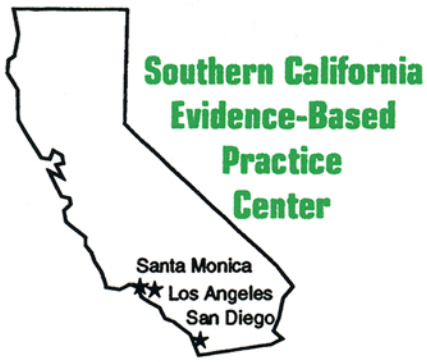
EVIDENCE REPORT AND EVIDENCE-BASED RECOMMENDATIONS:

INTERVENTIONS THAT INCREASE THE UTILIZATION OF MEDICARE-FUNDED PREVENTIVE SERVICES FOR PERSONS AGE 65 AND OLDER



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Preface

The Health Care Financing Administration (HCFA), in consultation with other Agencies in the Department of Health and Human Services, initiated the Healthy Aging Project to enhance and promote the health of older people. A major objective of the Healthy Aging Project is to identify, synthesize and disseminate evidence and expert opinion on health promotion and disease prevention interventions that are evidence-based. HCFA is sponsoring reports that present evidence and expert opinion to assist public and private sector organizations in their efforts to improve the delivery of Medicare-covered preventive benefits and promote behavioral risk factor reduction. These reports provide comprehensive, science-based information on effective and cost-effective interventions targeting the senior population. RAND is producing these reports under a HCFA contract.

HCFA expects that these evidence reports will inform peer review organizations, individual health plans, providers and purchasers, including Medicare and Medicaid, as well as the health care system as a whole by providing important information to help improve the delivery and quality of preventive health care for older people.

We welcome written comments on this evidence report. They may be sent to:

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The Southern California Evidence-Based Practice Center

The Southern California Evidence-Based Practice Center is part of the Evidence-Based Practice Program sponsored by the Agency for Health Care Policy and Research. One of 12 such Centers nationwide, the Center conducts systematic reviews and technology assessments of all aspects of health care; performs research on improving the methods of synthesizing the scientific evidence and developing evidence reports and technology assessments; and provides technical assistance to other organizations in their efforts to translate evidence reports and technology assessments into guidelines, performance measures, and other quality-improvement tools.

The Center combines the talents of RAND and its five affiliated regional health care institutions: the University of California, Los Angeles; the University of California, San Diego; Cedars-Sinai Medical Center; the University of Southern California; and Value Health Sciences. In addition, through the VA/RAND/ University of California Field Program "Center for the Study of Health Care Provider Behavior," four Department of Veterans Affairs facilities collaborate with the Center. The Center is also affiliated with five health services research training programs.

The Southern California Center is the natural outcome of more than 20 years of work by RAND and its affiliated institutions in reviewing the biomedical literature for evidence of benefits, harms, and costs; using meta-analysis, decision analysis, and cost-effectiveness analysis to synthesize the literature; developing measures of clinical appropriateness and practice guidelines; developing and assessing medical review criteria; and developing and assessing performance measures and other tools for translating evidence-based knowledge into clinical practice. The hallmark of this work has been (a) its multi-disciplinary nature: RAND and its affiliated institutions combine the talents of clinicians, health services researchers, epidemiologists, statisticians, economists, and advanced methods experts in meta-analysis and decision analysis; (b) the advancement of knowledge about the methods for performing literature reviews, synthesizing evidence, and developing practice guidelines or review criteria; and (c) the emphasis on developing and evaluating products for use in the real world of health care delivery.

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EXECUTIVE SUMMARY
AND EVIDENCE-BASED RECOMMENDATIONS

The proportion of the U.S. population over age 65 has increased from 5% in 1900 to 13% in 1997. This change in demographics, combined with an increase in average life expectancy, has highlighted the importance of preventive care services for older individuals. For example, in 1993, the five most common causes of mortality among patients age 65 and over were heart disease, cancer, cerebrovascular diseases, chronic obstructive pulmonary disease, pneumonia, and influenza, all of which are potentially preventable. Early detection and treatment can improve the health of patients with these and many other conditions and potentially decrease health care costs. Similarly, appropriate immunizations can prevent some of these conditions from occurring, or render the disease less severe. To determine the best strategies for early detection and prevention currently covered by Medicare for several of these conditions, the Health Care Financing Administration (HCFA) has commissioned this project to assess interventions designed to improve influenza and pneumococcal immunization rates, mammography rates, cervical smear cytology (pap test) rates, and colon cancer screening rates.

METHODS

In this report, we synthesize evidence from the scientific literature using the methods of the Southern California Evidence Based Practice Center (EPC), an Agency for Health Care Policy and Research-designated center for the systematic review of literature on the evidence of the benefits and harms of health care interventions. Our literature review process utilized the following steps:

- develop a conceptual model
- identify sources of evidence
- identify potential evidence
- evaluate potential evidence for methodologic quality and relevance
- extract study-level variables and results from studies meeting methodologic and clinical criteria
- synthesize the results.

For this study, HCFA specified that we review the evidence on the five screening/vaccination services currently covered by Medicare (i.e., influenza and pneumonia vaccinations, screening mammography, cervical smear cytology, colon cancer screening), using a target population of persons over age 65. HCFA specified the relevant outcome as receipt of these items by the target population.

Our conceptual model classified the potential targets of intervention as patient, provider, organization, or community. It classified the types of interventions as either reminders, feedback, education, financial incentives, regulatory and legislative interventions, organizational change, or media campaigns. These intervention types are defined in the Glossary of Terms located in the Appendix.

We used the following five sources to identify existing research and potentially relevant evidence for this report: Cochrane Effective Practice and Organization of Care (EPOC) Data Base, two previous systematic reviews, a draft chapter on immunizations from the Centers for Disease Control and Prevention (CDC) and Health Care Quality Improvement Projects (HCQIP) done by the Medicare Peer Review Organizations (PROs). Documents describing the HCQIPs are called Narrative Project Descriptions (NPDs).

After retrieving articles from the five sources, we reviewed them against exclusion criteria. To be accepted at this stage, a study had to address one or more of the five services of interest and employ one of the following study designs: randomized controlled trial, controlled clinical trial, controlled before and after study, or interrupted time series. While we were primarily searching for data relevant to the Medicare population, we included studies that reported data on populations under age 65 at this stage to avoid premature loss of potentially useful data. Because of the restrictions on study design, we excluded studies that employed a simple pre/post design. Such a study design has no control group; therefore, it cannot account for temporal effects unrelated to the intervention.

After retrieving the relevant articles, we abstracted data about the study design; the number and characteristics of patients; the setting, location, and target of the intervention; the intensity of the intervention; the types of outcome measures; the time from intervention until outcome measurement; and the results. Two physicians

working independently extracted data in duplicate, compared data and resolved discrepancies by consensus. A senior project member resolved discrepancies not resolvable by consensus.

ANALYSIS

All analyses were performed using the statistical analysis package SAS. We calculated the risk difference between groups for each comparison in each study. The Number Needed to Treat (NNT) was then calculated as the inverse of the risk difference.

We conducted a meta-regression analysis to determine

- the absolute and relative effectiveness of each different intervention component, such as patient reminders, adjusted for other intervention components, and controlling for measured and unmeasured study differences;
- the effect of each important covariate, such as target population, on the effectiveness of interventions controlling for measured and unmeasured study differences; and
- whether an intervention factor, such as top management buy-in and support, was instrumental in the success of interventions controlling for other intervention factors, and measured and unmeasured study differences.

These multivariate models produced an adjusted estimate of the odds ratio for receiving a screening service if one is subject to an intervention containing a particular intervention component, to the odds if one belongs to the control or usual care group. These models also produce an adjusted marginal odds ratio that represents the change in the odds of receiving the screening service if a particular intervention component is added to the "average" intervention without that component. Similar statistics are available for the covariate and intervention factor models.

DEVELOPMENT OF RECOMMENDATIONS

Based on the evidence, we developed several recommendations regarding interventions to increase the use of preventive and screening services in the Medicare population. These recommendations were distributed to over a dozen experts in the fields of public health, preventive medicine and geriatrics for their review and

feedback. Expert reviewers are listed in Table 16 in the Appendix. The recommendations made in this document incorporate many suggestions from these experts.

RESULTS

A total of 187 articles, presenting data on 218 unique studies, passed our screening criteria. Of these, 136 were randomized clinical trials, 24 were controlled clinical trials, and 58 were controlled before-and-after studies. We found no time series studies meeting our inclusion criteria (at least three measurement points both before and after implementation of the intervention). In the 218 studies, there were 288 comparisons of an intervention to usual care or a control group. These were distributed as follows:

- 78 controlled comparisons of interventions to increase influenza immunization
- 18 controlled comparisons to increase the use of pneumococcal immunization
- 76 controlled comparisons of interventions to increase the use of mammography
- 65 controlled comparisons to increase the use of cervical smear cytology
- 41 controlled comparisons to increase fecal occult blood testing for colon cancer
- 10 controlled comparisons to increase the use of methods for colon visualization.

We used meta-regression to summarize these studies, combining the immunization studies into a single analysis and treating each of the cancer screening tests separately. There were too few studies to do an analysis on interventions to increase the use of colon visualization (i.e., sigmoidoscopy, colonoscopy, or barium enema). Not all interventions had sufficient information for all preventive services; at least two separate studies were needed in order to enter any intervention into the model.

Across all four regressions, there were some consistent patterns. First, organizational change was consistently one of the most or the most effective interventions at increasing use of these clinical and preventive services. Second, patient financial incentives were also highly effective at increasing the use of the all services. Third, patient reminders demonstrated a relatively consistent effect across all services, as did patient education. For patient reminders, there is some evidence that personalized reminders (or those signed by the patient's

physician) are more effective than generic reminders. Finally, feedback appeared to be a relatively ineffective intervention, as it was statistically beneficial only for increasing mammography screening.

The sample sizes involved in studies of mass mailings for influenza vaccine made them unfeasible to enter into the statistical model; these studies were summarized separately. There was one study from the Narrative Project Description file that reported a statistically significant benefit and was subsequently published in *Morbidity and Mortality Weekly Report* (1995). Four studies that did not report a clinically meaningful benefit were found in the Narrative Project Description files.

In addition to these main results, we performed other analyses to test possible relationships between efficacy of an intervention and baseline immunization rate, intensity of intervention, and year of publication. Our analyses were limited by the large amount of missing data (i.e., studies did not report a baseline rate or did not report information about the intensity of the intervention). Our results were not consistent, and the relationship between efficacy and any of these other variables, based on these data, is not strong.

LIMITATIONS

The primary limitation of this review is the quantity and quality of the original studies. Even more so than reviews of single therapies for single conditions, the studies presented here are extremely heterogeneous in terms of the interventions that were tested and the specific populations or health care systems being studied. An additional limitation is that many of the original studies did not include sufficient detail to allow statistical testing. Lastly, since our data were abstracted from articles that studied both under 65 year old as well as the over 65 population, it is possible that our conclusions are not entirely applicable to the Medicare population. Lastly, for several services there were very few studies upon which to base conclusions.

CONCLUSIONS

Keeping in mind the limitations noted above, and that knowledge of local barriers and opportunities to improve services is a key ingredient in designing effective interventions, we draw the following conclusions from the literature:

1. Organizational change (such as standing orders) and financial incentives are the interventions that were most consistent at producing the largest improvements in use of all preventive and screening services.

2. Patient reminders are also consistently effective across all preventive and screening services, although in general, they were less so than organizational change or financial incentives. Patient reminders that are personalized or signed by the patient's physician are more effective than reminders that are generic.

