Strategies to Improve Colorectal Cancer Screening Rates
Melissa M. Garrett, MD, and Deborah A. Fisher, MD, MHS

Abstract
• Objective: To review the literature on interventions designed to increase rates of colorectal cancer screening in the United States.
• Methods: The MEDLINE database and Cochrane Database of Systematic Reviews were searched for randomized and quasi-randomized controlled trials, systematic reviews, and observational studies of interventions to increase colorectal cancer screening. Additional studies were identified by reviewing the reference lists of reviewed articles. Intervention was broadly defined as a strategy beyond current care to increase colorectal cancer screening rates among eligible individuals.
• Results: Interventions targeted at changing provider behavior, including automated reminders, were most successful when baseline screening rates were below the national average, approximately 55%. Similarly, interventions aimed at patient behaviors, including decision aid videos and written materials, were more likely to succeed if the preintervention screening rates were relatively low.
• Conclusion: No intervention, either patient- or provider-based, appears to be successful at increasing screening rates in all study populations. With most interventions, the improvements seen in populations with low baseline screening rates were not seen in populations where baseline screening rates were at or above the national average. Future research is needed to test which approaches (single or multifaceted) to increase utilization of colorectal cancer screening among average-risk individuals. Additional studies were identified by reviewing the reference lists of reviewed articles. Intervention was broadly defined as a strategy, beyond current care, to increase colorectal cancer screening rates among eligible individuals. Studies performed outside the United States, that included symptomatic or high-risk populations (eg, family or personal history of colorectal neoplasia), or were only published in abstract form were excluded. Studies of interventions to increase screening for other cancers were included if the data pertaining to colorectal cancer screening could be evaluated separately. The interventions were subcategorized into interventions aimed to change patient behaviors and those to change provider behaviors.

Colorectal cancer is a leading cause of cancer-related death in the United States and affects approximately 150,000 people annually. Screening for colorectal cancer, which by definition is performed before symptoms arise, has been shown to reduce cancer-specific mortality [1–3]. Authoritative bodies such as the American Gastroenterological Association and the U.S. Preventive Services Task Force recommend routine colorectal cancer screening in persons at average risk beginning at age 50 years (Table 1) [4,5].

Despite the known mortality reduction associated with screening, colorectal cancer screening rates remain low compared with other screening programs, such as mammograms for breast cancer or Pap smears for cervical cancer. On the Behavioral Risk Factor Surveillance System (BRFSS) survey of 2004, 57.3% of adults reported being screened with either fecal occult blood testing (FOBT) within the last year or lower endoscopy within the last 10 years [6]. Although this number is an improvement over the 2002 BRFSS survey, further progress is needed. To improve patient and provider adherence with screening recommendations, a number of methods have been proposed and studied. This paper will review interventions designed to increase rates of screening for colorectal cancer.

Methods
The MEDLINE database and the Cochrane Database of Systematic Reviews were searched for meta-analyses, systematic reviews, randomized and quasi-randomized controlled trials, and observational studies that pertained to interventions (single or multifaceted) to increase utilization of colorectal cancer screening among average-risk individuals. Additional studies were identified by reviewing the reference lists of review articles. Intervention was broadly defined as a strategy, beyond current care, to increase colorectal cancer screening rates among eligible individuals. Studies performed outside the United States, that included symptomatic or high-risk populations (eg, family or personal history of colorectal neoplasia), or were only published in abstract form were excluded. Studies of interventions to increase screening for other cancers were included if the data pertaining to colorectal cancer screening could be evaluated separately. The interventions were subcategorized into interventions aimed to change patient behaviors and those to change provider behaviors.

From the Department of Medicine, Division of Gastroenterology, Duke University Medical Center, Durham, NC.


Results

Interventions included provider and patient educational materials and programs, provider and patient reminders, provider audit with feedback, and patient decision aids. Table 2 summarizes the studies reviewed. Table 3 focuses on studies of computer reminders, which were the most commonly tested strategies.

