 72.6% for other; P=0.005). Visits were also more likely to be JNC adherent when the patient was a woman versus a man, although this difference was only of borderline significance (78.3% for men vs. 81.6% for women; P=0.06). We are repeating these unadjusted analyses on the complete year of data and will determine if these demographic differences persist after adjustment for demographic and clinical characteristics.

In our preliminary analyses, we found that blood pressure (BP) control was obtained in only 34.8% of visits (on par with studies in other settings); we also found that no racial differences in BP control were observed and that JNC drug adherence was not associated with BP control. However, in adjusted analyses (controlling for demographic and clinical characteristics), men were more likely than women to obtain BP control (OR 1.34 [1.10-1.62]), and those with a history of coronary artery disease (CAD) were more likely than non-CAD patients to have obtained BP control (OR 1.40 [1.05-1.86]).
Patients with diabetes were much less likely than patients without diabetes to have their BP controlled to a level of <130/85 mmHg (OR 0.43 [0.36-0.53]).

What, if any, proposed activities were not completed? Briefly describe those activities, the reasons they were not completed, and your plans for carrying them out.

The intervention phase of the project that was to begin in February 2003 was delayed and instead began in June 2003. The project consists of two interventions: computerized reminders sent to physicians caring for patients with hypertension and case management by a nurse practitioner for a randomized subgroup of patients with hypertension.

The 4-month delay was due to the longer-than-expected process of finalizing the computerized algorithm to generate the computerize reminders that are being sent to providers. It took several additional weeks for us to generate pilot reminders, study them, and readjust the algorithm before we could generate the final reminders that should be appropriate to study. We wanted to begin both interventions during the same time period; as a result, we delayed the start of case management until the reminders were finalized.

TRIP II Final Summary, March 2004

We have completed the implementation of paper-based reminders in four areas: health maintenance, disease-specific therapies, cost-effective substitutions, and diabetes management. The paper reminders significantly improved compliance with recommended actions, particularly for diabetes and health maintenance reminders.

We have also implemented 17 electronic reminders in a randomized set of 16 clinics for 6 months. We are now in the process of performing data analysis to understand the impact of the electronic reminders on guideline compliance. We also have developed and implemented the LMR Results Manager application in eight primary care clinics, and a randomized controlled trial of its impact is completed.

The application includes flagging of abnormal results, the tracking and follow-up functions, and enhanced writing capabilities for patient letters.

We currently are analyzing the data and publishing the results. We also evaluated primary care physician (PCP) and Internal Medicine house staff attitudes regarding clinical practice guidelines, the longitudinal medical record (LMR), and potential clinical decision support applications prior to the interventions and during the interventions. This work was published in the *Journal of Biomedical Informatics* in 2003. During the intervention phase, 174 participants were eligible, and our response rate was 64% (120/174). We found that the most common barriers to guideline adherence reported by PCPs included lack of time during patient visits (51%), patient noncompliance (42%), lack of guideline knowledge (35%), and forgetting to apply the guideline during visit (26%). The reminders appeared to be well received, with 30% of physicians reporting that they act upon the reminder during an office visit and 76% reporting that the reminders help improve overall healthcare quality. The significance of the research is three-fold. First, we expect to show that provider compliance with guidelines will be improved through the use of a broad range of computer-based alerts, reminders, and guidelines. Second, we will assess how information technologies can improve the complex process of test result tracking and follow-up in a wide range of clinical settings. Third, we have described barriers to implementation of clinical practice guidelines and strategies to overcome them in order to facilitate widespread acceptance.

TRIP II Progress Report, November 2003

a.   Specific Aims

There are three specific aims in this grant project, as listed below:
1. To evaluate the effectiveness of paper-based and interactive computer-based alerts and reminders for improving compliance with guidelines and reducing costs in the ambulatory setting
2. To evaluate the impact of automated tracking and follow-up systems on guideline compliance
3. To identify and address patient, clinician, and system barriers to the effective use of computer-based decision support

b. Studies and Results

Aim 1: We have currently completed the implementation of paper-based reminders in four areas: health maintenance, disease-specific therapies, cost-effective substitutions, and diabetes management. Table 1 has a summary of the paper-based reminders that were implemented. Preliminary results are shown in Table 1. The paper reminders significantly improved compliance with recommended actions, particularly for diabetes and health maintenance reminders. This paper will be submitted by Dec 2003.

