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# Enhancing Outpatient Preventive Screening using Computerized Provider Order Entry (CPOE) and Automated Alerts

Scientific Abstract:

Computerized provider order entry (CPOE) has been used as a clinical decision support tool in both outpatient and inpatient medicine but rarely has it been used for preventive health screening. CPOE enabled with patient-specific data, delivered at point of care at the time of provider order entry will increase rates of preventive health screening in an outpatient setting in an urban teaching hospital. Compared to a group of physicians using the same clinical documentation and ordering system without the CPOE intervention described here, the CPOE-enabled physicians may have rates ten percent higher in ordering routine yearly screening tests such as the lipid profile, fasting blood glucose in non-diabetics, and hemoglobin A1c and urine microalbumin in diabetics. As up-to-date and frequent screening is associated with improved outcomes, this system will impact outpatient care as a whole.

Lay Abstract:

This research is designed to study a computer system to remind physicians to order certain screening blood tests every year. The physician will see information about particular patients when that physician is putting in orders in clinic. This information will be accompanied by reminders to order specific tests that are used to screen for problems such as high cholesterol or high blood sugar in patients without diabetes. It will also remind physicians of patients with diabetes about blood and urine tests that help physicians manage blood sugars in their patients. By ordering more frequent screening tests, this study is intended to show that this system may have an impact on the health of clinic patients by preventing worse health problems by finding signs of them early.

Study description:

1. Study Purpose and Rationale.

Primary care physicians offer their patients a panoply of outpatient screening options such as cancer screening (mammography, colonoscopy), diabetic screening (fasting blood glucose, hemoglobin A1c in diabetics), cholesterol screening (lipid profiles). Every provider uses a combination of experience, rigorous practice, clinical documentation whether hand-written or computerized, to ensure every patient remains current regarding these basic screens. However, lengthy problem lists, brief patient encounters, complexity of billing and documentation, and more can contribute to patients falling behind in routine screening. In population of diabetics in North Carolina, for example, up to 31% of patients had no lipid profiles ordered in a two year period (1). Prompt and regularly repeated screening should be sine qua non for the outpatient physician.

Computerized provider order entry (CPOE) is the process by which clinicians enter patient orders into systems that transmit those orders directly to the relevant receiving department (e.g. medication orders being entered by physicians transmitting directly to the pharmacy (2). These systems may have a component of clinical decision support (CDS) such as automated alerts built-in. Automated alerts in CPOE have been shown to reduce medication errors up to 66% compared to hand-written orders (3-6). CPOE has also been utilized to achieve better glycemic control inpatient and to implement “best of care” order sets in clinical scenarios such as myocardial infarction (7, 8). A meta-analysis of trials of CPOE reminder systems demonstrates increased adherence to processes of care under study (median improvement 5.6% with the largest effect of 17% seen in a “home-grown” clinical information system); these effects were notably larger when physician input was required (9).

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Manual clinician reminder systems have shown dramatic effect in improving screening rates; in a public health clinic in the mid 1990s, manual clinician reminders to order mammograms improved the rates of patients undergoing mammography to 72% from 47% in one year (10). Automating reminders to both providers and patients in cancer screening has been described with respect to colonoscopy, mammography, and Papanicolau smears with varying effect (11-13). There is little evidence that automated reminders and CPOE have been studied for routine non-cancer screening in the outpatient setting.

The Columbia University Medical Center uses the Eclipsys Electronic Health Records System in both inpatient and outpatient environments. This system utilizes automated "pop-up" alerts for drug-allergy interactions, critical lab values, and nutrition orders. It allows customization of alerts to include institution-specific alert content. In the Associates in Internal Medicine (AIM) Practice, resident physicians develop a continuity panel of patients from the community and are responsible for primary care for those patients.

This study will observe the introduction of an automated "Screening Panel" into the AIM clinic clinician workflow by measuring rates of physician ordering of relevant yearly screening before and after the alert system has been implemented. AIM physicians document every primary care visit in a structured AIM-specific template note format. There is a brief "Screening" section of this note that permits providers to enter screening data into blank text boxes if known. This Screening section is manual-entry and non-interactive beyond acting as a location for providers to type in relevant information.