Provider Behaviors

Educational seminars/continuing medical education/academic detailing. Walsh et al [7] randomized providers to receive educational seminars and academic detailing with their patients receiving written educational materials. Academic detailing, as discussed by the authors, is used to “investigate knowledge and motivations, define clear educational and behavioral objectives, present both sides of an issue, and stimulate active physician participation in interactions.” The study outcomes were rates of FOBT screening 2 years after the intervention and rates of flexible sigmoidoscopy and colonoscopy 5 years after the intervention. Baseline screening rates were 64.5% (Table 2). There were no statistical differences in screening rates between the intervention and the control groups at 2 or 5 years. A study by Manfredi et al [8] looked at a multifaceted intervention of chart reminders, on-site training, and physician continuing education. This study found a net increase in the proportion of patients who received testing, but the contribution of provider education on the study outcome could not be separately evaluated. This study targeted low-income and minority populations with a baseline screening rate of less than 5%.

Written educational materials for providers. Zubarik et al [9] designed educational materials distributed to sites caring for an inner city population to help increase rates of flexible sigmoidoscopy. This was a small observational study with retrospective and prospective cohorts. The authors report that 50 flexible sigmoidoscopies were performed in the 5 months before the intervention and 71 in the 5 months after the intervention. Neither baseline screening rates nor the number of patients seen in the targeted clinics were reported.

Computer reminder systems. McPhee et al [10] randomized providers to receive computer-generated lists of overdue tests including screening for colon, cervical, and breast cancer. The postintervention FOBT screening rate increased 14.5%. A second study by McPhee et al [11] compared 3 interventions: computer reminders, audit with feedback (see section below), and patient education. The computer reminders were beneficial; the rates of screening were increased for 6 of 7 tests, including the rate of FOBT (\( P < 0.001 \)). Tape and

Table 1. Colorectal Cancer Screening Recommendations

For individuals at average risk and age 50 years or older, ANY of the following options:

- Annual fecal occult blood testing (FOBT)
- Flexible sigmoidoscopy every 5 years
- Annual FOBT and flexible sigmoidoscopy every 5 years
- Double-contrast barium enema every 5 years
- Colonoscopy every 10 years, unless findings


Campbell [12] demonstrated a statistically significant increase in the proportion of patients undergoing flexible sigmoidoscopy with the addition automated reminders (7.1% in the computer-reminder group versus 4.4% in the control group), but no increase in the rate of FOBT. Turner et al [13] compared the rates of screening between patients who carried a paper card with a list of screening tests that were due versus a computer-generated prompt sheet. The baseline screening rates were 28%. The group of patients in the computergenerated prompt sheet showed an increase in colorectal cancer screening of 1% (not statistically significant), with a decrease in screening for the paper card group.

Frame et al [14] studied an intervention that automatically generated annual provider and patient reminders. The control group was manually tracked with reminders generated only after provider request, usually after patient appointments or chart reviews. The baseline screening rates for FOBT were 40% in the intervention group, which increased to 58% after the intervention. A similar increase was not seen in the control group. A follow-up study by Cooley et al [15] was conducted in 1996, after the funding had ended. The rates for colon cancer screening were 55% overall in 1992 and 52% in 1996, suggesting that the effects of the intervention were durable.

Paper chart reminders. Roetzheim et al [16] performed a trial of 1237 subjects in community health centers. This study used chart stickers indicating whether screening tests were ordered. The baseline screening rate for colorectal cancer was approximately 20%. Multivariate analysis found the intervention was significant for increasing FOBT testing, with an odds ratio of 2.56. As discussed previously, Manfredi et al [8] demonstrated the success of a multifaceted intervention that included office chart reminders.

Ruffin and Gorenflo [17] studied another multifaceted intervention. Four groups were used: a control group, a provider intervention group where providers were given
past history of screening for each patient and current screening recommendations, a patient-based intervention group where the patient was given this information, and a final group in which both provider and patient received this information. The baseline screening rates were approximately 40%, but lower baseline rates were noted in the combination groups. At 3 years, no impact was found in any group.

Audit with feedback. In the previously discussed study by McPhee et al [11], researchers compared computer reminders against audit with feedback. The study did not show that the audit with feedback was effective, although computer-generated reminders did increase screening rates.

