

The Effectiveness of a Secure Email Reminder System for Colorectal Cancer Screening

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ABSTRACT. *This study looks at the effectiveness of using a secure email system linked to an electronic health record to send reminders to patients in an effort to increase colorectal cancer (CRC) screening rates; 1397 subjects were randomized to receive usual care, a letter reminder or an email reminder which invited patients to pick up a fecal occult blood test at the lab for CRC screening. The number of completed CRC screenings was tallied after a 3 month study period. Rates of CRC screening in the 3 groups were 7.8% in the usual care group, 23.6% in the letter reminder group and 22.7% in the email group. Significant statistical difference was seen between usual care group and letter reminders ($p < 0.0005$) and between usual care and email reminders ($p < 0.0005$) but not between the letter reminders and the email reminders ($p = 7.11$). Email reminders are as effective as letter reminders in increasing CRC screening rates.*

INTRODUCTION. Colorectal cancer (CRC) is the second most common cancer in women and the third most common cancer in men in the Western world¹. In the United States CRC is the third most common cancer in both men and women with a predicted 146,970 new cases diagnosed in 2009². It is also the second leading cause of cancer death for both men and women in the United States with a predicted 49,920 deaths for 2009².

Most CRCs develop from polyps arising on the mucosal wall of the colon. As these adenomatous polyps grow in size, they may develop dysplastic cells which eventually invade the bowel wall and then metastasize. Survival depends on when in this natural course the cancer is diagnosed, so it is important to diagnose CRC in the earliest stages of the disease. Unfortunately, presenting symptoms for CRC are vague and often occur late in the disease¹. It is clear that screening methods are needed to detect and diagnose CRCs at an earlier stage to increase the survival rate.

Several groups have produced guidelines for screening people of average risk for CRC^{3,4}. All of the guidelines agree that screening should begin by age 50 and recommend one of the following methods of screening:

- 1) yearly fecal occult blood testing (FOBT),
- 2) sigmoidoscopy every 5 years,
- 3) annual FOBT plus sigmoidoscopy every 5 years,
- 4) or colonoscopy every 10 years.

FOBT is the most widely used and also the most widely studied of the different screening methods. Several prospective randomized controlled trials have shown that periodic screening with FOBT can reduce CRC mortality by 15-33%^{5,7}. Sensitivity of a single sample is an estimated 40% for guaiac cards and improves to > 90% with multiple samples repeated semiannually. The specificity is calculated to be 96-98%⁴.

Despite the availability of screening guidelines and the compelling evidence of their effectiveness, only 60.8% of the 195,318 participants of the 2006 Behavioral Risk Factor Surveillance System survey reported having had an FOBT within 1 year preceding the survey or a lower endoscopy within 10 years preceding the survey⁸ and 29.5% reported never having been screened. In addition, of those medical groups reporting to the National Committee on Quality Assurance, the average colorectal screening rate is only 53.3% for Medicare patients and 54.5% for commercial patients⁹.

This study looks at the effectiveness of using a secure email system linked to an electronic health record to send reminders to patients in an effort to increase CRC screening rates.

BACKGROUND. Efforts by providers and healthcare organizations to try to increase participation in preventive medicine efforts can be categorized into seven intervention components¹⁰: 1) reminders to patients or clinicians, 2) feedback to clinicians or to health plans, 3) education of the patient or the clinician on the health prevention guidelines, 4) incentives in the form of bonuses for the clinicians (i.e. pay for performance) or discounts for the patients, 5) regulatory and legislative actions, 6) mass media campaigns, and 7) organizational change. A meta-analysis to show the relative effectiveness of these different interventions reviewed 81 studies and concluded that reorganizing the delivery of preventive services with such things as planned preventive services and designated non-

physician staff was the most effective strategy¹⁰. Reminders were the next most effective.