Table 1. Percent of time that actions were taken for therapeutic reminders and diabetes reminders

Reminder	Intervention	Control	P Value
HbA1c overdue	59.7	45.9	<0.0001
Cholesterol overdue	38.6	19.7	<0.0001
Ophtho overdue	17.1	9.8	0.04
Change in compliance for health maintenance reminders			
Reminder	Pre-Intervention	Post-Intervention	P Value
Pap smear	79.3	87.5	<0.001
Mammogram	58.9	64.9	<0.001
Cholesterol	78.1	87.2	<0.001
Pneumovax	53.7	68.8	<0.001

Since then, we have implemented 17 electronic reminders in a randomized set of 16 clinics for the 6 months. The study period ended in May 2003, and we are now in the process of performing data analysis to understand the impact of the electronic reminders on guideline compliance. We will study the difference between intervention and control groups in the time to completion of recommended care for each disease. For patients with diabetes, this will include an analysis of time to completion of overdue HbA1c testing, dilated eye examination, and initiation of ACE inhibitor therapy in those with concurrent hypertension. For patients with coronary artery disease, we will analyze time to initiation of aspirin therapy and beta-blocker therapy. We also will analyze time to completion of overdue cholesterol testing in both low-risk patients and high-risk groups (such as those with diabetes or coronary artery disease). Finally, among these high-risk groups with elevated cholesterol, we will analyze the time to initiation of appropriate cholesterol-lowering medication therapy. We expect to submit a paper regarding the results of this work in the next 4 months.

Aim 2: We have developed and implemented the LMR Results Manager application in eight primary care clinics, and a randomized controlled trial of its impact is currently underway. The application includes flagging of abnormal results, the tracking and follow-up functions, and enhanced patient letter-writing capabilities. Decision support guides physicians in the management of abnormal cholesterol, HbA1c, Pap smear, and mammogram results. The design of the application has been described in a paper that we published in the *Journal of Biomedical Informatics* in 2003.

The application is being widely used in the eight deployed clinics, which bodes well for the effect it will have on clinical outcomes (Figure 1). The RCT is expected to be completed in by January 2004; then, we will analyze the data and publish the results.

Specific outcomes to be studied include:

- % of patients with timely follow-up (comparison of intervention and control clinics)
- Abnormal cholesterol
- Abnormal HbA1c
- Abnormal mammograms
- Abnormal Pap smear
- Patient satisfaction regarding test result communication
- Physician satisfaction regarding result follow-up system

Baseline data on patient satisfaction regarding test result communication has been collected and currently is being analyzed. We also have recently started collecting the follow-up data for patient satisfaction.

Baseline data on physician satisfaction regarding results management has been collected and analyzed. Highlights of results (baseline on 168 responses) include that 59% of physicians expressed dissatisfaction with the way they managed test results at baseline, and 83% of physicians reported at least one delayed result review in a 2-month period. Physicians who reported fewer delays in result reviews were more likely to be satisfied, as were those who tracked test orders to completion. These results were presented at the SGIM conference in May 2003. The manuscript is being prepared for submission to the *Archives of Internal Medicine*.