3. Provider reminders are very effective at improving receipt of immunizations and show consistent but moderate effectiveness at improving the use of cancer screening services.

4. Patient education is consistently less effective than organizational change and reminders. The effect of patient education, while still significant, is modest.

5. Feedback is of limited, if any, effectiveness.

6. Mass mailings by PROs to improve influenza immunizations have been shown to produce clinically trivial effects when unaccompanied by other interventions.

7. Multiple interventions are more effective than single interventions, although highly successful single interventions exist. Adding organizational change or reminders to an "average" intervention produces the greatest increase in effectiveness. However, the relative cost effectiveness of adding interventions has not been established.

8. Computer-assisted provider reminders are more cost-effective than patient reminders in the few studies that have addressed this issue.

9. There are insufficient data to draw conclusions about which interventions are most effective for special populations, geographic settings, or delivery systems.

10. There are insufficient data to draw conclusions about the effect of pre-intervention rates, intensity of interventions, or other factors in determining the success of interventions.

RECOMMENDATIONS

1. No intervention is consistently effective for all services and all settings (i.e., there is no "magic bullet"). To be most effective, interventions should address the barriers to obtaining clinical preventive services that are specific to the service and the local setting, and they should take into account the cost and difficulty of implementation.

2. Many interventions increase the receipt of immunizations: organizational change, provider and patient reminders, provider and patient financial incentives, and provider and patient education. Although all these interventions are effective at improving immunization rates, some are more successful than others. Therefore, the subsequent recommendations reflect these differences:

   - Standing orders (which we classify as a type of organizational change) should be implemented in any clinical setting in which they are applicable, such as hospitals, nursing homes, and clinics. This intervention is likely to be both low cost and very effective.

   - Patient reminders or provider reminders should be implemented in any setting in which standing orders cannot be implemented. Patient reminders that are personalized or signed by the patient's doctor appear to be more effective than generic reminders. Patient reminders have a low estimated cost ($1 to $5) per unit, while the cost of provider reminders is likely to be very dependent upon the state of the available information technology system. When a computerized information technology system is available, computerized provider reminders have been consistently more cost-effective than patient reminders.

   - Mass mailings of post cards, letters, and brochures by Peer Review Organizations have been shown to produce clinically trivial effects on influenza immunization rates when unaccompanied by other interventions. Therefore, this approach should be abandoned.

3. Many interventions improve rates for cancer screening. Some interventions are consistently more effective than others, and the subsequent recommendations reflect these differences:

   - Organizational change is consistently one of the most effective interventions for improving cancer screening, and should be implemented whenever possible. However, there is insufficient evidence to recommend as superior any particular organizational change. Examples of successful organizational change include:
     - The use of a "prevention team" that included nurse standing orders for mammography
     - The use of nurses to distribute kits and instruct patients in the completion of fecal occult blood testing
     - The use of a health educator to contact patients via telephone to offer barrier counseling and/or assist in appointment scheduling for cervical cancer screening.
   - Patient reminders and provider reminders are effective at increasing the use of cancer screening and either one should be implemented in any setting in which organizational change cannot be implemented. Patient reminders that are personalized or signed by the patient's doctor appear to be modestly more effective than generic reminders. Patient reminders have a low estimated cost ($1 to $5) per unit, while the cost of provider reminders is likely to be very dependent upon the state of the available information technology system. When a computerized information technology system is available, computerized provider reminders have been consistently more cost-effective than patient reminders.
   - Provider education is moderately effective at increasing the use of cancer screening, and it should be considered in any situation in which organizational change and/or reminders cannot be implemented. Provider education receives a lower recommendation than patient reminders or provider reminders based both on the evidence of its lower efficacy and its likely expense.

4. In general, patient education and provider feedback are not as effective as other interventions for most screening and preventive services; therefore, they should not be the first choice for intervention.

5. Multiple interventions should, on average, produce greater effectiveness than single interventions, although the incremental cost-effectiveness of adding interventions remains unknown.

EVIDENCE REPORT

INTRODUCTION

The proportion of the U.S. population over age 65 has increased from 5% in 1900 to 13% in 1997. This change in demographics, combined with an increase in average life expectancy, has highlighted the importance of preventive care services for older individuals (Rowe, 1999). For example, in 1993, the five most common causes of mortality among patients age 65 and over were heart disease, cancer, cerebrovascular diseases, chronic obstructive pulmonary disease, and pneumonia and influenza, all of which are potentially preventable (CDC, 1996). Early detection and treatment can improve the health of patients with many of these conditions and potentially decrease health care costs. Similarly, appropriate immunizations can prevent several of these conditions from occurring, or render the disease less severe. To help determine the best strategies for early detection and prevention of some of these conditions, the Health Care Financing Administration (HCFA) has commissioned this project to assess interventions designed to improve influenza and pneumococcal immunization rates, mammography rates, cervical smear cytology rates, and colon cancer screening rates.

INFLUENZA IMMUNIZATION

Influenza and consequent respiratory diseases are common causes of morbidity and mortality in the United States each year, with 20,000 to 40,000 deaths reported for each influenza epidemic. Over 90% of these deaths occur among those age 65 or older (Centers for Disease Control and Prevention, 1996). Influenza vaccination has been shown to be efficacious in the elderly, decreasing hospitalizations by 27% to 57% (Nichol, 1994) and deaths by 27% to 30% (Fedson, 1993).

PNEUMOCOCCAL VACCINATION

Pneumococcal infection is common in the United States, accounting for 15% of severe community-acquired pneumonia (US Preventive Services Task Force, 1996).

Invasive pneumococcal infection has a mortality rate of over 30% in elders (Haglund, 1993; Wenger,1990; Breiman, 1990; Bennett, 1992; Jette, 1989). Case control and epidemiological studies have shown that pneumococcal vaccination has an aggregate efficacy of approximately 55% to 70% for preventing pneumococcal infection in elderly persons (American College of Physicians, 1994). The newer 23-valent vaccine may prove to be even more effective in this population.

MAMMOGRAPHY

Approximately one-third of newly diagnosed cancers in American women consists of cancers of the breast. In 1995 alone, there were 182,000 new breast cancer cases, and 46,000 deaths attributable to breast cancer (Wingo, 1995).

Slightly less than half of all new breast cancer cases, but slightly more than half of breast cancer deaths, occur among women age 65 or older (Ries, 1994). Although routine mammography has been shown to decrease breast cancer mortality among women over age 50 by 20% to 30% (U.S. Preventive Services Task Force, 1996), only slightly more than half (58%) of women age 55 or older have ever received a mammogram (Ruchlin, 1997).

Three trials have specifically addressed the effectiveness of mammography in older women (i.e., those aged 70 to 74). Two of them found that mammography screening reduced breast cancer mortality (Tabar, 1992; Morrison, 1988). Although the third study showed no improvement in mortality, only a small number of patients were studied, which produced a large confidence interval (Nystrom, 1993).

CERVICAL SMEAR CYTOLOGY

Cervical smear cytology tests are associated with a 20% to 60% decrease in cervical cancer mortality (Cramer, 1974; Miller, 1976; Anderson, 1988; Johanneson, 1978; Laara, 1987; Boon, 1990; Costa, 1991; Benedet, 1992; Sigurdsson, 1993). Although recent improvements in cervical smear cytology rates have correlated with a decrease in the incidence of advanced cervical cancer in the United States (U.S. Preventive

Services Task Force, 1996), there were still 16,000 new cervical cancer cases and 4,800 deaths attributable to cervical cancer in 1995 (Wingo, 1995).

The U.S. Preventive Services Task Force currently recommends that all women over age 65 receive at least one cervical smear cytology test if they have not received such tests regularly in the past.

COLON CANCER SCREENING

Colorectal cancer accounts for approximately 140,000 new cases of cancer and 55,000 deaths each year, making it the second most common cause of cancer death in the United States (Wingo, 1995). The risk of experiencing colorectal cancer increases with age.

According to Mandel and colleagues (1993), mortality from colorectal cancer decreases by about one-third if lesions are detected early and treatment is initiated. Both fecal occult blood testing and sigmoidoscopy have been shown to be effective in colorectal cancer screening (U.S. Preventive Services Task Force, 1996); therefore, the U.S. Preventive Services Task Force recommends that all individuals over age 65 undergo either fecal occult blood testing or sigmoidoscopy at least once.

METHODS

In this report, we synthesize evidence from the scientific literature on improving the utilization of existing Medicare clinical preventive and screening services among persons age 65 or older. The services under review are mammography for breast cancer screening in women, cervical smear cytology for cervical cancer screening, fecal occult blood or colon visualization for colon cancer screening, influenza vaccination, and pneumococcal vaccination.

We employed the evidence review and synthesis methods of the Southern California Evidence Based Practice Center, an Agency for Health Care Policy and Research-designated center for the systematic review of literature on the evidence for benefits and harms of health care interventions. Our literature review process utilized the following steps:

- develop a conceptual model (also sometimes called an evidence model or a causal pathway (Woolf, 1994))
- identify sources of evidence (in this case, sources of scientific literature)
- identify potential evidence
- evaluate potential evidence for methodologic quality and relevance
- extract study-level variables and results from studies meeting methodologic and clinical criteria
- synthesize the results.

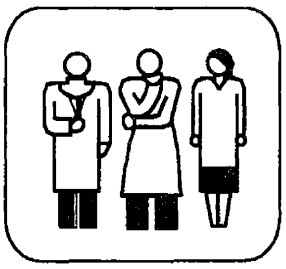
We present descriptions of each step below.

DEVELOPMENT OF CONCEPTUAL MODEL

We initially met with the project's technical experts on behavior change (Jeremy Grimshaw, M.D., from the Health Services Research Unit of the University of Aberdeen and the coordinating editor of the Cochrane Effective Practice and Organization of Care Group; Brian Mittman, Ph.D. and Lisa Rubenstein, M.D., M.S.P.H, both from the Department of Veterans Affairs Center for the Study of Health Care Provider Behavior) to discuss which interventions and study-level variables to extract from the literature. Subsequent discussions between project staff and HCFA concluded that we should review the evidence on the five

screening/vaccination items currently covered by Medicare (e.g., influenza and pneumonia vaccinations, mammography, cervical smear cytology, and colon cancer screening), using a target population of persons over age 65. These discussions further specified the relevant outcomes as receipt of these items by the target population (i.e., the use of screening mammography and the other items was assumed a priori to be efficacious in producing better health outcomes, thereby justifying receipt of the item as a valid measure of outcome).

Using these parameters and input from the technical experts, we developed the project's conceptual model from a larger model produced by the Veterans Administration (VA) Center for the Study of Health Care Provider Behavior Change (Table 1).