Reminders can take the form of either inreach or outreach services. Inreach involves addressing the need for a CRC screening at every visit, even when the patient is there for another problem, and can be performed in either the outpatient or inpatient setting. Alerts and reminders, as prompts for inreach, have been shown to be effective in improving vaccination rates, breast cancer screening, cardiovascular risk reduction and CRC screening in the outpatient setting¹¹. In addition, indirect evidence that inreach is effective is the knowledge that frequency of office visits is one of the main factors correlating with whether or not a patient has had a CRC screening¹². Finally, 74-94% of patients in one study who had not received CRC screening stated that a doctor's recommendation would have motivated them to undergo screening¹³. The reasons for physicians to not use inreach services are several and include the lack of a reminder system to identify those patients in need of CRC screening as a major factor¹⁴. Other barriers include lack of time, too many other issues to address at the visit, and patient distrust¹⁵. In addition, this effective method must rely on the patient to get an appointment before the subject of screening can be discussed, which suggests that this reminder method alone would be inadequate to cover all patients needing screening.

A more proactive approach is by outreach. Outreach involves reminding patients of their personal screening recommendations independent of office visit utilization. Studies on outreach methods for CRC screening have found response rates as high as 15-23%. Methods vary, including phone calls or letters, and the letter reminders may include additional educational material or FOBT cards¹⁶⁻¹⁸. The cost effectiveness of some outreach programs have been examined with cost per additional patient screened varying from \$94 to \$319^{16,19}. Little is known about the frequency of use of CRC screening outreach programs, however. Factors that are known to affect the use of reminders for other preventive services include whether or not the group was required to report quality results, the group's public recognition of quality and its information technology capabilities²⁰.

The growing use and acceptance of email in patient-provider communication, the development of guidelines for the use of email in healthcare^{21,22} and satisfaction of providers with this mode of communication²²⁻²⁴ suggest a role for email communication in outreach programs but little research has been performed on this method. One available study found no difference in email and letter reminders in promoting screening

mammograms²⁵. As part of a larger study aimed at promoting screening mammograms, a subgroup of subjects was selected to receive email reminders. This subgroup consisted of employees of a large healthcare facility for whom email addresses were available. Letter reminders were sent to 488 subjects while the remaining 399 subjects received email reminders. The percentage of subjects current in their mammogram screenings were 68.1% for those receiving letter reminders and 72.2% for those receiving email reminders with no statistical difference between the groups.

The purpose of this work was to explore feasibility and results from use of email to deliver CRC screening reminders. This study compared email reminders to both usual care and to letter reminders in their effectiveness to increase screening rates using FOBT in patients past due for CRC screening. Approval was sought and granted for this study from the Institutional Review Boards of the participating institutions.

METHODS. This study was conducted in a nonprofit Health Maintenance Organization (HMO) in the northwest United States with approximately 479,000 members. The HMO has an electronic health record (EHR) which contains patient demographics, medical histories, outpatient encounter diagnoses, procedures and progress notes. It also contains information about future appointments that are scheduled with both primary care clinicians and specialists. Another information system contains information about hospitalizations, including diagnoses and surgical procedures performed during those hospitalizations.

The HMO is actively developing programs to encourage patients to participate in CRC screening. An automated telephone reminder system was being tested concurrent with this study, as was a program which promotes CRC screening to patients during influenza vaccination campaigns. Primary care providers are also encouraged to send a health maintenance reminder to their patients during their birthday month. This practice, even if followed, would still miss patients who have not yet signed up with a primary care provider.

Another information system is available at the HMO to aid clinicians and their staff to identify patients for both inreach and outreach efforts. Known as the "panel support tool" it is used to track preventive medicine needs and quality measures. Various queries can be performed to identify patients who are in need of labs, screening tests, or adjustment in their medications based on recommended guidelines. In addition to individual patient's preventive health needs, a clinician can

view his patient panel's overall statistics for several measures (including CRC screening) and can retrieve lists of patients who are not in compliance with recommended measures.