Patient Behaviors

Decision aid videos. Pignone et al [18] studied an 11-minute video about colorectal cancer screening options shown to subjects in a primary care clinic. The intervention significantly

<table>
<thead>
<tr>
<th>Study</th>
<th>Practice Setting</th>
<th>Intervention</th>
<th>Baseline Screening Rate</th>
<th>Postintervention Screening Rate</th>
<th>Impact on Screening Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walsh [7]</td>
<td>Academic and community</td>
<td>Educational seminars and academic detailing</td>
<td>64.5%–74.4%</td>
<td>77.2%–84.1%</td>
<td>No difference</td>
</tr>
<tr>
<td>Manfredi [8]</td>
<td>Community</td>
<td>Chart reminders and CME</td>
<td>3.2%–4.5%</td>
<td>5.2%–12.5%</td>
<td>Significant increase</td>
</tr>
<tr>
<td>McPhee [10]</td>
<td>Community</td>
<td>Computer-generated lists of overdue tests</td>
<td>23%–34.6%</td>
<td>31%–50.4%</td>
<td>Significant increase for FOBT, not sigmoidoscopy</td>
</tr>
<tr>
<td>McPhee [11]</td>
<td>Academic</td>
<td>Computer reminders and audit with feedback</td>
<td>64%–69% FOBT</td>
<td>90%</td>
<td>Significant increase</td>
</tr>
<tr>
<td>Tape [12]</td>
<td>Academic</td>
<td>Computer reminders</td>
<td>25%–28% FOBT 4%–7% sigmoidoscopy</td>
<td>Reported as # ordered/total # visits a patient was eligible: 14.3</td>
<td>Significant increase for sigmoidoscopy, not FOBT</td>
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</tr>
<tr>
<td>Turner [13]</td>
<td>Community</td>
<td>Automated health reminder</td>
<td>28%</td>
<td>31%</td>
<td>No difference</td>
</tr>
<tr>
<td>Frame [14]</td>
<td>Community</td>
<td>Automated health reminder</td>
<td>40%</td>
<td>58%</td>
<td>Significant increase</td>
</tr>
<tr>
<td>Roetzheim [16]</td>
<td>Community</td>
<td>Paper chart reminders</td>
<td>22%–35%</td>
<td>40.1%</td>
<td>Significant increase</td>
</tr>
<tr>
<td>Ruffin [17]</td>
<td>Community</td>
<td>Guidelines given to patient and providers</td>
<td>40%</td>
<td>40%</td>
<td>No difference at 3 years</td>
</tr>
<tr>
<td>Pignone [18]</td>
<td>Community</td>
<td>Decision aid video</td>
<td>NR*</td>
<td>36.8%</td>
<td>Significant increase compa red with control group</td>
</tr>
<tr>
<td>Zapka [19]</td>
<td>Academic and community</td>
<td>Decision aid video</td>
<td>62%†</td>
<td>55%</td>
<td>No difference</td>
</tr>
<tr>
<td>Tilley [21]</td>
<td>Work site</td>
<td>Educational booklet and telephone call</td>
<td>61%</td>
<td>Odds of being screened, 1.3 (95% confidence interval, 1.1–1.6)‡</td>
<td>Statistically (but not clinically) significant increase</td>
</tr>
<tr>
<td>Dietrich [22]</td>
<td>Community</td>
<td>Telephone management program</td>
<td>39%</td>
<td>63%</td>
<td>Significant increase</td>
</tr>
</tbody>
</table>

CME = continuing medical education; FOBT = fecal occult blood testing; NR = not reported.

*Baseline screening rates at study sites were not reported. Patients reporting FOBT in the past year or flexible sigmoidoscopy in the prior 5 years were ineligible.

†62% refers to “ever had” FOBT. Up-to-date baseline screening status was not reported.

‡Unadjusted postintervention screening rate was 61% (unchanged), but the adjusted analysis showed a small, statistically significant benefit of the intervention.
Impact of the number of FOBT and flexible sigmoidoscopies completed (36.8%) compared with the control group (22.6%). A similar intervention was published by Zapka et al [19]. Subjects were followed via telephone at 6 months to assess screening rates. The postintervention screening rate (55%) was the same for the control and intervention groups. At baseline, approximately 62% of subjects reported “ever having” an FOBT.