Center for the Study of Healthcare Provider Behavior

Table 1. Classification for Interventions That Change Behavior Developed by VA Center for the Study of Provider Behavior

A. Passive dissemination of recommendation

1. Published clinical practice guideline
2. Published clinical recommendation
3. Published research finding
4. Postal mailed clinical practice guideline
5. Postal mailed educational or technical bulletin
6. Postal mailed research finding or alert
7. Internal (organizational) mailed clinical practice guideline
8. Internal (organizational) mailed educational or technical bulleting
9. Internal (organizational mailed) research finding or alert
10. Internal (organizational mailed) organizational policy statement [but see administrative interventions]
11. Clinical practice guideline distributed at an internal (organizational) meeting
12. Organizational/departmental policy statement distributed at an internal (organizational) meeting

B. Education, Opinion Leaders

1. One-session educational lecture, seminar, talk (with or without educational handouts), provided at a national or regional professional meeting; attendees might include known local peers but majority are not local peers
2. One-session educational lecture, seminar, talk (with or without educational handouts), provided at a local professional meeting; attendees are known local peers
3. One-session educational lecture, seminar, talk (with or without educational handouts), provided at a university or other independent institution; attendees might include known local peers
4. One-session educational lecture, seminar, talk (with or without educational handouts), provided within a provider organization (hospital, medical group)
5. Two-session educational lecture, seminar, talk, provided at a university or other independent institution
6. Two-session educational lecture, seminar, talk, provided within a provider organization (hospital, medical group)
7. Three+ session educational lecture, seminar, talk, provided at a university or other independent institution
8. Three+ session educational lecture, seminar, talk, provided within a provider organization (hospital, medical group)

C. Audit/feedback without opinion leader/study group social influence component

1. Mailed distribution of aggregate-level performance data
2. Mailed distribution of individual-level performance data
3. Group-setting distribution of aggregate-level performance data, without discussion

Table 1. Classification for Interventions That Change Behavior Developed by VA Center for the Study of Provider Behavior (continued)

4. Group-setting distribution of individual-level performance data, with peer comparison, without discussion
5. Group-setting distribution of individual-level performance data, without peer comparison, without discussion

D. Audit/feedback with opinion leader/study group social influence component

1. Group-setting distribution of aggregate-level performance data, with opinion leader lecture/presentation discussion
2. Group-setting distribution of aggregate-level performance data, with group (peer) discussion (with or without opinion leader lecture/presentation discussion)
3. Group-setting distribution of individual-level performance data without peer comparison, with opinion leader lecture/presentation discussion
4. Group-setting distribution of individual-level performance data with peer comparison, with opinion leader lecture/presentation discussion
5. Group-setting distribution of individual-level performance data without peer comparison, with group (peer) discussion (with or without opinion leader lecture/presentation discussion)
6. Group-setting distribution of individual-level performance data with peer comparison, with group (peer) discussion (with or without opinion leader lecture/presentation discussion)
7. Individual-setting provision of individual-level performance data without peer comparison
8. Individual-setting provision of individual-level performance data with peer comparison

E. Educational visits/detailing/outreach

1. Detailing visits provided by a known local peer of like discipline
2. Detailing visits provided by a known local individual in a different discipline
3. Detailing visits provided by a non-local individual of like discipline
4. Detailing visits provided by a non-local individual in a different discipline

F. Physician reminders

1. Hard-copy reminders, sent via mail or other general distribution
2. Hard-copy reminders, placed in charts
3. Hard-copy reminders, provided at time of patient visit, other than in charts
4. Computerized reminders, sent via email-general distribution
5. Computerized reminders, provided by electronic charting, other point-of-care/patient bedside manner

Table 1. Classification for Interventions That Change Behavior Developed by VA Center for the Study of Provider Behavior (continued)

G. Organizational quality improvement, redesign (reengineering)

1. Total Quality Management/ Continuos Quality Improvement (TQM/CQI) intervention involving interdisciplinary quality team operating under an organizational quality council with full TQM/CQI process (diagnosis and process-mapping, data collection/analysis, solution formulation, implementation)
2. TQM/CQI intervention with less than full (conventional) process
3. Other system/policy/procedure change (e.g., patient visit protocol including automatic screening/vaccination administered by nurse during vitals/pre-physician encounter phase of visit)

H. Administrative interventions, financial incentives

1. Promulgation of departmental policy without monitoring or incentives/sanctions
2. Promulgation of departmental policy with performance monitoring but no incentives/sanctions
3. Promulgation of departmental policy with performance monitoring and no (explicit) incentives/sanctions
4. Promulgation of departmental policy with performance monitoring and incentives (rewards) for good performance
5. Promulgation of departmental policy with performance monitoring and sanctions for poor performance
6. Promulgation of departmental policy with performance monitoring and incentives and sanctions
7. Payor-provided incentives

I. Patient reminders, incentives

1. Hard-copy reminders, sent via mail or other general distribution
2. Patient financial incentives (reduced/eliminated co-pay; gift)

J. Mass media, other community-level interventions (outside the healthcare provider organization)

1. Mass media publication targeting patients (and providers?)
2. Community-based screening/vaccination programs/events

Under the advice of the technical experts, we reduced the VA model's full classification scheme down to seven broad categories of interventions, or key domains, that could be used to increase utilization of mammograms, cervical smear cytology, colon cancer screening, pneumococcal vaccination, and influenza vaccination among persons age 65 or older:

- reminders
- feedback
- education
- financial incentives
- regulatory and legislative interventions
- organizational change
- media campaigns.

In addition, we categorized the four potential targets of intervention as patient, provider, organization, and community.

The final conceptual model is depicted in Figure 1. A detailed description of each intervention category is presented below.

Reminders. These can be provided verbally, on paper, or on a computer screen. They can be intended to prompt a health professional to recall information or a patient to utilize a service. They can be mailed to patients, placed in charts, or even sent via e-mail to providers.

Feedback. Feedback occurs when a summary of clinical performance over a specified period of time is given to a provider. The summary may include recommendations for clinical action. The information may have been obtained from medical records, computerized databases, or observations from patients. Audit and feedback are often combined with opinion leader counseling of clinicians, and have the potential both to improve clinical knowledge and to create social influences that may improve performance.

Education. Medical education interventions span a broad array of methods for disseminating information to health professionals, including distribution of published or printed recommendations for clinical care, such as clinical practice guidelines, audio-visual materials, and electronic publications. Materials may be delivered personally or through mass mailings. Providers may also attend conferences, workshops, trainings, or lectures. Patients may be educated through pamphlets, peer educators, newsletters, and so forth.

Financial Incentives. Direct or indirect financial reward or benefit can be tied to a specific action on the part of a provider or a patient. For example, patient co-payments may be eliminated or reduced, or gifts can be offered to patients as incentives.

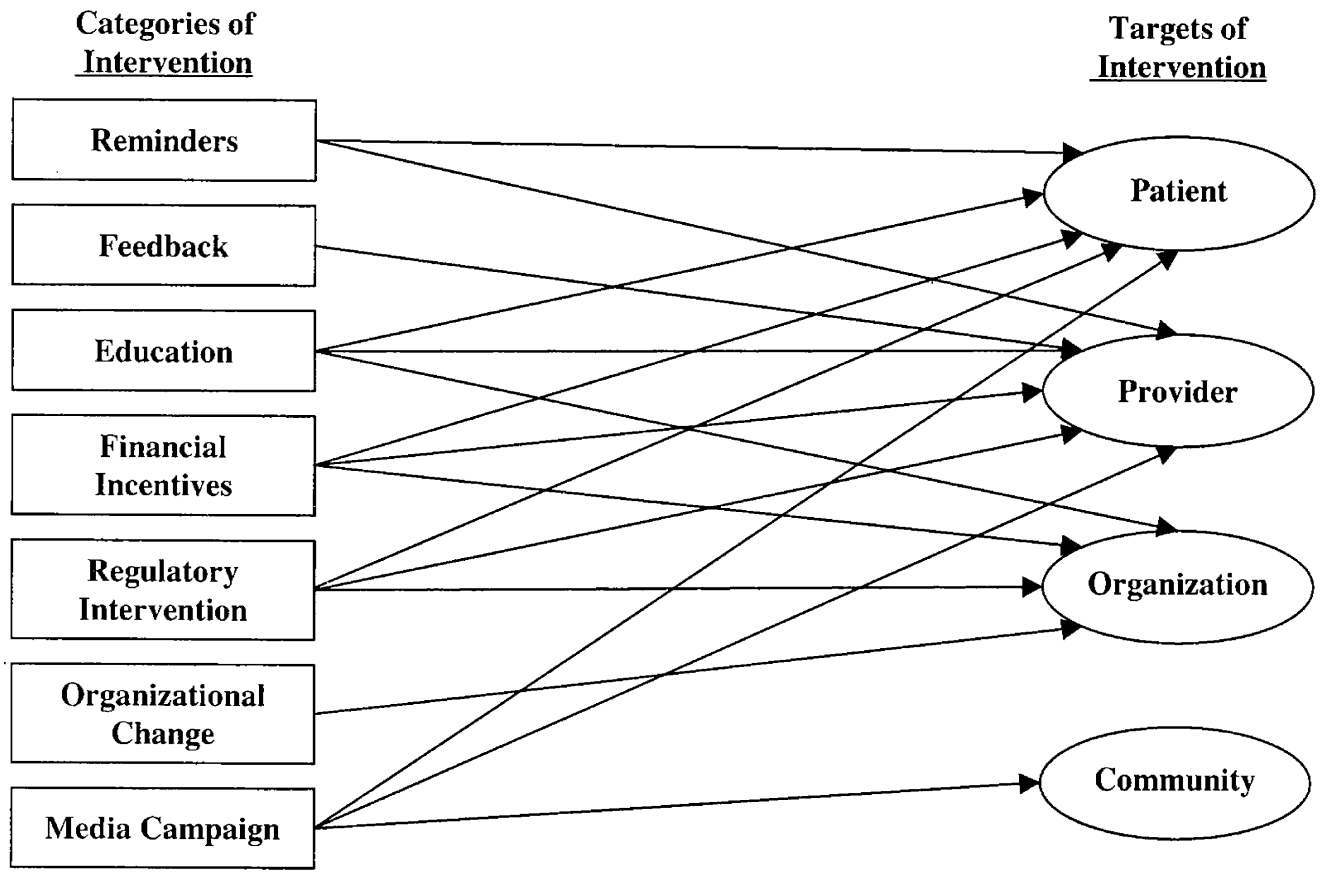
Regulatory & Legislative Interventions. These initiatives are not often viewed as healthcare provider behavior change interventions because they operate at a national or state level, but such initiatives can have significant, if sometimes indirect, influences on provider behavior. Legislative and regulatory initiatives operate by changing the environment and organizations within which providers practice, and by creating new incentives and barriers that shape behavior. Examples include changes in medical liability, licensure requirements, and management of patient complaints.

Organizational Change. We defined organizational change as any change in the process of care at a clinic, program, or hospital specifically designed to improve preventive care services. This definition encompasses adding new personnel with new functions to the process of care, changing the process by which patients obtain services or appointments, changing the role of a current provider, or improving the facilities or infrastructure. Additional examples of organizational change include adding case management (e.g., coordination of assessment, treatment, and arrangement for referrals) and revision of professional roles, such as shifting roles among health care professionals (i.e., from doctors to nurses, psychologists to social workers).

Media Campaigns. Media campaigns use communication that reaches great numbers of people including television, radio, newspapers, posters, leaflets and booklets, alone or in conjunction with other interventions. Campaigns are usually targeted at the population level.

Delivery strategies, such as those listed at the bottom of Figure 1, can significantly affect the success of these interventions. Most of these service delivery elements incorporate widely accepted psychological theory. For example, organizational interventions should have the full support of upper management, and involve teamwork and collaboration between staff levels; media campaigns should have high visual appeal; and educational sessions should use active learning strategies.

Figure 1. Conceptual Model



Factors postulated to increase the effectiveness of any intervention

- Use of Social Influence
- Marketing/Outreach
- High Visual Appeal
- Collaboration/Teamwork
- Theory Based
- Top Management Support
- Active Learning Strategies

IDENTIFICATION OF LITERATURE SOURCES

We used the five sources described below to identify existing research and potentially relevant evidence for this report.

