

Intervention to Increase Recommendation and Delivery of Screening for Breast, Cervical, and Colorectal Cancers by Healthcare Providers

A Systematic Review of Provider Reminders

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Abstract: Most major medical organizations recommend routine screening for breast, cervical, and colorectal cancers. Screening can lead to early detection of these cancers, resulting in reduced mortality. Yet, not all people who should be screened are screened regularly or, in some cases, ever. This report presents results of systematic reviews of effectiveness, applicability, economic efficiency, barriers to implementation, and other harms or benefits of provider reminder/recall interventions to increase screening for breast, cervical, and colorectal cancers. These interventions involve using systems to inform healthcare providers when individual clients are due (reminder) or overdue (recall) for specific cancer screening tests. Evidence in this review of studies published from 1986 through 2004 indicates that reminder/recall systems can effectively increase screening with mammography, Pap, fecal occult blood tests, and flexible sigmoidoscopy. Additional research is needed to determine if provider reminder/recall systems are effective in increasing colorectal cancer screening by colonoscopy. Specific areas for further research are also suggested.

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Introduction

Cancer is the second leading cause of death in the U.S.,¹ and breast and colorectal cancers are among the leading causes of cancer deaths.² For breast, colorectal, and cervical cancers, effective screening tests can reduce cancer-related mortality.^{3–6} Furthermore, some screening tests (e.g., Pap, flexible sigmoidos-

copy, colonoscopy) may lead to a reduction in incidence via detection of pre-neoplastic lesions, which can be removed or treated.³ The U.S. Preventive Services Task Force (USPSTF) recommends breast cancer screening with mammography,⁴ cervical cancer screening with Pap,⁵ and colorectal cancer screening with fecal occult blood tests (FOBTs), flexible sigmoidoscopy, or colonoscopy.⁶

Each year, an estimated 4475 deaths from breast cancer, 3644 deaths from cervical cancer, and 9632 deaths from colorectal cancer could be prevented if all eligible Americans received appropriate cancer screening services.⁷ Yet, the 2005 National Health Interview Survey of U.S. adults⁸ showed that only 67% of women aged ≥ 40 years reported mammograms within the previous 2 years, and only 78% of women aged ≥ 18 years reported having a Pap within the previous 3 years. Among adults aged ≥ 50 years, only 50% reported ever having colorectal

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screening endoscopy, and only 17% reported an FOBT within the previous 2 years. Lower rates were observed among American Indians and Alaska Natives; people of Asian, Latino, or Hispanic ethnicity; African Americans (endoscopy only); and among people who are poorer or less educated. Efforts to maximize control of breast, cervical, and colorectal cancers face the additional challenge of ensuring that cancer screening, once initiated, is repeated at recommended intervals.^{9,10} Increasing use of these screening tests at recommended intervals and reducing social inequalities in their use are important steps toward reducing cancer and mortality.²

The systematic review reported in this article focused on interventions to increase cancer screening, not on subsequent follow-up for abnormal screening results. Despite the fact that not everyone with a positive screening test is adequately followed, diagnosed, and treated, there is independent evidence (from the USPSTF among others)^{4–6} establishing the effectiveness of screening for reducing morbidity and mortality.

Guide to Community Preventive Services

The *Guide to Community Preventive Services (Community Guide)*, developed by the independent, nonfederal Task Force on Community Preventive Services (Task Force), has conducted systematic reviews on the effectiveness, applicability, economic efficiency, barriers to implementation, and other harms or benefits of community- and systems-based interventions to increase screening for breast, cervical, and colorectal cancers.¹¹

An array of such interventions are available to programs and planners for use in promoting cancer screening.^{11,12} They can be conceptualized as falling under three primary strategies: increasing community demand for cancer screening services; reducing barriers to access; and reducing missed opportunities by healthcare providers to discuss, recommend, or deliver cancer screening services. The first two strategies encompass client-directed approaches intended to influence client knowledge, motivation, access, and decision to be screened. The third strategy includes provider-directed approaches to reduce missed opportunities during the provider–client interaction to recommend, order, or deliver cancer screening services. Evidence from these systematic reviews provides the basis for Task Force recommendations on interventions in each of these strategic areas as well as for identifying additional research needs.