The HMO also provides an online software application which allows patients to access portions of their medical record and to send secure electronic messages to their physician. Patients can view most of their laboratory test results, past and future appointment times, request appointments or referrals and renew medications, among other features. The application is web-based and password-protected with 128-bit encryption. Patients are required to actively request enrollment in this service using a simple online application, at which time they provide a home email address. When a clinician sends an email to a patient, a generic message is sent to their home email alerting the patient to login to the secure email system to retrieve their message. The emails both sent and received become part of the patient's medical record.

Selection of Subjects. In November, 2007, the HMO's research center was preparing for a large scale outreach for CRC screening. A total of 18,847 patients had been identified who were both enrolled in the secure email service and were due for CRC screening. Of these, a random sample of 2100 patients were selected as subjects in this study, based on power calculations. Included were men and women between the ages of 50 and 80 who had accounts on the secure email system and who had 12 or more months of insurance coverage with no more than one 45 day break prior to November 1, 2007. From this group were excluded those patients who had either a FOBT in the previous 12 months, a sigmoidoscopy in the previous 5 years, or a colonoscopy in the previous 10 years as recorded in their medical record. Also excluded were those patients with a total colectomy, a history of colon cancer or inflammatory bowel disease, use of anticoagulants like Coumadin or Plavix, or an oncology visit in the previous 12 months. If a patient had a sigmoidoscopy or colonoscopy ordered in the previous six months, but had not yet had the procedure, they were also excluded on the assumption they had chosen one of these tests instead of FOBT. We did not wish to imply that patients should change that choice, since we were recommending FOBT in the reminders, and also wanted to allow enough time for patients to arrange their appointment and complete the procedure. Also excluded were patients for whom a FOBT had been ordered in the previous 3 months. Finally, patients who were on hospice or in a nursing home facility as well as those patients with the diagnosis of dementia were also excluded from the study.

Study Design. This randomized prospective cohort study had three arms. Of the 18,847 patients between the ages of 50-80 with secure email accounts due for CRC screening, 2100 were randomized into one of three study arms: the first cohort were to receive usual care, the second cohort were to receive a single letter reminder, and the third cohort were to receive a single email reminder delivered through the secure email system. The three cohorts were matched for age and gender.

Two months following identification of the cohorts, the investigators generated the letter and email reminders for patients in the intervention arms of the study. The delay between cohort identification and initiation of the study was due to a desire to avoid a holiday season and the known poor response rate during this time of year. In addition, January 1st is a date when many employees can change their healthcare benefits, so subjects enrolled prior to that date might leave the study due to a change in benefit plans. Because of this delay, the investigators reviewed the health records of all subjects to be certain that the initial cohort screened for the study was still eligible for enrollment. The initial chart review was done using the panel support tool and any new discrepancies were verified in the EHR. A total of 691 patients were found to be ineligible during this second screening because they had either received their screening test or had the test ordered in the interim (60%), had unenrolled in the secure email system (26%), or were no longer members of the HMO (5%) or no longer met study criteria. Those that were still eligible were enrolled in the study and, if in one of the intervention arms, had the letter or email reminder generated within their electronic medical chart and sent during the first two weeks of January, 2008. A FOBT was ordered for subjects of the intervention arms at this time. The content of the email and letter reminders was identical. In order for a subject to respond to this reminder, they had to travel to an HMO laboratory to pick up screening cards, complete the test at home, and return the cards by mail to the laboratory.

Ninety days after sending the letter and email reminders, charts were again reviewed to determine which subjects had completed either a FOBT, a sigmoidoscopy or a colonoscopy within those 90 days. Also tracked during this time were any returned reminder letters or unread email reminders. Additionally, for those who completed some form of colon cancer screening the number of days to completion of the screening was noted.

RESULTS. Over 38% of the HMO population was enrolled in the secure email service at the time of this study 53% of whom were between the ages of 50 and

80. In the HMO population 59.2% were already compliant with CRC screening guidelines at the beginning of the study. This includes a commercial rate of 55.2% and a Medicare rate of 67.6%. Within the population of patients enrolled in secure email the compliance rate was 69.15%. This supports a supposition that the patients who enroll in the secure email system are more likely to be proactive in their health care.