COCHRANE EFFECTIVE PRACTICE AND ORGANIZATION OF CARE (EPOC) DATA BASE

The EPOC is a Cochrane Review Group that focuses on interventions designed to improve professional practice and the delivery of effective health services, such as various forms of continuing education, quality assurance, informatics, and financial, organizational, and regulatory interventions to help health care professionals deliver services more effectively or efficiently. Specific examples of relevant interventions include case management, revision of professional roles, use of multi-disciplinary teams, formularies, and changes in medical record systems. Interventions aimed at changing consumer behavior do not fall within EPOC's scope, unless both professional and patient behavior is affected. The EPOC library is located at the Health Services Research Unit, University of Aberdeen, Scotland.

Like other Cochrane Review Groups, EPOC maintains a database, or register, of published studies that fall within its scope. EPOC developed its register via a sophisticated search and review of relevant Medline articles. Although the Medline search is not yet complete, the EPOC register remains a unique source of studies on changing professional practice. At the time of this search, it contained 673 records of studies, which were either randomized controlled trials (N=423), controlled clinical trials (N=48), controlled before and after studies (N=154) or interrupted time series (N = 48). A reference librarian in Aberdeen searched this register and the Medline years not covered by the EPOC register for articles relevant to this project, using the search strategy outlined in Table 2.

Table 2. EPOC Literature Search Strategy

#epoc strategy - subject terms and methods 20/07/98
exp *education,continuing/
(education$ adj2 (program$ or intervention? or meeting? or session? or strateg$ or workshop? or visit?)).tw.
(behavio?r$ adj2 intervention?).tw.
*pamphlets/
(leaflet? or booklet? or poster or posters).tw.
((written or printed or oral) adj information).tw.
(information$ adj2 campaign).tw.
(education$ adj1 (method? or material?)).tw.
outreach.tw.
((opinion or education$ or influential) adj1 leader?).tw.
facilitator?.tw.
academic detailing.tw.
consensus conference?.tw.
practice guideline?.tw.
(guideline? adj2 (introduc$ or issu$ or impact or effect? or disseminat$ or distribut$)).tw.
((effect? or impact or evaluat$ or introduc$ or compar$) adj2 training program$).tw.
*reminder systems/
reminder?.tw.
(recall adj2 system$).tw.
(prompter? or prompting).tw.
algorithm?.tw.
*feedback/ or feedback.tw.
(feedback adj1 (loop? or control? or regula$ or mechanism? or inhib$ or system? or circuit? or sensory or visual or audi$)).tw
22 not 23
chart review$.tw.
((effect? or impact or records or chart?) adj2 audit).tw.
*patient education/
counsel$.tw.
compliance.tw.
marketing.tw.
exp *reimbursement mechanisms/
fee for service.tw.
*capitation fee/
*"deductibles and coinsurance"/
cost shar$.tw.
(copayment? or co payment?).tw.
(prepay$ or prepaid or prospective payment?).tw.
*hospital charges/
formular$.tw.
fundhold$.tw.
*medicaid/
*medicare/
blue cross.tw.
*nurse clinicians/
*nurse midwives/

Table 2. EPOC Literature Search Strategy
(continued)

*nurse practitioners/
(nurse adj (rehabilitator? or clinician? or practitioner? or midwi$)).tw.
*pharmacists/
clinical pharmacist?.tw.
paramedic?.tw.
*patient care team/
(team adj2 (care or treatment)).tw.
(integrat$ adj2 (care or service?)).tw.
(care adj2 (coordinat$ or program$ or continuity)).tw.
(case adj1 management).tw.
exp *ambulatory care facilities/
*ambulatory care/
*home care services/
*hospices/
*nursing homes/
*office visits/
*day care/
*aftercare/
*community health nursing/
(chang$ adj1 location?).tw.
domiciliary.tw.
(home adj1 treat$).tw.
day surgery.tw.
*medical records/
*medical records systems, computerized/
(information adj2 (management or system?)).tw.
*peer review/
*utilization review/
*physician's practice patterns/
quality assurance.tw.
*process assessment/ [health care]
*program evaluation/
*length of stay/
(early adj1 discharg$).tw.
offset.tw.
triage.tw.
near patient testing.tw.
*medical history taking/
*telephone/
(physician patient adj (interaction? or relationship?)).tw.
*health maintenance organizations/
managed care.tw.
(hospital? adj1 merg$).tw.
((standard or usual or routine or regular or traditional or conventional or pattern) adj2 care).tw.
(program$ adj2 (reduc$ or increas$ or decreas$ or chang$ or improv$ or modify$ or monitor$ or care)).tw.
(program$ adj1 (health or care or intervention?)).tw.
((effect? or impact or evaluat$ or introduc$ or compar$) adj2 treatment program$).tw.

Table 2. EPOC Literature Search Strategy (continued)

((effect? or impact or evaluat$ or introduc$ or compar$) adj2 care program$).tw.
((effect? or impact or evaluat$ or introduc$ or compar$) adj2 screening program$).tw.
((effect? or impact or evaluat$ or introduc$ or compara$) adj2 prevent$ program$).tw.
(computer$ adj2 (dosage or dosing or diagnosis or therapy or decision?)).tw.
((introduc$ or impact or effect? or implement$ or computer$) adj2 protocol?).tw.
((effect? or impact or introduc$) adj2 (legislation or regulations)).tw.
or/1-21, 24-98
randomized controlled trial.pt.
controlled clinical trial.pt.
intervention studies/
experiment$.tw.
(time adj series).tw.
(pre test or pretest or (posttest or post test)).tw.
random allocation/
impact.tw.
intervention?.tw.
chang$.tw.
evaluation studies/
evaluat$.tw.
effect?.tw.
comparative studies/
animal/
human/
114 not 115
or/100-113
117 not 116
99 and 118

The titles and abstracts of all studies identified by this search were sent to the Southern California Evidence Based Practice Center for review.

PREVIOUS SYSTEMATIC REVIEWS

In addition to the search described above, Dr. Jeremy Grimshaw of the EPOC identified seven previously completed systematic reviews relevant to this project from his personal files. Each review discusses one or more interventions aimed at increasing utilization of health services. Table 3 lists these seven publications.

Table 3. Review Articles

Austin SM, Balas EA, Mitchell JA, Ewigman BG. (1994). Effect of physician reminders on preventive care: Meta-analysis of randomized clinical trials. Paper presented at the Annual Symposium of Computers in Applied Medical Care: 121-124.

Buntinx F, Winkens R, Grol R, Knottnerus JA. (1993). Influencing diagnostic and preventive performance in ambulatory care by feedback and reminders: A review. Family Practice, 10, 219-228.

Grilli R, Freemantle N, Minozzi S, Domenighetti G, Finer D. (1998). Impact of mass media on health services utilisation (Cochrane Review). In: The Cochrane Library, Issue 4. Oxford: Update Software.

Gyorkos TW, Tannenbaum TN, Abrahamowicz M, Bédard L, Carsley J, Franco ED, Delage G, Miller MA, Lamping DL, Grover SA. (1994). Evaluation of the effectiveness of immunization delivery methods. Revue Canadienne de Santé Publique, 85, 14-30.

Mandelblatt J, Kanetsky PA. (1995). Effectiveness of interventions to enhance physician screening for breast cancer. The Journal of Family Practice, 40(2), 162-171.

Shea S, DuMouchel W, Bahamonde L. (1996). A meta-analysis of 16 randomized controlled trials to evaluate computer-based clinical reminder systems for preventive care in the ambulatory setting. Journal of the American Medical Informatics Association, 3(6), 399-409.

Snell JL, Buck EL. (1996). Increasing cancer screening: A meta-analysis. Preventive Medicine, 25, 702-707.

These seven reports utilized the following criteria for identifying and selecting studies for review:

Austin and colleagues (1994) analyzed the use of physician reminders. All trials included in their meta-analysis were conducted in a family or internal medicine clinic and focused on cervical cancer screening and tetanus immunization. The final review consisted of studies that met the following criteria: a) was a randomized controlled clinical trial; b) compared information or utilization management intervention in the

study group with no similar assistance in the control groups; and c) evaluated the change in the process and / or outcome of patient care.

Buntinx and colleagues (1993) studied the effects of feedback and reminders on the performance of doctors with ambulant patients. The authors searched the Medline database electronically for articles published from 1983 to early 1992. They also manually searched FAMLI for articles published from 1980 to 1990. They carefully screened the references of each article they retrieved and obtained additional papers from personal collections and experts in the field. The final review included only randomized studies that examined the effect of various forms of feedback on the performance of doctors relative to guidelines for cervical screening, mammogram referral, detection of occult blood in feces, and vaccination.

Mandelblatt and Kanetsky (1995) analyzed interventions to enhance physician screening for breast cancer. They obtained studies from a Medline search of articles published between January 1980 and April 1993, and they reviewed entries posted to the Current Contents database between November 1992 and April 1993. Bibliographic references in retrieved articles were reviewed for additional citations. The final publication included only concurrent control studies based in the United States.

Shea et al (1996) studied the use of computer-based reminder systems for preventive care in ambulatory settings. They searched the Medline, Nursing and Allied Health, and Health Planning and Administration databases using the key phrase "reminder systems." They subsequently reviewed the reference lists for the 90 articles retrieved through this search; this process identified 28 more articles. The final publication included 16 randomized, controlled studies of computer-based reminder systems for preventive services in ambulatory settings.

Snell and Buck (1996) reviewed the effects of interventions directed at either patients or physicians on screening rates for breast, cervical, and colorectal cancers. They searched the National Library of Medicine database (MeSH) for literature published from 1989 to 1994. Six different searches were performed using combinations of the words mammogram, breast cancer, prevention, health promotion, cancer screening,

intervention, reminder, physician, and patients. They also retrieved relevant references listed in bibliographies.

Gyorkos and colleagues (1994) examined methods of increasing immunization delivery. They searched the Medline and SCISEARCH databases for literature published from 1979 to 1992, and they reviewed the bibliographies of retrieved articles for additional references. They also consulted content experts to identify unpublished documentation. The final publication included only studies that met the following selection criteria: a) restricted the target population to humans from developed countries; b) placed no restriction on the type of outcome measured; c) compared one or more interventions with a control group; and d) was published in French or English.

Grilli et al (1998) analyzed the impact of mass media on health services utilization. They included randomized controlled trials, controlled clinical trials, controlled before and after studies, and interrupted time series studies that met the EPOC criteria (described earlier). To identify relevant studies, they searched the Medline and Embase databases without language or time restriction. The Medline search was based upon the following terms: health promotion (MeSH descriptor); and communications-media (exploded); or journalism (exploded); or advertising (exploded); or propaganda (exploded); or marketing of health services (exploded). The Embase search was based upon the following terms: health promotion (EMTREE descriptor); plus audiovisual-equipment (exploded); or mass communication (exploded); or commercial-phenomena (exploded); or publication (EMTREE descriptor); or patient information (EMTREE descriptor); or visual information (EMTREE descriptor). They also searched the EPOC register, ERIC, and PsychLit.

CENTER FOR QUALITY OF CARE RESEARCH, NETHERLANDS

This center recently completed a systematic review of the literature studying interventions used to improve delivery of preventive services in primary care (Hulscher, 1999). To identify relevant articles, they searched Medline for literature published from 1968 to 1995 using two search strategies. The first search used keywords referring to implementation combined with keywords referring to preventive activities in primary care settings. The second search used the implementation keywords combined with keywords referring to test

ordering behavior, followed by manual selection of studies performed in primary care. They also manually searched the tables of contents of 21 scientific journals, focusing on studies about implementing guidelines and changes. Studies were also identified through the EPOC database described earlier.