Discussion between healthcare providers and their clients regarding the options for and importance of cancer screening is an important determinant of adherence to cancer screening recommendations.^{13–15} Missed opportunities to engage in such provider–client interactions

and lack of adherence to offered or ordered screening tests can limit the ability to achieve higher screening rates and associated reductions in cancer-related mortality.^{13,14,16} The effectiveness of one provider-directed intervention intended to facilitate such interactions, provider reminder and recall systems (provider reminders), is the subject of this systematic review. Reviews of two other provider-directed approaches, provider assessment and feedback and provider incentives,¹⁷ along with those of client-directed approaches to increase community demand^{18,19} have been published.

Provider reminder and recall systems inform those who deliver health services that individual clients are due (reminder) or overdue (recall) for specific cancer screening tests. Reminders may be generated electronically or manually, and they may be delivered in client charts or by computer, mail, or other means. They can vary in format (notation, flow chart, electronic message, or checklist) and content. These reminders convey information to providers, before, during, or after a scheduled visit, regarding the client's cancer screening status. Similar interventions have been demonstrated to improve adherence to vaccine recommendations and to control tobacco use.^{20–22}

Methods

General methods for conducting systematic reviews for the *Community Guide* have been described in detail elsewhere.^{23,24} Specific methods for conducting reviews of interventions to increase breast, cervical, and colorectal cancer screening, for assessing applicability, economic efficiency, other positive or negative effects, and barriers to implementation are also described in detail elsewhere.¹² That description includes the overall literature search of primary scientific publications from 1986 through November 2004, resulting in selection of 244 candidate studies satisfying the general inclusion criteria for the *Community Guide* cancer screening reviews and specific criteria applied to the final selection of qualifying studies relevant to each review (suitability of study design and quality of execution^{23,24}; see Review of Evidence section). That section discusses methodologic issues specific to the subset of the 244 studies dealing with provider reminder systems and which are reviewed in this article.

Conceptual Approach

The analytic model (Figure 1) shows hypothesized relationships among the provider reminder intervention, a series of intermediate steps, and ultimate health outcomes. Completed screening (shaded in the figure) is the outcome of primary interest in this review. Although completed screening is an intermediate step in the model, it is the basis for

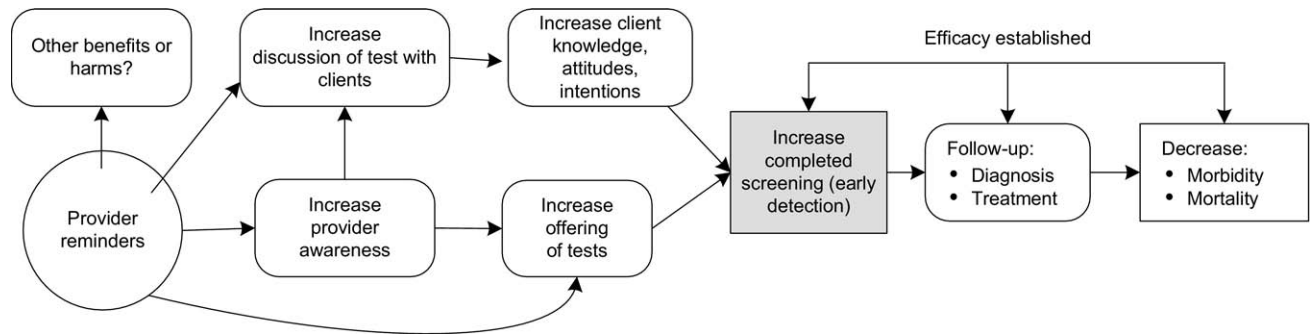


Figure 1. Analytic framework indicating the pathways along which provider reminder interventions are hypothesized to increase community demand for cancer screening services. Circle indicates intervention; rectangles with rounded corners indicate mediators or intermediate outcomes; the shaded rectangle indicates the outcome of interest for this review; and the unshaded, square-cornered rectangle indicates desired health outcomes.