Patient education and reminders. Williams et al [20] studied a patient-initiated touch-sensitive computer system to determine if there would be a change in the proportion of eligible patients undergoing screening for colon, oral cavity, breast, and cervical cancer. This intervention did not increase the rates of screening for colorectal cancer by either FOBT or flexible sigmoidoscopy. The intervention was successful in increasing the rates for breast exam and mammography. The authors noted that men had a higher odds ratio for the completion of flexible sigmoidoscopy. Tilley et al [21] studied the rates of screening among autoworkers. In this randomized controlled trial of almost 5000 subjects, a comparison was made between the standard program offered to workers, which included FOBT and flexible sigmoidoscopy, and an “enhanced” program referred to as ColoRecord. The ColoRecord program added an educational booklet and follow-up telephone call. The unadjusted screening rate did not change from a baseline of 61%; however, the likelihood of being screened was significantly higher in the intervention group (odds ratio, 1.3; 95% CI, 1.1 to 1.6) after adjusting for baseline differences in the 2 groups.

Telephone care management. In a recent article by Dietrich et al [22], telephone care management was studied. A total of 1413 women overdue for usual cancer screening were randomized to receive usual care versus a telephone management program. Over 18 months, patients received an average of 4 phone calls from preventative care managers about breast, cervical, or colorectal cancer screening. The intervention raised rates for all 3 types of screening, but colorectal cancer screening had the largest increase, from 39% to 63%. In the usual care group, the rate also increased, from 39% to 50%.

Discussion

Review of the literature revealed no consistent findings regarding specific interventions to increase colorectal cancer screening. An important predictor of the success of an intervention appeared to be the baseline rate of screening in the population under study. If screening rates were equal to or greater than the BRFSS survey rate (approximately 55%), interventions were less likely to succeed. A comparison of the 2 decision aid video studies illustrates this point. The Pignone et al [18] study was performed in central North Carolina, where screening rates were low. The Zapka et al [19] study, which used a similar intervention, did not demonstrate significant improvement. The most obvious difference is the population under study. Zapka et al studied a population in central Massachusetts with a baseline screening rate of up to 62%.

The baseline screening rate of a population is not an isolated measure but potentially reflects a number of characteristics of the population, such as level of education, insurance status, and overall involvement with health care and prevention. Lower baseline screening rates maybe due to lack of information, understanding, or opportunity for screening. Rates approaching or exceeding that of the national average may be difficult to increase as these populations may include individuals whose barriers to screening are more complex than a lack of knowledge or forgetfulness that testing is overdue.

Two studies may challenge our conclusion that interventions were not effective in populations with baseline screening rates greater than 55%. The Tilley et al [21] study was performed in a population with a baseline screening rate of 61% and reported a statistically significant impact for their intervention. Nonetheless, their results had limited clinical significance because adjusted odds ratio for screening in the intervention group was only 1.3. Generally, odds ratios of at least 2.0 are considered clinically important. The other exception is the second study by McPhee et al [11]. The baseline provider compliance with FOBT was nearly 70%, much higher than the rates reported by BRFSS. The computer reminders were successful in increasing this rate even further. On the other hand, a lower baseline screening rate does not guarantee success for an intervention. There may be a theoretical threshold for colorectal cancer screening that approximates current BRFSS estimates (55%). While it is possible to achieve higher rates, doing so may require more intensive and/or systematic approaches.

Table 3. Computer Reminder Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Outcome Measure</th>
<th>Significantly Increased Screening?</th>
</tr>
</thead>
<tbody>
<tr>
<td>McPhee [10]</td>
<td>Provider compliance with FOBT</td>
<td>Yes</td>
</tr>
<tr>
<td>McPhee [11]</td>
<td>Provider compliance with FOBT</td>
<td>Yes</td>
</tr>
<tr>
<td>Tape [12]</td>
<td>Proportion of subjects who underwent FOBT or flexible sigmoidoscopy</td>
<td>Yes, for sigmoidoscopy only</td>
</tr>
<tr>
<td>Turner [13]</td>
<td>Proportion of subjects who underwent FOBT</td>
<td>No</td>
</tr>
<tr>
<td>Frame [14]</td>
<td>Provider compliance with FOBT</td>
<td>Yes</td>
</tr>
</tbody>
</table>