They accepted for review any type of professional, organizational, financial, or regulatory intervention aimed at professionals to improve preventive activities. However, their search only included studies published in English, German, or Dutch. The final publication reviewed 58 relevant studies, comprising 86 comparisons between intervention and control groups.

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

The CDC recently summarized the scientific evidence on interventions aimed at increasing population-based vaccination coverage. (It shared a draft copy of the summary with us.) Interventions included increasing community demand for vaccinations, enhancing access to vaccination services, legislating / regulating vaccinations, and provider-based strategies. To develop the summary, the CDC performed electronic searches of the Medline, Embase, PsychLit, CAB Health, and Sociological Abstracts databases. Studies had to meet the following inclusion criteria:

- be published between 1980 and 1995
- address universally recommended adult, adolescent, or childhood vaccinations
- be a primary study (rather than a review)
- take place in an industrialized country
- be written in English
- meet the summary's definition of interventions
- provide information on one or more outcomes related to the analytic frameworks
- compare a group of persons who had been exposed to the intervention with a group who had not been exposed or had been less exposed.

The CDC searches resulted in a total of 99 articles. From these 99 articles, we subsequently selected the all studies relevant to influenza and pneumococcal vaccination for further review.

HEALTH CARE QUALITY IMPROVEMENT PROJECTS (HCQIP)

Each U.S. state and territory is associated with a Medicare Peer Review Organization (PRO) that conducts various research projects. HCFA maintains a database with a narrative description of each research project, called the NPD (Narrative Project Document). An NPD includes the aims, background, quality indicators, collaborators, sampling methods, interventions, measurement, and results of a project.

We searched the NPD database using the following keywords:

- for influenza vaccine – influenza, flu, immunization
- for pneumococcal vaccine – pneumococcal, ppv, immunization
- for mammography – breast, mammography, preventive
- for cervical smear cytology – pap, cervical, cervico
- for colon cancer screening – colitis, colon cancer, polyps, endoscopy, colonoscopy.

This search retrieved 148 NPDs. The majority addressed influenza vaccination; none covered cervical smear cytology. The remainder dealt with pneumoccocal vaccination, mammography, or colon cancer screening.

EVALUATION OF POTENTIAL EVIDENCE

After retrieving articles from the literature sources described above, we then reviewed them against exclusion criteria to determine whether to include them in the evidence synthesis. After consultation with our technical experts (Drs. Mittman, Rubenstein, and Grimshaw), we created a one-page screening review form (Figure 2). The form consists of a series of yes/no questions, formatted into a checklist (with a check meaning "yes"). After evaluation against this checklist, an article was either accepted for further review or rejected. Two physician reviewers, each trained in the critical analysis of scientific literature, independently reviewed each study, abstracted data, and resolved disagreements by consensus. Any disagreements that remained unresolved after discussion between the reviewers were resolved by a third party (Dr. Shekelle or Dr. Stone). Project staff entered data from the checklists into an electronic database used to track all studies as they went through the screening process.

In order to be accepted at this stage, a study had to address one or more of the five services of interest and use one of the following study designs: randomized controlled trial, controlled clinical trial, controlled before and after study, or interrupted time series with adequate data points. While we were primarily searching for data relevant to the Medicare population, we included studies that included data on populations under age 65 at this stage to avoid premature loss of potentially useful data.

We defined the study types according to the EPOC criteria, described below.

Randomized controlled trial (RCT). A trial in which the participants (or other units) are definitely assigned prospectively to one or two (or more) alternative forms of health care, using a process of random allocation (e.g., random number generation, coin flips).

Controlled clinical trial (CCT). A trial in which participants (or other units) are either:

a) definitely assigned prospectively to one or two (or more) alternative forms of health care using a quasi-random allocation method (e.g., alternation, date of birth, patient identifier)

OR

b) possibly assigned prospectively to one or two (or more) alternative forms of health care using a process of random or quasi-random allocation.

Controlled before and after study (CBA). A study in which the intervention and control groups become involved in the study other than by random process, and in which the baseline period of assessment is included in the main outcomes. The EPOC uses these two minimum criteria for including CBAs in its reviews:

a) contemporaneous data collection – data on the pre- and post-intervention periods for the study and control sites are the same

b) appropriate choice of control sites – the study and control sites are comparable with respect to dominant reimbursement system, level of care, setting of care, and academic status.

Interrupted time series (ITS). An ITS study examines data trends and attributes a change in trend to an intervention. Such studies can be either retrospective or prospective. The EPOC uses these two minimum criteria for including ITS designs in its reviews:

a) a clearly defined point in time at which the intervention occurred

b) at least three data points before and three data points after the intervention.

Because of these restrictions on study design, we excluded studies that employed a simple pre/post design. (A simple pre/post study design is one in which an intervention is administered to providers, patients, or communities, and the proportion of persons receiving the service is recorded once before and once after the intervention.) Such a study design has no control group; therefore, it cannot account for temporal effects unrelated to the intervention.

Figure 2. Screening Form

HCFA Healthy Aging
Evidence Report #1

	Unique Article Identification Number																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Service																			
Cervical smear cytology																			
Mammogram																			
Colon Cancer screen																			
Pneumonia vaccine																			
Influenza vaccine																			
Target																			
Provider																			
Patient																			
Community																			
Organization																			
Intervention																			
Education																			
Feedback																			
Financial incentives																			
Reminders																			
Organizational Change																			
Mass media																			
Regulatory Intervention																			
Other intervention																			
Unknown/unclear																			
Country																			
USA																			
Other																			
Study Design																			
RCT																			
CCT																			
CBA																			
ITS																			
Other - Reject																			
Age																			
65 years and older																			
<65 and >=65 years																			

EXTRACTION OF STUDY-LEVEL VARIABLES AND RESULTS

After retrieving relevant articles, we abstracted their data on a specialized form (Figure 3). The form contains questions about the study design; the number and characteristics of the patients; the setting, location, and target of the intervention; the intensity of the intervention; the types of outcome measures; the time from intervention until outcome measurement; and the results. We selected the variables for abstraction with input from the project's technical experts. Two physicians working independently extracted data in duplicate, and resolved disagreements by consensus. Dr. Stone resolved disagreements not resolved by consensus. As a final check Dr. Shekelle reviewed all data on sample size and outcomes which could have entered into the meta-regression analysis.

To evaluate the quality of the study, we collected information on the study design (with the hierarchy of internal validity being RCT, CCT, CBA, and ITS), withdrawal/dropout rate, and agreement between the unit of randomization and the unit of analysis. We did not assess studies for additional criteria with empirical support for their association with bias (blinding and concealment of allocation) (Moher, 1998) because those were not feasible in many studies of these types of interventions. The primary outcome consisted of the proportion of patients who received the service before and after the intervention.

Figure 3. Abstraction Form

HCFA-Healthy Aging
Evidence Report #1

1. Article ID number: ___ ___ ___ ___ ___

2. First Author: ___ ___ ___ ___ ___ ___ ___ ___

3. Reviewer:
   - Preethi 1
   - Walter 2
   - Erin 3
   - Tommy 4
   - Paul 5
   - Michael 6
   - Other 7

4. Date of publication: 1 9 ___ ___

5. Are any vulnerable populations specifically included?

	YES	NO
Persons 85 and older	1	2
African-Americans	1	2
Hispanic	1	2
Other minority populations	1	2
Low-income populations	1	2
Nursing home	1	2
Other	1	

6. Target of the intervention:

	YES	NO
Patients	1	2
Providers	1	2
Organizations	1	2
Community (or other geographic area)	1	2

7. If the target is provider, what best characterizes the provider type?

	YES	NO
Physicians	1	2
Nurses	1	2
Allied health professionals	1	2
Other _____	1	
Not Applicable	1	

Figure 3. Abstraction Form (continued)

8. What best characterizes the setting of the intervention?

   Academic setting 1
   Non-Academic setting 2
   Both academic and
   Non-academic setting 3
   Not sure 4
   Not applicable 9

9. What best characterizes the geographic setting of the intervention?

   Mainly rural 1
   Mainly urban/suburban 2
   Mixed rural/urban/suburban 3
   Not sure 4

10. In what health-care practice settings did the intervention occur?

    Hospital 1
    Outpatient 2
    Both hospital and outpatient 3
    Nursing home 4
    Not applicable 9

11. What best describes the reimbursement system of the care in which the intervention occurred?

    Fee-for-service 1
    HMO 2
    Managed care, not HMO 3
    Mixed reimbursement
    systems 4
    Other _____ 5
    Not applicable 9

Figure 3. Abstraction Form (continued)

13. What best characterizes the intervention? Check all that apply.

	Groups			
Description of intervention	**1**	**2**	**3**	**4**
Control/No Intervention/Usual Care				
I. Education without detailing/outreach • Provider				
• Patient				
II. Educational visit with detailing/outreach				
III. Feedback				
IV. Financial/administrative intervention or incentives: • Provider				
• Organization				
• Patient				
V. Reminders • Provider				
• Patient				
VI. Organizational change, quality improvement, redesign/reengineering				
VII. Mass Media, other community-level interventions				
VIII. Regulatory • Provider				
• Organization				
• Patient				

14. Does the intervention also include any of the following?

	Groups			
Feature that fosters intervention success	**1**	**2**	**3**	**4**
Use of social influence, including opinion-leader involvement				
Marketing/outreach				
High visual appeal/clarity				
Collaboration, teamwork				
Design based on needs, barriers, incentives assessments OR Well-established social science theory.				
Top management buy-in and support				
Active learning strategies				

Figure 3. Abstraction Form (continued)

15.

Group 1

Description of intervention	Intensity	Duration	# times	Medium	Content
Control/No Intervention/Usual Care					
I. Education without detailing/outreach					
• Provider					
• Patient					
II. Educational visit with detailing/outreach					
III. Feedback					
IV. Financial/administrative intervention or incentives:					
• Provider					
• Organization					
• Patient					
V. Reminders					
• Provider					
• Patient					
VI. Organizational change, quality improvement, redesign/reengineering					
VII. Mass Media, other community-level interventions					
VIII. Regulatory					
• Provider					
• Organization					
• Patient					

Group 2

Description of intervention	Intensity	Duration	# times	Medium	Content
Control/No Intervention/Usual Care					
I. Education without detailing/outreach					
• Provider					
• Patient					
II. Educational visit with detailing/outreach					
III. Feedback					
IV. Financial/administrative intervention or incentives:					
• Provider					
• Organization					
• Patient					
V. Reminders					
• Provider					
• Patient					
VI. Organizational change, quality improvement, redesign/reengineering					
VII. Mass Media, other community-level interventions					
VIII. Regulatory					
• Provider					
• Organization					
• Patient					

Figure 3. Abstraction Form (continued)

Group 3

Description of intervention	Intensity	Duration	# times	Medium	Content
Control/No Intervention/Usual Care					
I. Education without detailing/outreach					
• Provider					
• Patient					
II. Educational visit with detailing/outreach					
III. Feedback					
IV. Financial/administrative intervention or incentives:					
• Provider					
• Organization					
• Patient					
V. Reminders					
• Provider					
• Patient					
VI. Organizational change, quality improvement, redesign/reengineering					
VII. Mass Media, other community-level interventions					
VIII. Regulatory					
• Provider					
• Organization					
• Patient					

Group 4

Description of intervention	Intensity	Duration	# times	Medium	Content
Control/No Intervention/Usual Care					
I. Education without detailing/outreach					
• Provider					
• Patient					
II. Educational visit with detailing/outreach					
III. Feedback					
IV. Financial/administrative intervention or incentives:					
• Provider					
• Organization					
• Patient					
V. Reminders					
• Provider					
• Patient					
VI. Organizational change, quality improvement, redesign/reengineering					
VII. Mass Media, other community-level interventions					
VIII. Regulatory					
• Provider					
• Organization					
• Patient					

Figure 3. Abstraction Form (continued)

16. How many analyzed units were enrolled and followed up in...

Group 1	Entered	___ ___ ___ ___ ___
	Followed	___ ___ ___ ___ ___
Group 2	Entered	___ ___ ___ ___ ___
	Followed	___ ___ ___ ___ ___
Group 3	Entered	___ ___ ___ ___ ___
	Followed	___ ___ ___ ___ ___
Group 4	Entered	___ ___ ___ ___ ___
	Followed	___ ___ ___ ___ ___

17. What was the unit of allocation?

Patient	1
Provider	2
Organization	3
Community or geographic area	4
Not applicable	9

18. What was the unit of analysis?

Patient	1
Provider	2
Organization	3
Community or geographic area	4
Not applicable	9

19. If the unit of allocation and the unit of analysis are not the same, was any statistical correction made for clustering?