evaluating intervention effectiveness, because links to the health outcome of ultimate interest—decreased mortality from breast, cervical, and colorectal cancers—have been established.^{4–6} The goal of provider reminders is to increase delivery of appropriate cancer screening services by health-care providers. The systematic review development team (the team)¹¹ postulated that by increasing provider awareness about their clients' cancer screening status, the intervention increases some combination of discussing screening with clients, recommending screening, and ordering screening tests. These, in turn, influence client behavior, leading to increased test completion, which in turn leads to early detection, and, ultimately, to reduced cancer morbidity and mortality. The model also indicates that this intervention may result in other benefits and harms, such as positive or negative effects on other health behaviors or use of health-care services.

Increased recommending and ordering of screening tests is an important intermediate step toward increasing actual screening rates. Therefore, studies evaluating these outcomes were included in this review due to their potential contribution to insights into intervention effects on provider behavior, as well as the applicability, implementation, and other positive or negative effects of the intervention. However, these outcomes were not considered valid indices of test completion, because recommended or ordered tests may not always be followed through to actual screening. Thus, studies that reported only on screening tests recommended or ordered were not considered in the analysis of the effectiveness of provider reminder interventions for improving cancer screening rates.

In general, to answer questions about intervention effectiveness, *Community Guide* systematic reviews consider data from all available studies of sufficient quality that compare outcomes in a group exposed to an intervention with outcomes in a group either concurrently or historically unexposed (or less exposed) to the intervention.^{23,24} Consistent with the approaches of many groups that focus on

population-based or public health interventions,²⁵ this approach is broadly inclusive of a range of study designs. Because a substantial number of adequately executed studies identified in the literature search included concurrent comparison groups and these studies appropriately represented provider reminder interventions and the populations to which such interventions are generally directed, this review was limited to studies with concurrent comparison groups (i.e., individual or group randomized trials and nonrandomized trials).

Intervention effectiveness was evaluated by comparing pre- and post-intervention screening rates for clients of providers exposed to a provider reminder with those for comparison groups. For each study, the effect estimate was calculated by subtracting the percentage point (i.e., absolute) change in screening rates for the comparison group from that for the intervention group. Although mammography and colorectal endoscopy are also used for diagnostic or therapeutic purposes, reference to them in these reviews relates specifically to the screening application.

Because provider behavior was thought to be less influenced than client behavior by barriers to screening in the client population or by the nature of screening tests,^{11,12} effectiveness, applicability, and economic efficiency were determined by considering evidence across mammography, Pap, and FOBT screening collectively, rather than separately, as long as evidence was reasonably consistent across tests. Because only one qualifying study examined effectiveness of provider reminder systems for colorectal cancer screening using a test other than FOBT—flexible sigmoidoscopy—evidence of effectiveness for this latter test was considered separately. Because several studies, in separate study arms, assessed multiple reminder systems or multiple screening tests, or both, and contributed more than one data point to aggregated estimates, sensitivity analysis was performed to determine if studies with multiple effect estimates substantially influence reported results.