The intervention in this study will change the Health Maintenance section for roughly one half of participating physicians. The intervention group will see a Health Maintenance button in place of the blank text fields. This button when selected will prompt physicians with a pop-up table that will include screening labs (lipid profile, fasting blood glucose), date of last labs available in the Columbia Clinical Information System, and the result of the last screening. Based on ICD9 coding entered for the patient at-hand, screening specific to diabetics will also appear in this table including hemoglobin A1c and urine microalbumin with the format described. Underneath the table will be an Order button that takes the user to the Eclipsys order field to facilitate providers entering screening lab orders during that patient encounter if the provider notes the patient is due for repeat screening labs. The control group in this study will continue to see blank text boxes in the Health Maintenance section of their structured notes.

This intervention should increase provider screening rates regardless of post-graduate year for resident physicians in the Columbia AIM clinic.

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2. Study Design and Statistical Procedures.

This study is a prospective randomized controlled trial, 2 years in length (1 year pre-intervention, 1 year post-intervention), in which the intervention and control groups are subsets of house-staff practicing in the AIM clinic of Columbia University Medical Center. The intervention group will receive access to the CPOE intervention which provides an additional alert describing status of screening tests for each patient as well as a stream-lined order window facilitating physician ordering of the screening tests in question. The intervention will be presented as a new button in place of manual text fields in the Health Maintenance section of the AMB AIM Structured Note template in Eclipsys. An alert window will be presented with the following tables:

| Test Name | Date of last test | Value of last test | Repeat indicated? |
|---|---|---|---|
| Lipid Profile | 9/23/2009 | TC 200 TG 150 | (a blank box) |

| | | | |
|---|---|---|---|
| | | LDL 110 HDL 60 | |
| Fasting blood glucose | 10/12/2008 | 84 | **!!** (an Eclipsys alert flag) |

Figure 1: Alert window for non-diabetics

| Test Name | Date of last test | Value of last test | Repeat indicated? |
|---|---|---|---|
| Lipid Profile | 9/23/2009 | TC 200 TG 150<br>LDL 110 HDL 60 | (a blank box) |
| Hemoglobin A1c | 9/23/2009 | 6.4 | |
| Urine microalbumin | No value recorded | N/A | **!!** |

Figure 2: Alert window for diabetics

ICD9 coding (required for all patient visits) will be used to generate two alert windows depending on whether the patient's health issues including an ICD9 code for any form of diabetes.

The control group will not receive this additional alert or ordering window; the control group physicians will continue to use the remaining features of Eclipsys without change. The two groups of physicians will be allotted into intervention or control groups to ensure similar numbers of specific post-graduate year (PGY) physicians in each group.

The primary outcome will be rates of physician ordering of each screening test (analyzed as separate outcomes). A panel of screening tests will be implemented: lipid profiles; fasting blood glucose (for non-diabetics only); hemoglobinA1c (for diabetics); urine microalbumin (for diabetics). These results will be analyzed by post graduate year by diabetic status of patients.

Secondary outcomes include rates of patients receiving the ordered test, time to receive the test, and physician alert behavior (rates of acknowledging or ignoring alerts, rates of MDs actually using screening alert intervention).

The unit of analysis is the physician. For statistical analysis, lipid profile screening rates will be considered here for illustrative purposes. The study is powered to detect a twenty percent difference in screening rates between the two groups (estimated 70% in the control group to 90% in the intervention group). At 80% power, 70 subjects (physicians) will be required in each arm. Screening rates will be compared using the chi-squared test; $p<0.05$ will be considered statistically significant.

3. Study Procedures
Physicians will be invited to participate via email and given informed consent for their participation. House-staff who consent to participate will be randomized to the intervention or control arms ensuring similar numbers of PGY1s, PGY2s and PGY3s are in each group. Eclipsys ordering habits among participating physicians will be analyzed for one year prior to the intervention. The groups will be followed for one year and screening rates analyzed at the end of that time period.

4. Study Drugs or Devices
None

5. Study Questionnaires
None

6. Study Subjects.

NY Presbyterian House-staff in the Columbia Department of Medicine, participants in the AIM Clinic

7. Recruitment

Residents will be recruited through email invitations and announcements at resident noon conference.

8. Confidentiality of Study Data

Physician participants will be de-identified after enrollment and allotment into intervention or control arms. Patient data will be analyzed by medical record number only to connect patients to their outpatient physicians.

9. Potential Risks

This study poses minimal risk to study participants and their patients other than risks inherent in using an electronic order entry system (errors in ordering, technical malfunctions preventing orders from being processed appropriately).

10. Potential Benefits

An important potential benefit is increased rates of preventive screening in patients who may not have been ordered to receive the testing otherwise. This screening may lead to changes in management of dyslipidemia or abnormal glycemia.

11. Alternatives

None