Yes	2
No	2
Not applicable	9

20. Was there a sample-size justification or power calculation?

Yes	1
No	2

21. What outcomes were measured?

Proportions	1
Other	2

Figure 3. Abstraction Form (continued)

22. When were the outcomes measured relative to after the start of the intervention?

___ ___ ___ weeks

23. Costs analyzed? ..... Y / N **(If Yes, give to Erin)**

24. Describe the outcomes: **(If not a proportion, give to Erin)**

Mammogram

	Proportion (%) before intervention	Proportion (%) after intervention	p-value	Comparison group
Group 1	___ ___ . ___	___ ___ ___ . ___	___ . ___ ___ ___	___
			___ . ___ ___ ___	___
Group 2	___ ___ . ___	___ ___ ___ . ___	___ . ___ ___ ___	___
			___ . ___ ___ ___	___
Group 3	___ ___ . ___	___ ___ ___ . ___	___ . ___ ___ ___	___
			___ . ___ ___ ___	___
Group 4	___ ___ . ___	___ ___ ___ . ___	___ . ___ ___ ___	___
			___ . ___ ___ ___	___

Cervical smear cytology

	Proportion (%) before intervention	Proportion (%) after intervention	p-value	Comparison group
Group 1	___ ___ . ___	___ ___ ___ . ___	___ . ___ ___ ___	___
			___ . ___ ___ ___	___
Group 2	___ ___ . ___	___ ___ ___ . ___	___ . ___ ___ ___	___
			___ . ___ ___ ___	___
Group 3	___ ___ . ___	___ ___ ___ . ___	___ . ___ ___ ___	___
			___ . ___ ___ ___	___
Group 4	___ ___ . ___	___ ___ ___ . ___	___ . ___ ___ ___	___
			___ . ___ ___ ___	___

Figure 3. Abstraction Form (continued)

Colon Cancer Screen (FOBT)

	Proportion (%) before intervention	Proportion (%) after intervention	p-value	Comparison group
Group 1				
Group 2				
Group 3				
Group 4				

Colon Cancer Screen (colon visualization)

	Proportion (%) before intervention	Proportion (%) after intervention	p-value	Comparison group
Group 1				
Group 2				
Group 3				
Group 4				

Figure 3. Abstraction Form (continued)

Flu Shot

	Proportion (%) before intervention	Proportion (%) after intervention	p-value	Comparison group
Group 1				
Group 2				
Group 3				
Group 4				

Pneumococcal Vaccine

	Proportion (%) before intervention	Proportion (%) after intervention	p-value	Comparison group
Group 1				
Group 2				
Group 3				
Group 4				

Figure 3. Abstraction Form (continued)

Additional instructions

Intensity: Length of time in minutes for each unit of intervention, e.g. 60 minute educational session, 1 minute TV spot, 5 minute educational visit with detailing.

Duration: Length of time in days from start of intervention to end of intervention, e.g. TV spots ran for 15 days, educational session occurred only once (1 day), reminders started June 1 and ended June 30 (30 days).

Number of units of intervention: Number of times the intervention occurred for each target, e.g. 1 educational session each week for 5 weeks for each provider (5 units), 2 reminders sent to each patient (2 units), 1 brochure given to each patient (1 unit).

Medium/Delivery vehicle of intervention. Write down number(s) from list below (3 numbers max):

1. In person
2. By telephone
3. In group
4. Radio
5. TV
6. ---
7. Electronic
8. ---
9. ---
10. Poster
11. Mail
12. Other
13. Printed material (e.g. newsprint, brochure, computer printout)

Content: Was there mention that the content was tailored to the audience (e.g. large print, 6th grade level writing, etc)? Write Y for Yes and N for No.

EXPERT PANEL REVIEW OF EVIDENCE REPORT

We presented the draft evidence report to a panel of experts (Table 4) for feedback and discussion on March 17, 1999 at a meeting organized by the Partnership for Prevention. During this meeting we reviewed our methods and preliminary results.

In the draft report, we had restricted our sample to studies that presented data on individuals age 65 or over. Because of this restriction, we only had enough studies to perform meta-regression analyses for influenza vaccination. The expert panelists recommended that we increase our sample size so that we could perform additional quantitative analyses. They suggested that we do so by going back to the literature and including all studies of adult populations (i.e., studies that examined patients under age 65), under the assumption that the age of the study population would have minimal or no impact on the effectiveness of interventions. They also suggested that we contact managed care organizations to determine whether there was additional, unpublished information available that met our eligibility criteria.

In addition, the expert panelists recommended that we combine the interventions for pneumonia vaccination and influenza vaccination into a single analysis because such interventions were unlikely to differ in their clinical effectiveness. They also suggested that we perform analyses that would examine the interventions as a function of the year the intervention was attempted, the baseline rate of the procedure prior to the intervention, and the intensity of the intervention.

Table 4. Expert Panel

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Medicine and Gerontology
Johns Hopkins Geriatric Center
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Ned Calonge, MD, MPH
Director, Geriatric Medicine and Gerentology
Johns Hopkins Bayview Medical Center

Gary Dennis, MD, FAACS
President, National Medical Association

Marge Drugay, ND, RN, C
Drugay and Associates

Jonathan Fielding, MD, MPH, MBA
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Lisa Foley, JD
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Jessie C. Gruman, PhD
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William Kavesh, MD, MPH
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Russell Morgan, DrPH
President, SPRY Foundation

Don Nielsen, MD
Senior VP for Quality Leadership
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Michael Rosnick, MD
Medical Director, HMA Health Plan

Randolph D. Smoak, Jr., MD
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Kurt C. Stange, MD, PhD
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Jan Towers, PhD, NP-C, CRNP
Director of Government Affairs, Practice
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American Academy of Nurse Practitioners

Steven H. Woolf, MD, MPH
Professor of Family Medicine
Medical College of Virginia
Virginia Commonwealth University

William L. Roper, MD, MPH
Chairman, Partnership for Prevention
Dean, School of Public Health
University of North Carolina @ Chapel Hill
(Expert Panel Chair)

Disclaimer: Participation as an Expert Panelist does not indicate consensus with the recommendations of this evidence report.

STATISTICAL METHODS

Prior to our analysis, we entered all data on outcomes and interventions into the statistical package SAS. In the analysis itself, we sought to answer the following questions:

1. What is the absolute effectiveness of each intervention in improving the use of clinical preventive and screening services?
2. What is the relative effectiveness of each intervention in improving the use of clinical preventive and screening services?
3. How do important covariates, such as the target population (e.g. low income or other vulnerable populations) or the setting in which the intervention is applied (e.g., academic versus non-academic practice and managed care versus fee-for-service systems), impact the effectiveness of the interventions?
4. What is the relative cost effectiveness of each intervention in increasing the use of clinical preventive and screening services?
5. What elements appear to be instrumental in determining the success of each intervention?

META-REGRESSION ANALYSIS

We first retrieved all studies that assessed the effects of an intervention or interventions relative to either a group that received usual care or to a control group. We then fit a series of meta-regressions to these studies (Struck, 1993). The basic data matrix for the meta-regressions was as follows. Each study with a single intervention arm contributed four observations corresponding to the cells of a two-by-two table of treatment by outcome (control and intervention cases that received the preventive or screening service; control and intervention cases that did not) to a weighted logistic regression that predicted receipt of the preventive or screening service or not. An observation's weight was equal to the number of individuals belonging to the corresponding cell. Studies which had more than one intervention contributed an additional pair of observations (those who did not and those who did receive the service in the intervention group respectively) for each additional intervention. For example, a study that had three intervention arms contributed eight

observations to the meta-regression, two for the control group, two for the first intervention, two for the second intervention, and two for the third intervention.

To assess the statistical significance of each type of intervention, or of the interaction between treatment and a particular covariate of interest, for example whether intervening worked better for particular subpopulations, we constructed specific models that contained both an intervention component indicator or specific covariate by treatment interaction indicator, and indicator variables for each study. The inclusion of study indicators controlled for all measured study characteristics and all unmeasured ones, and is akin to fitting a fixed effects model. Each model produced odds ratios for covariates of interest that are adjusted for all measured and unmeasured study level differences. We present both adjusted odds ratios versus control or usual care, and versus the "average" intervention across all studies as explained below.

QUESTION 1: ABSOLUTE EFFECTIVENESS OF EACH INTERVENTION

To assess the absolute effectiveness of each intervention, we categorized each intervention as to which intervention components it contained. For example, one intervention might contain both patient reminders and provider reminders while another had patient financial incentives and organizational change. An overall treatment indicator and individual intervention component indicators were constructed. For example, if an intervention contained both patient and provider reminders, the associated dummy variables for these components were set equal to one for the pair of observations corresponding to that intervention arm and were zero otherwise. In addition, the overall treatment indicator was set equal to one for all intervention observations. Thus the data matrix consisted of an overall treatment indicator, indicator variables for all intervention components that had sufficient number of observations to be included in the model, and study level indicators as discussed above to control for all measured and unmeasured study level differences.

The outcome of this model is twofold. First, odds ratios for the effectiveness of each intervention component at improving the use of clinical and preventive services as compared to the control or usual care situation and adjusted for all other effects are produced. For example, we estimate the odds ratio of the effect of patient

reminders as compared to the control or usual care situation on the use of services, and provide a 95% confidence interval for that estimate. Second, the marginal effect of each intervention component as compared with the "average" intervention across all interventions in our study that do not contain that particular component can be estimated. These latter results are relevant for our second research question and will be discussed in its context below. The two sets of odds ratios are also related mathematically as will be explained below.

We ran separate models for each of the following preventive and screening services:

- immunization (this model combined studies for both influenza vaccination and pneumococcal vaccination)
- screening mammography
- cervical smear cytology screening.
- fecal occult blood testing (for colon cancer screening)

We were unable to perform a meta-regression analysis on the use of colon visualization (i.e., sigmoidoscopy, colonoscopy, or barium enema) due to the insufficient number of studies on this topic.

QUESTION 2: RELATIVE EFFECTIVENESS OF EACH INTERVENTION

We identified two possible sources of information for determining the relative effectiveness of the interventions: direct evidence, which consisted of eligible studies that directly compared interventions to one another, and indirect evidence, which consisted of results from the meta-regression models described above. The direct evidence was limited because few studies met our criteria, and those that did usually performed the comparisons of interest only once. Hence, there was generally only a single data point available. Furthermore, the paucity of such studies made interpretation of the effects of the intervention difficult due to the presence of other covariates. For example, the sole study of a particular intervention versus another may have taken place only in an HMO setting among non-elderly adults. To infer that this relationship between the interventions would be similar in a fee-for-service situation is not supportable.