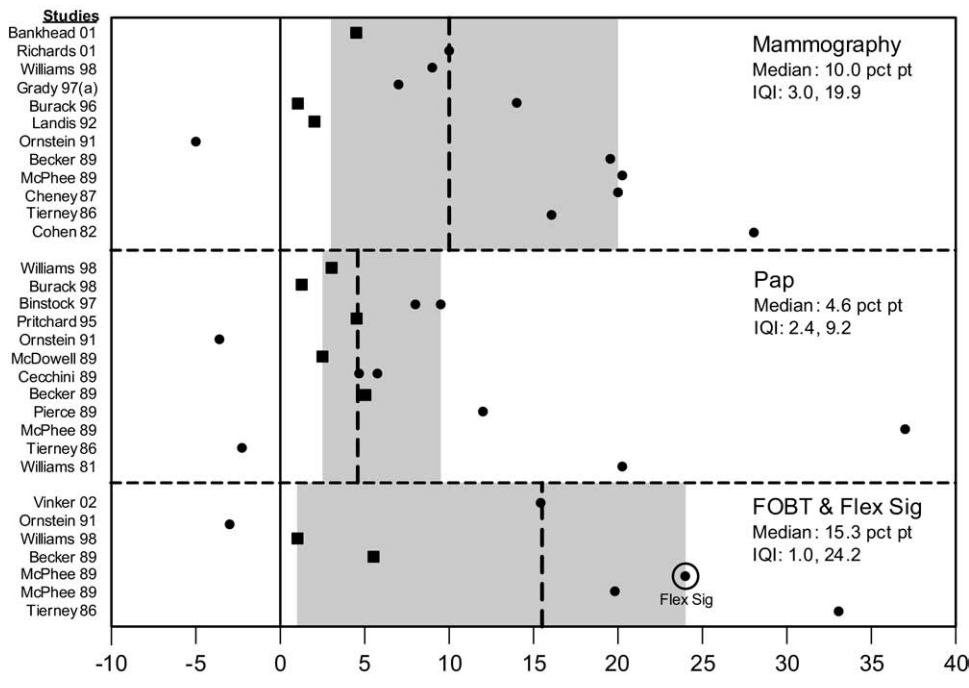


Figure 2. Scatterplot graph showing direction and size of effects from provider reminder interventions to increase screening for breast, cervical, and colorectal cancers. For data points represented by circles, $p < 0.05$; data points represented by squares are not significant. Flex Sig, flexible sigmoidoscopy; FOBT, fecal occult blood test; IQI, interquartile interval

Results

Review of Evidence

Effectiveness. The search for evidence identified 38 studies^{26–63} that reported on using provider reminders to increase recommended screening for breast, cervical, and colorectal cancers. Of these, six^{26–31} were excluded because of their low quality of execution and six more^{32–37} were excluded because of the lack of a concurrent comparison group. Of the 26 remaining studies that qualified for review, five^{45,47,50,53,59} had good quality of execution, including the only study that reported on colorectal screening by flexible sigmoidoscopy,⁴⁵ and 21^{38–44,46,48,49,51,52,54–58,60–63} had fair quality of execution. Details of the qualifying studies are available at www.thecommunityguide.org/cancer.

The qualifying studies examined mammography,^{38–54} Pap,^{39,45,46,48,49,51–62} and colorectal screening.^{39,45,46,48,49,51,53,54,63} All measured outcomes (screening tests completed, or screening tests recommended or ordered but not necessarily completed) were ascertained by record review.

Twenty studies^{38–40,43–46,48–54,56,58–60,62,63} evaluated provider reminders delivered as printed or electronic chart notations or flags, all based on client’s screening history; four^{41,42,47,61} studies evaluated generic, preventive care checklists (not spe-

cific to client’s screening history); and two evaluated memoranda listing clients who were overdue for screening⁵⁵ or who had never been screened.⁵⁷ Thirteen^{39,43–46,48–50,53–55,57,58} provider reminder systems were automated (computer-generated or assisted), and 13^{38,40–42,47,51,52,56,59–63} required manual record reviews. Most study populations consisted entirely of fully trained physicians, but 11 study populations consisted entirely^{41,44–46,51,52,54,62} or mostly^{48,50,53} of resident trainees.

Completed screening tests.

Thirty-four effect estimates from 20 studies^{38–49,55–61,63} pertained to the primary outcome of interest, completed screening tests: 13^{38–49} for mammography, 14^{39,45,46,48,49,55–61} for Pap, six^{39,45,46,48,49,63} for FOBT, and one⁴⁵ for flexible sigmoidoscopy. Among the studies that reported multiple effect estimates, two^{55,57} included two intervention arms for cervical cancer screening, one⁴⁰ included two arms for breast cancer screening, and five evaluated the effects of provider reminders for multiple screening tests (three^{39,46,48,49} or four⁴⁵). As shown in Figure 2, all except four estimates were in a favorable direction. The median post-intervention increase was 7.2% (interquartile interval [IQI], 2.4%–19.7%). Inclusion of a single value (study median) from studies that contributed more than one effect estimate did not appreciably influence this value.