FOBT = fecal occult blood testing.
What should be the goal for screening in a population? The Healthy People 2010 [23] objective is to “increase the proportion of adults who receive a colorectal cancer screening examination.” The Web site reports that in 2003, 22% of adults older than 50 years had received FOBT in the prior 2 years and 43% of adults over 50 years had undergone flexible sigmoidoscopy. The goals for 2010 are to increase FOBT screening to 33% and sigmoidoscopy screening to 50%. A goal of 100% screening of a population is not reasonable for most populations and health care settings; the risk-benefit ratio for near-complete compliance must be considered. As McGlynn [24] notes in her discussion of challenges in measuring quality of health care, there is a point when the cost of attempting to achieve 100% compliance will exceed the expected benefit. Factoring in the expenses of transportation, intensive counseling, mobile screening units, and other services required may reduce the cost-effectiveness of these preventive services.

A relatively simple intervention such as reminders may be a useful starting point. Many health care organizations already use electronic medical records, some with built-in systems to track screening and immunizations. For example, the Veterans Health Administration (VHA) has implemented both an automatic reminder system and regular auditing of colorectal cancer and other performance measures. The overall VHA colorectal cancer screening rate was 75% in fiscal year 2005 [25], considerably higher than the BRFSS survey rate.

Interventions have been applied to increase rates for screening of multiple types of cancers. Studies generally demonstrated efficacy for some but not all cancer screening programs. For example, in the Roetzheim et al [16] study, the paper chart reminder was effective for increasing rates for colorectal cancer screening but not breast or cervical cancer. The opposite effect was found by Williams et al [20] in the patient-initiated touch system. Interestingly, Williams et al found that patients who had a health maintenance exam in the prior year had higher rates of screening for all forms of cancer. Perhaps having time to discuss options about screening is an important factor in increasing screening rates for all cancers. When providers use the majority of the visit to address acute issues, health maintenance may not be addressed.

A few studies tested multifaceted interventions to change provider behaviors. Manfredi et al [8] found a positive effect of multiple interventions, but it is not possible to determine if it was the reminder, the on-site training, or the physician continuing medical education and quality assurance that had the most impact. Furthermore, the Manfredi study was performed in a population with very low baseline screening rates (3%-4%), a favorable setting for any intervention. For example, the reminder alone might have been successful in this population. Yen’s [27] systematic review of interventions to impact physician practice found that multifaceted education strategies that incorporate at least 1 active intervention were more effective at changing physician behavior than any single intervention. Yen defined “active” as academic detailing, reminders, clinical decision support systems and “passive” as printed educational material and formal continuing medical education. It is unclear if multifaceted patient-based interventions are effective or more effective than single interventions. It is also possible that interventions aimed at both providers and patients would act synergistically to increase the rates. The study by Walsh et al [7] did not support this hypothesis but was in a setting with relatively high baseline screening rates. The study by Ruffin and Gorenflo [17] was performed in a setting with a 40% baseline screening rate but also did not support the efficacy of concurrent provider and patient interventions.

In reviewing the literature, no intervention was found to be successful in all populations, but the most evidence supported one of the least complex strategies: computer reminders. The most striking predictor of an intervention’s success was the baseline screening rate. Colorectal cancer screening rates are still low in comparison with screening rates for other common cancers. For example, 1998 National Health Interview Survey [28] reported that 79% of women had undergone cervical cancer screening within the last 3 years and 67% of women over age 40 had received a mammogram within the last 2 years. Further research is needed to develop and test interventions that will improve colorectal cancer screening beyond 55% to the levels achieved in other cancer screening programs.

Corresponding author: Deborah A. Fisher, MD, MHS, 508 Fulton St., Bldg. 6, Durham, NC 27705, deborah.fisher@duke.edu.

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Author contributions: conception and design, DAF; analysis and interpretation of data, MMG, DAF; drafting of the article, MMG, DAF; critical revision of the article, DAF.

References
Clinical review


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