Our analysis of the indirect evidence for the relative effectiveness of the interventions consisted of assessing the results of the meta-regressions discussed above in two ways. First, we compared the adjusted odds ratio of effectiveness for individual interventions versus control. Second, we calculated the adjusted odds ratio for the marginal effect of an intervention component versus the "average" intervention across all studies that did not contain that intervention component.

To clarify the analysis discussion, we use the mammogram intervention meta-regression model as an example. A simple meta-regression containing just a treatment indicator and study level indicator variables produces an estimated treatment odds ratio as compared to the control or usual care group of 1.67 with a 95% confidence interval of (1.57, 1.77). The intervention model contains the overall treatment indicator and as many of the seven intervention component indicators for provider education, patient education, feedback, patient financial incentives, provider reminders, patient reminders, and organizational change as sample size allowed. In effect this model is parceling out the 1.67 odds ratio across these intervention components. The odds ratio for patient reminders versus the control or usual care setting is 2.57, and is 3.57 for patient financial incentives. We note in comparison that the intervention with the lowest odds ratio is patient education at 1.31, and see that the overall treatment odds of 1.67 is in the middle of the distribution of individual intervention component effects. Interpreting these odds, we can conclude that an intervention group with patient reminders has 2.57 times the odds of a group subject to no intervention or usual care of receiving the service. In contrast, patient financial incentives will increase the odds of receiving the service by a factor of 3.57. The marginal odds ratio of patient reminders versus the "average" intervention without patient reminders across all the studies is 1.31, and the marginal odds ratio for patient financial incentives is 1.81. So adding either of these intervention components to an "average" intervention that does not contain the particular component increases the odds of receiving the service. We note that the ratio of the odds versus control (2.57/3.57=0.72) equals the ratio of the marginal odds ratios (1.31/1.81=0.72) as expected.

In addition to considering the marginal effectiveness of each intervention component, we determined the treatment effect of an intervention consisting of a single component versus an intervention consisting of many

components. To do so, in each service setting, we fit a simple meta-regression that contained an overall treatment indicator equaling one for all intervention observations and zero otherwise, a multiple intervention treatment indicator equaling one for all intervention observations that had multiple components and zero otherwise, and study level indicators to control for all measured and unmeasured study level differences. For these meta-regressions, we present both the odds ratios for single and multiple component interventions versus the control or usual care setting, and the marginal odds ratio of adding additional components to an "average" intervention with a single component.

QUESTION 3: IMPORTANT COVARIATES

To assess the impact of important covariates on the effectiveness of the interventions, we again turned to two sources of information: direct evidence and indirect evidence. We defined direct evidence as all studies that assessed the effectiveness of an intervention, stratified by the covariate of interest. (For example, the effectiveness of an intervention in an HMO setting versus a fee-for-service setting, or the effectiveness of an intervention among a low income population versus a non-low income population) However, we were unable to identify any such studies given the level of detail in our data collection.

We initially defined indirect evidence to be the results of meta-regression analysis that examined the covariates of interest in a covariate by intervention interaction. For example, we hoped to answer how well patient reminders worked for low income patients as compared to how well patient reminders worked for non-low income patients. However, there were too few studies to allow us to enter covariates into our model in this fashion. Therefore, we were limited to assessing the effect of the covariate by treatment across all interventions within a particular service (such as screening mammography or immunizations). Even with this modification, we found there were too few data to develop a model for most covariates and services. However, for each service and for those covariates for which adequate sample size existed, we fit a series of simple meta-regressions with just an overall treatment indicator and a covariate by treatment interaction dummy. These models are similar to those fit to determine the effectiveness of multiple component

intervention as opposed to single component intervention discussed in the context of the second research question above. For example, in the mammogram studies, we fit a meta-regression with an overall treatment indicator and an indicator variable that equaled one for all intervention observations that were part of studies of low income patients. The results indicate how well the treatment works in studies that focused on low income settings as compared to ones that did not.

QUESTION 4: COST EFFECTIVENESS

To assess the cost effectiveness of the interventions, we first determined whether each study presented cost data. Ideally, we would be able to derive direct evidence of cost effectiveness from studies that compared interventions head-to-head for both effectiveness and cost. As we noted above, however, few studies performed more than one comparison of effectiveness, which made drawing generalizations problematic. The number of such studies that reported costs was even fewer. Therefore, we were not able to perform quantitative analyses on cost effectiveness and chose to summarize these studies qualitatively instead.

QUESTION 5: ELEMENTS INSTRUMENTAL TO THE SUCCESS OF EACH INTERVENTION

To identify which elements appeared to be instrumental in determining the success of the interventions, we assessed each study for the factors postulated to increase the effectiveness of any intervention, as shown in our conceptual model (Figure 1). These factors included use of social influence/ opinion leader involvement; marketing/outreach; high visual appeal/ clarity; collaboration/ teamwork; design based on needs, barriers, incentives, assessments or theory; top management support; and active learning strategies. We extracted data on the intensity of the intervention and the underlying screening or preventive service rate in the population. This underlying rate is often estimated by the control or usual source of care group rate. To assess the effects of these factors, our goal was to conduct a meta-regression analysis similar to that outlined above for the first three research questions.

Regarding the intervention factors postulated to increase the effectiveness of any intervention, we fit meta-regression models for each screening setting that were similar in form to the intervention component

regressions discussed above with respect to the first research question. Our models contained an overall treatment indicator, indicator variables for each intervention factor which equaled one if the intervention contained that factor and zero otherwise, and study level indicators to control for measured and unmeasured differences across the studies. The results of these models, specifically the odds ratios versus control and the marginal odds ratios, are interpreted in the same manner as discussed above.

Unfortunately, data limitations curtailed our work in the intensity and control rate investigations. We fit some preliminary models in both settings that were similar to the covariate by treatment models discussed in the context of the third research question above. For example, in the mammogram setting, we fit a regression with an overall treatment indicator and then treatment by control rate categories (less than 20%; 20-40%; 40-60%; greater than 60%), with these categories chosen based on both clinical expertise and the empirical distribution of rates observed across studies. Unfortunately, a large number of studies were missing data, and necessitated that a missing category be included in the model. We conducted a sensitivity analysis of various methods to impute the missing data. However, the results from this analysis were counter-intuitive. We had expected that the treatment effect would decrease as the underlying population use of services increased, as the intervention could not improve an already high service rate much. We did not observe this to be the case, nor were the results in any way consistent across the different service settings. Analogous problems were encountered in the intensity analyses. The large amount of unreported data, and the difficulty of transforming different intensity metrics to a common scale were insurmountable.

RESULTS

IDENTIFICATION OF EVIDENCE

Figure 4 describes the flow of evidence from the original sources to final acceptance. The EPOC literature searches identified 264 potentially relevant articles, the CDC summary contained 99 articles on immunizations, and the review by Hulscher and colleagues from the Center for Quality of Care Research contained 58 articles. In addition, the systematic reviews identified by Dr. Grimshaw contained a total of 86 references, and the database for the Health Care Quality Improvement Projects yielded 149 potentially relevant Narrative Project Descriptions (NPDs). After eliminating 107 duplicate articles, 549 potentially relevant sources of information remained, which subsequently underwent screening. A Venn diagram describing the original sources of each of these articles is presented in Figure 5. (The "review" articles on this diagram refer to the seven articles that Dr. Grimshaw supplied to the project.) A total of 187 articles, all published between 1979 and 1999, met the screening criteria; these are included in the remaining descriptions and analyses.

DISTRIBUTION OF EVIDENCE

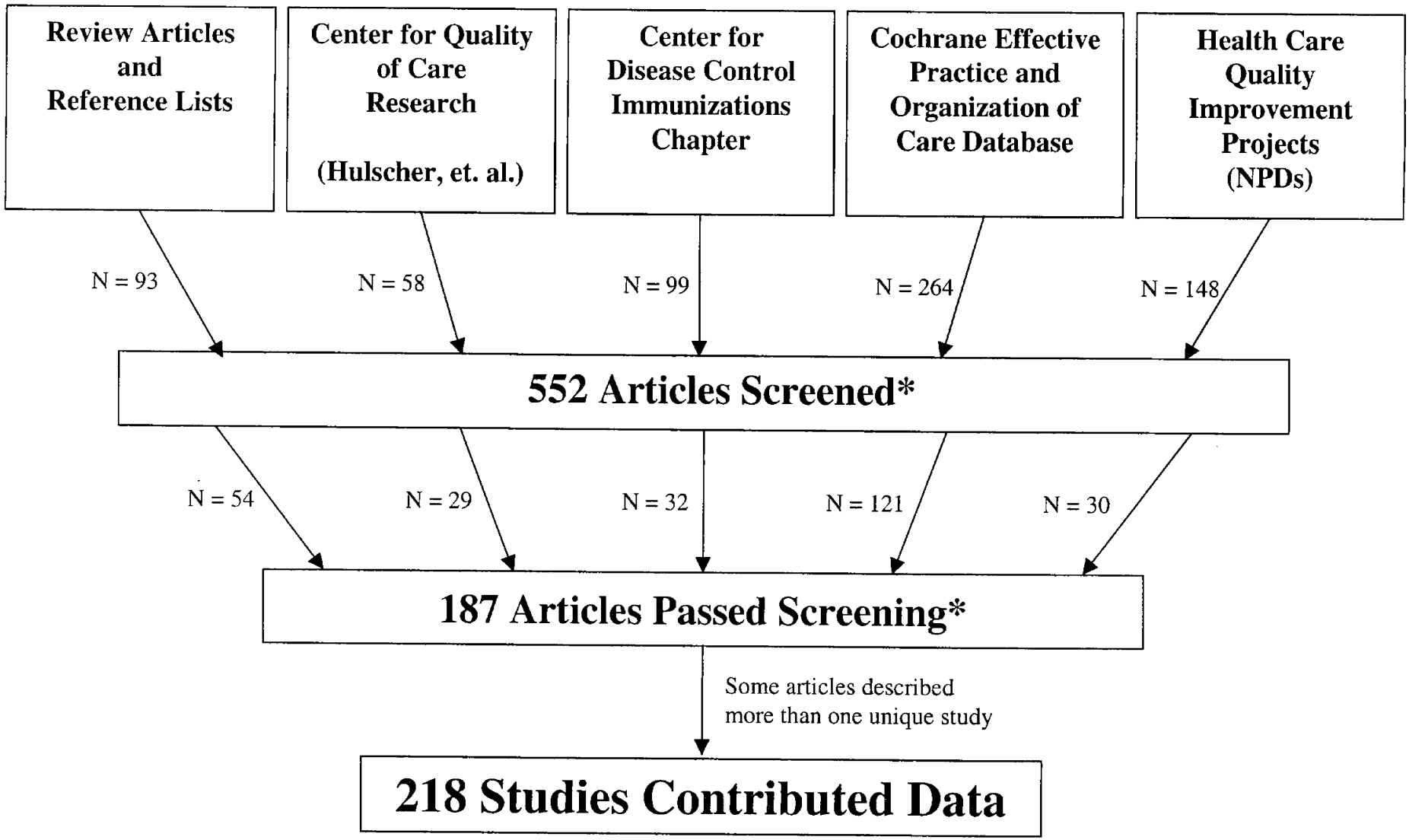
Table 5 presents the 187 studies stratified by service and broad characterization of intervention. Note that some studies addressed more than one service or combined several interventions; therefore, the total sums to more than 187.