Mammography screening increased by a median of 10.0% (IQI, 3.0%–19.0%), Pap by a median of 4.6% (IQI, 2.4%–9.2%), and FOBTs and flexible sigmoidoscopy by a median of 15.3% (IQI, 1.0%–24.2%). For FOBT alone, the median was 10.5% (IQI, 0.0%–23.1%), whereas the single effect measure for flexible sigmoidoscopy was 24.3%. Effect estimates did not vary substantially by method of generating the reminder (electronic versus manual), delivery, content, format (client-specific vs generic), or by training status of provider.

For all screening modalities, but in particular for mammography, the absolute effect of provider reminders on completed screenings appears to have diminished over time (Figure 2). This trend is not associated with method

of reminder generation or delivery, content, format, or provider training status (trained vs trainees). Because background screening rates often were not provided for study populations, the role, if any, of temporal changes in baseline screening rates on these results could not be determined.

Recommended or ordered tests. Fourteen effect estimates from seven studies^{43,50–54,62} pertained to change in screening tests recommended or ordered. All were in a favorable direction, with a median increase of 7.9% (IQR, 6.0%–12.0%). Increases in recommended or ordered screening by mammography ranged from 7.0% to 38.0% (six studies)^{43,50–54}; by Pap 3.0%–23.0% (five studies)^{51–54,62}; and by FOBT 4.0%–33.0% (three studies).^{51,53,54}

Applicability

The same body of evidence was used to evaluate the applicability of these interventions in different settings and in different provider and client populations. Provider reminders resulted in increases in both completed screenings and recommended or ordered screenings in studies from the United Kingdom,^{38,47,59} Italy,⁵⁷ Canada,⁵⁸ Australia,⁶⁰ Israel,⁶³ and in various locations within the U.S.^{39–45,48–56,61,62} They were implemented in a variety of healthcare settings, including university and nonuniversity clinics and offices and in urban,^{40–43,45,48,50,51,53–56,58,60–63} rural,^{49,52} and mixed urban and rural areas.^{39,44,47,57} Most provider characteristics were not specified, but the reminders were effective for both physician trainees and trained professionals, as noted above. Similarly, race and ethnicity of client populations were generally not reported, although some studies^{39,40,44,45,50,54,56,62} specified that these populations included white or African-American clients or both. Some studies^{40,57–59} also specified that client populations included people who had never been screened or who were several years overdue for screening.

Economic Efficiency

Five studies met criteria for analyzing the cost effectiveness of provider reminders in promoting mammography^{38,47} and Pap.^{55,58,64} Two separate studies, using similar methods and reported on by the same group of investigators, estimated cost effectiveness of flagging charts of eligible women who appeared at the clinic in time for routine mammography⁴⁷ and for women who had previously failed to attend at the time they were due for screening.³⁸ For women who appeared on time, the cost effectiveness of flagging the chart was estimated at \$75 per additional mammogram,⁴⁷ whereas for those who required additional prompting, cost effectiveness was estimated at \$118 per additional mammogram.³⁸ All

of these estimates were likely inflated because they included cost to management of increased clinic attendance and additional consultation costs attributable to the use of flags, which were both beyond the cost of the screening promotion intervention. The studies of provider reminders for obtaining a Pap produced cost-effectiveness estimates of \$17.33 for a computer-printed message⁵⁸; \$19.62 for tagged group files⁶⁴; \$10.78 for a chart notation⁵⁵; and \$72.95 for a memorandum to the provider.⁵⁵

Other Positive or Negative Effects

No reports of benefits or harms related to the use of provider reminders were found. Potential benefits include increases in the use of other preventive services linked to the reminder system.

Barriers to Implementation

Administrative burden and lack of information technology infrastructure are potential barriers to provider reminder use.