The 2100 subjects eligible for the study had been randomized into the three arms before the delayed chart review. The number of subjects remaining in each arm of the study (and therefore enrolled in the study) was 494 receiving usual care, 458 receiving the letter reminder and 457 for email reminders. Subjects were originally randomized based on gender and age and no difference in either in the three cohorts was detected in the enrolled group ($p=0.950$ for age, 0.954 for gender).

Success of an outreach program depends on the ability to successfully reach patients. While only two of 458 letter reminders (0.4%) were returned for incorrect addresses, of the emails sent out, 159 (35%) had not been opened by the subjects during the three month study period

Response to the intervention is shown in Table 1. Positive response is defined as completion of either a FOBT, sigmoidoscopy or colonoscopy within the 3 months of the study. Those subjects whose history was updated during the study period to document a prior sigmoidoscopy (within the past 5 years) or colonoscopy (within the past 10 years) not previously recorded in their record were removed from the study (12 subjects). The positive response rate in the study group overall was 17.8%. The positive response rate within each arm were 7.8% for patients receiving usual care, 23.6% for subjects receiving the letter reminder and 22.7% for subjects receiving the email reminder.

A significant difference among at least 2 of the groups was demonstrated using Pearson chi-square test ($p < 0.0005$). Chi square analysis was then performed on separate pairings of the 3 groups and there was a statistically significant difference between usual care and letter reminders ($p < 0.0005$) and between usual care and email reminders ($p < 0.0005$) but not between letter reminders and

Table 1. Positive response rates (screening rates during the study period) in each cohort

Intervention	Number (%) of subjects screened
Usual Care	38 (7.8%)
Letter Reminder	107 (23.6%)
Email Reminder	103 (22.7%)
Total	248 (17.8%)

email reminders ($p=0.711$).

DISCUSSION. This study shows that reminders are an effective tool in promoting colon cancer screening in the population studied. More important, email reminders were as effective as letter reminders and both were significantly more effective than usual care (which may include both inreach and outreach initiated by their clinicians) in increasing the rate of screening for CRC in delinquent patients. The response rates to both the email and letter reminders were approximately 23%. This is much higher than the expected response rate of 14%, based on the limited current literature for similar programs. One reason may be that this study population had all enrolled in the secure email program and had a higher CRC screening rate than the HMO population, suggesting that they are both early technology adopters and likely to be a self-selected population of more health-conscious patients. It is also possible that the higher response was in part due to having a FOBT ordered at the time of outreach.

One potential advantage that email reminders have over letter reminders, although not explicitly explored in this work, is a potential cost savings. The estimated cost of letter reminder campaigns is high, while email reminders can be automated. The timing, verification of need, and generation of a reminder email can all be automated, and once implemented should be maintainable with considerably less personnel costs as compared to letter reminders. One could imagine a web-based system with a page devoted to recommended preventive health care needs and when they were next due. An annual email could be sent if there were preventive services due. Links could be available for more detailed explanations of the recommendations, to request tests and appointments, or to ask the clinician any questions the patient may still have, thus giving patients more control over their health and health care needs.

One drawback to using any outreach method is access to accurate contact information. The rate of incorrect email addresses is likely to be higher in this HMO than street addresses since street addresses are verified on a regular basis. An effective email reminder program may, therefore, require effort to keep email addresses up to date.

CONCLUSION. In this and other studies, letter reminders have been shown effective in increasing preventive services screening rates among patients. With the ever-increasing role of email in medicine use of email reminders for CRC screening outreach was explored and found to be as effective as letter reminders in increasing CRC screening rates. Although more study is needed before it can be

widely implemented the possibility of automating the process and subsequent cost savings make email a promising new tool in preventive medicine.

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