Figure 1. Monthly Usage of Results Manager Application to Generate Patient Result Letters. The application was rolled out to eight clinics starting in March 2003, after a successful 3-month pilot in two clinics.
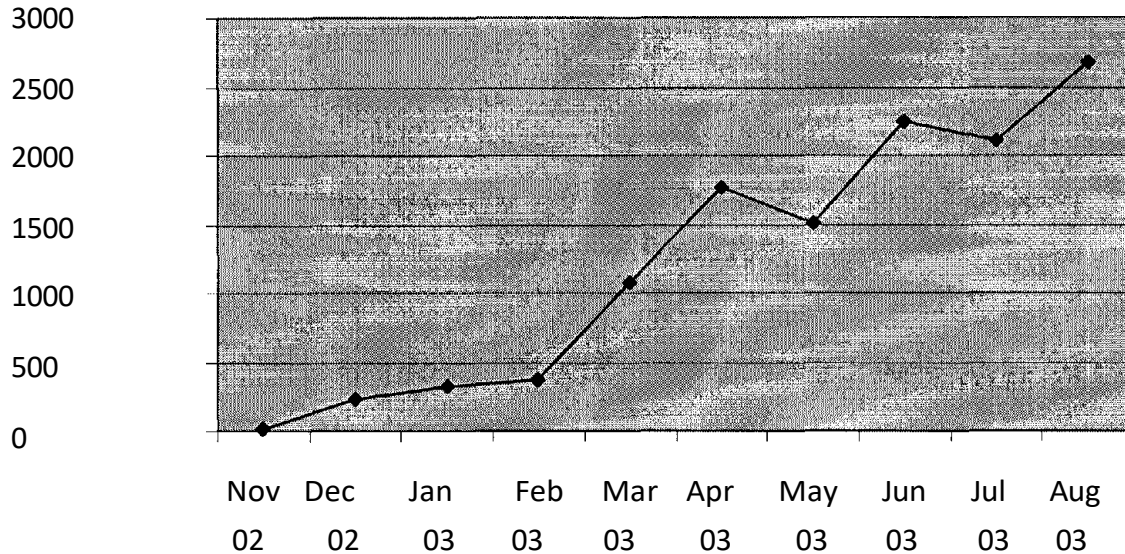
Aim 3: We evaluated primary care physician (PCP) and Internal Medicine house staff attitudes regarding clinical practice guidelines, the longitudinal medical record (LMR), and potential clinical decision support applications prior to the interventions and during the interventions. Prior to the intervention, we surveyed 216 eligible physicians and achieved a response rate of 65% (140/216). Less than 1/3 were satisfied with their current method of managing results, and only 15% were satisfied with their system of notifying patients of abnormal results. Over 90% of respondents felt that an automated system to track abnormal test results would be useful. Approximately 80% of physicians reported that they would be able to comply with guidelines more often if they received electronic clinical reminders. This work was published in the *Journal of Biomedical Informatics* in 2003.

During the intervention phase, 174 participants were eligible, and our response rate was 64% (120/174). We found that the most common barriers to guideline adherence reported by PCPs included lack of time during patient visits (51%), patient non compliance (42%), lack of guideline knowledge (35%), and forgetting to apply the guideline during visit (26%). PCPs felt that electronic clinical reminders were more useful for routine health maintenance items (58%) than for diabetes (40%) or coronary artery disease (45%).

In addition, 75% of PCPs preferred receiving reminders in an electronic format over a paper format. Reminders appeared to be well received, with 30% of physicians reporting that they act upon the reminder during an office visit and 76% reporting that the reminders help improve overall healthcare quality. This work will be presented at the American Medical Informatics National Meeting in Washington, DC, in November 2003.

Significance

The significance of the research is three-fold. First, we expect to show that provider compliance with guidelines will be improved through the use of a broad range of computer-based alerts, reminders, and guidelines. We have already shown that paper reminders do have a significant impact. Importantly, we are integrating these reminder techniques into the clinical workflow to stimulate interest in the continued implementation of these computer systems. Second, we will assess how information technologies can improve the complex process of test result tracking and follow-up in a wide range of clinical settings. Third, we have described barriers to implementation of clinical practice guidelines and strategies to overcome them in order to facilitate widespread acceptance. Based on our survey results, we see that providers believe that decision support systems can help improve the quality of the care they deliver and improve their current methods for managing patients.

Publications

Abstracts:

Sequist TD, Gandhi TK, Poon EP, Murff HJ, Karson AS, Fairchild DG, Kuperman GJ, Bates DW. *Clinician Attitudes Towards Health Maintenance and Disease Specific Practice Guidelines and Electronic Clinical Reminders.* 2003 American Medical Informatics Association Annual Conference.

Poon, EG, Gandhi TK, Sequist TD, Karson A, Murff H, Weber A, Bates DW. *'I Wish I Had Seen This Result Earlier': Problems in the Test Result Management Systems in Primary Care Physicians' Offices.* Proc of Society of General Internal Medicine Annual Meeting, May 2003.

Manuscripts:

Poon EG, Wang SJ, Gandhi TK, Bates DW, Kuperman GJ. *Design and Implementation of a Comprehensive Outpatient Results Manager.* J Biomedical Informatics 2003; 36:80-91.

Murff HJ, Gandhi TK, Karson AS, Mort EA, Poon EG, Wang SJ, Fairchild DG, Bates DW, *Primary care physician satisfaction with tracking abnormal results and attitudes concerning decision support systems.* Int J Med Info 2003;71(2):137-149.

Project-generated Resources

None thus far.

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