Conclusions About Provider Reminders

According to *Community Guide* rules of evidence,²³ based on consistently favorable results, there is strong evidence that provider reminder and recall systems are effective in increasing breast, cervical, and colorectal cancer screening by mammography, Pap, and FOBT, respectively. In addition, there is sufficient evidence that provider reminders are effective in increasing colorectal cancer screening by flexible sigmoidoscopy, based on a single well-executed study. These findings apply across a broad range of clinical settings and provider and client populations, including clients infrequently or never screened. Evidence was insufficient to determine the effectiveness of provider reminders in increasing colorectal cancer screening by colonoscopy because no studies evaluated this screening modality.

Research Issues for Provider Reminder and Recall Systems

Effectiveness. Effectiveness of provider reminders for increasing cancer screening by mammography, Pap, FOBT, and flexible sigmoidoscopy is established. Additional studies will be necessary to determine whether provider reminders are also effective in promoting screening colonoscopy.

Applicability. What contextual or population prevalence factors help to explain the reduced impact of provider reminders in more recent effectiveness studies compared to older studies?

Other positive and negative effects. How can provider reminder systems that encourage use of cancer screening services be adapted for other preventive health-care services?

Economic evaluations.

- How are the costs and cost effectiveness of these interventions related to the structural characteristics of the settings of interventions?
- In particular, can health plans address logistic problems (e.g., contacting providers and reducing administrative time) more efficiently than individual clinical practices, thereby lowering costs and improving cost effectiveness?
- It is also not known whether benefits and cost savings can be achieved by provider reminder systems when used to promote multiple preventive services simultaneously.

Discussion

This review has summarized evidence supporting the Task Force recommendation⁶⁵ for use of provider reminder and recall systems to increase recommended screening for breast, cervical, and colorectal cancers. This intervention can be effective in a variety of clinical settings in which improvement in recommendation and delivery of breast, cervical, and colorectal cancer screening services is indicated.

The great majority of intervention studies to increase colorectal cancer screening focus on FOBT, and there is a paucity of studies evaluating colorectal endoscopy for screening purposes. Nonetheless, the single study in this review that evaluated an endoscopic procedure was of sufficiently high quality to justify a conclusion that provider reminders resulted in an increase in screening by flexible sigmoidoscopy.²³ This also has face validity, because there is no reason to expect that provider reminders would function differently for colonoscopy than for other cancer screening tests. However, because endoscopic procedures are important methods of screening for colorectal cancer, a leading cause of cancer mortality, it is important to increase the evidence base beyond studies covered in this review (published through 2004) to evaluate the effectiveness of interventions for promoting such procedures.

Provider reminders, like provider assessment and feedback, are intended to address the screening needs of individuals who attend healthcare facilities at least occasionally. Despite general success of provider reminders in increasing rates of cancer screening and other preventive services,^{20–22} they may not be the approach of choice in communities in which many people have limited access

to health care, or in which there are identifiable pockets of people who underuse healthcare services and therefore require targeted efforts for education and motivation. An important limitation of this and other cancer screening intervention reviews^{17–19} is that they do not offer specific guidance as to which recommended intervention or set of interventions is most appropriate for a given population or setting, nor do they ensure that recommended interventions will be effective under all circumstances. The choice of one or more recommended interventions is likely to be influenced by a number of different factors, including overall population screening rate, location and identity of populations in greatest need, opportunities to deliver specific interventions, and availability of tracking systems. Making the “right” selection will rely, to a large degree, on knowledge about local context, culture, needs, screening history, and options for delivery. Cancer Control P.L.A.N.E.T. (*Plan, Link, Act, Network, with Evidence-based Tools*; cancercontrolplanet.cancer.gov/) is an important resource for communities and organizations seeking to adopt and adapt evidence-based cancer screening interventions. This website not only provides useful information for determining cancer control program priorities and exploring different intervention approaches but also provides guidance on identifying potential partners, adapting and implementing research-tested intervention programs and products, and evaluating the intervention program.

Research questions offered in this article help to identify important gaps in the knowledge base and can be used to guide future research, both in determining research priorities and in allocating research funds.

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