The intervention with the greatest number of studies was patient reminders (131 interventions), followed closely by patient education (122 interventions). Eighty-two studies employed provider reminders, while 69 studies used provider education. Once again, these categories were not mutually exclusive. For example, physicians could receive both education and reminders simultaneously in a study. Organizational change/quality improvement, financial/administrative incentives, and media campaigns were studied less frequently than the other interventions.

As is clear from the above numbers, patients were most often the targets of interventions: They were targeted in a total of 179 studies, while 113 studies intervened at the provider level. In almost all of the latter, the provider was a nurse or physician. Thirty-three studies targeted the community, either through mass mailings or media campaigns.

The most-studied procedure was influenza vaccine with 78 interventions reported. Mammography was also studied frequently, with 76 studies passing our review guidelines. In addition, 65 studies on cervical smear cytology, 41 studies on colon cancer screening using the Fecal Occult Blood Test (FOBT), and 18 studies on pneumococcal vaccine met our screening criteria and are included in this report. Only ten studies that met our criteria addressed colon visualization.

Figure 4. Literature Sources



* Because Articles came through more than one source, Ns will not sum to the totals reported in the boxes

Figure 5. Number of Retrieved Articles by Source

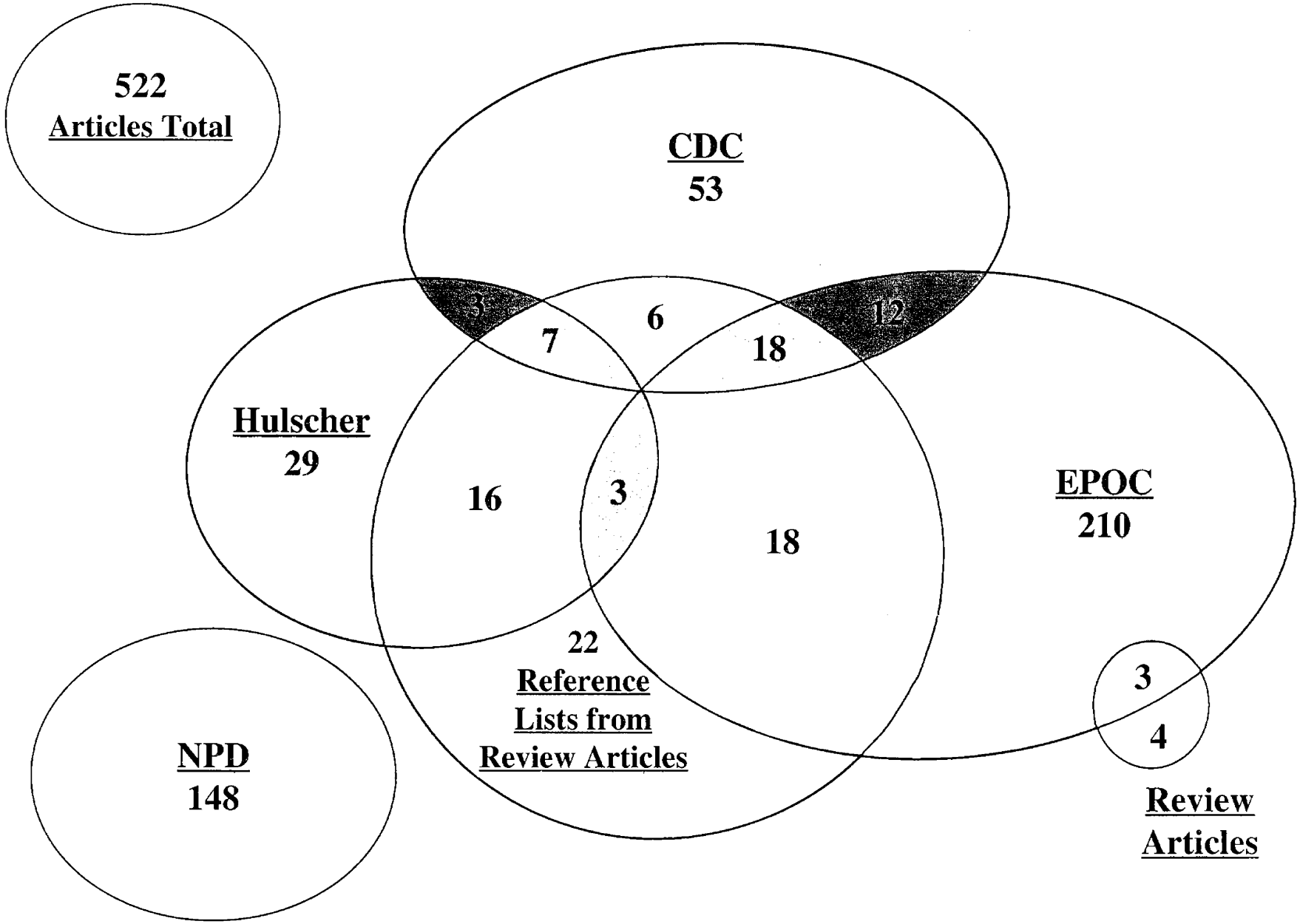


Table 5. Interventions by Service

	Total number of articles	187
Intervention	**Service**	**# of studies***
Educational	Influenza	55
	Pneumonia	10
	Mammogram	70
	Cervical smear cytology	32
	Colon cancer	35
Feedback	Influenza	5
	Pneumonia	2
	Mammogram	9
	Cervical smear cytology	7
	Colon Cancer	6
Financial/administrative intervention or incentives	Influenza	18
	Pneumonia	2
	Mammogram	20
	Cervical smear cytology	5
	Colon Cancer	7
Reminders	Influenza	62
	Pneumonia	13
	Mammogram	74
	Cervical smear cytology	38
	Colon cancer	45
Organizational Change, quality improvement, redesign/reengineering	Influenza	29
	Pneumonia	7
	Mammogram	33
	Cervical smear cytology	12
	Colon Cancer	12
Mass media, other community-level interventions	Influenza	22
	Pneumonia	1
	Mammogram	16
	Cervical smear cytology	2
Regulatory	Influenza	1

* The number of studies in this column will not sum up to the total number of articles, as some articles appear more than once.

DESCRIPTION OF EVIDENCE

The evidence tables in Appendix 1 present descriptive information for each study meeting our acceptance criteria:

- the author, year, country of origin, and study design;
- the age and vulnerable population targeted in the study;
- the target of the intervention (patients, provider type, organizations, communities);
- the study's setting (academic or nonacademic), the geographic setting (urban/suburban or rural), and the setting's reimbursement system (HMO, fee-for-service, mixed);
- the two interventions being compared (e.g., control versus patient education, provider reminder versus provider reminder plus patient education);
- the characteristics of the two interventions (population size [N], baseline rate, and follow-up rate); and
- the absolute rate increase when comparing the two interventions.

A separate evidence table is presented for each service: influenza vaccination, pneumococcal vaccination, mammography screening, cervical smear cytology, colon cancer screening (visualization), and colon cancer screening (fecal occult blood test).

QUALITY OF EVIDENCE

Of the 218 separate studies included in our analysis, 136 were randomized clinical trials, 24 were controlled clinical trials, 58 were controlled before/after studies, and none were interrupted time series. Thus, over one-third of the studies did not use the study design (RCT) with the strongest internal validity. Only eight studies reported results at the provider level; the rest reported results at the patient level. However, more than half of the studies used either the provider, the organization, or the community as the unit of allocation. Because none of these studies corrected for the potential clustering of patients within one of these larger units, they tended to underestimate the variance in the estimate of the effect of the intervention. In addition, many studies lacked the basic information necessary for inferential statistical analysis. This was particularly true for the NPDs, which generally did not report any statistical analyses testing for differences among groups.

Hence, our ability to make inferences about differences among interventions, both for individual studies and for pooled analyses, was limited.

DESCRIPTION OF RESULTS

QUESTION 1: ABSOLUTE EFFECTIVENESS OF EACH INTERVENTION

What is the absolute effectiveness of each intervention in improving the use of clinical preventive and screening services?

We identified the following studies as being relevant to Question 1:

- 78 controlled comparisons of interventions to increase the use of influenza immunization
- 18 controlled comparisons to increase the use of pneumococcal immunization
- 76 controlled comparisons to increase the use of mammography
- 65 controlled comparisons to increase the use of cervical smear cytology
- 41 controlled comparisons to increase fecal occult blood testing for colon cancer
- 10 controlled comparisons to increase the use of methods for colon visualization.

META-REGRESSION

Table 6: Effectiveness of Interventions to Improve the Use of Clinical and Preventive Services presents the results of the meta-regression analysis for immunizations, mammography, cervical smear cytology, and colon cancer screening. The table reports the odds ratio for improvement in the receipt for each type of intervention versus the control or usual care situation, adjusted for other interventions and study level differences, and ordered within service from the most effective intervention to the least. It also presents the 95% confidence interval. All interventions for mammography had statistically-significant adjusted odds ratios. All interventions for cervical smear cytology, colon cancer screening, and immunization also had statistically significant adjusted odds ratios, with the exception of feedback. Therefore we can conclude that, with the exception of feedback, all interventions that we had adequate sample size to include in the model are effective in improving the use of clinical preventive and screening services when compared to the control situation.

Table 6. Effectiveness of Interventions To Improve the Use of Clinical Preventive and Screening Services

Immunizations			Mammography			Cervical Smear Cytology			Colon Cancer Screening (FOBT)		
Intervention	Odds Ratio	95% Confidence Interval	Intervention	Odds Ratio	95% Confidence Interval	Intervention	Odds Ratio	95% Confidence Interval	Intervention	Odds Ratio	95% Confidence Interval
Organizational Change	7.17	5.94 - 8.67	**Patient Financial Incentive**	3.57	2.36 - 5.40	**Patient Financial Incentive**	3.12	2.62 - 3.72	**Organizational Change**	18.1	12.7 – 25.9
Provider Reminder	4.32	3.80 - 4.91	**Patient Reminder**	2.57	2.22 - 2.98	**Organizational Change**	2.65	2.26 - 3.12	**Provider Education**	4.02	2.81 - 5.75
Patient Financial Incentive	3.49	2.96 - 4.12	**Organizational Change**	2.26	1.81 - 2.83	**Patient Reminder**	1.84	1.67 - 2.02	**Patient Reminder**	3.73	2.76 – 5.04
Provider Financial Incentive	2.62	1.90 - 3.61	**Provider Education**	2.26	1.81 - 2.82	**Provider Education**	1.59	1.29 - 1.97	**Patient Financial Incentive**	2.22	1.70 – 2.91
Patient Reminder	2.44	2.17 - 2.73	**Provider Reminder**	1.59	1.36 - 1.86	**Patient Education**	1.53	1.30 - 1.82	**Patient Education**	1.76	1.13 – 2.76
Provider Education	1.66	1.38 - 2.00	**Feedback**	1.49	1.24 - 1.80	**Provider Reminder**	1.40	1.27 - 1.54	**Provider Reminder**	1.45	1.15 – 1.84
Patient Education	1.33	1.18 - 1.49	**Patient Education**	1.31	1.12 - 1.52	**Feedback**	1.12	0.97 - 1.30	**Feedback**	1.13	0.94 – 1.36
Feedback	1.11	0.90 - 1.38									

We identified some consistent patterns across all four regressions. First, organizational change was consistently one of the most or the most effective interventions at increasing use of the clinical and preventive services. Second, patient financial incentives were also highly effective. Third, patient reminders demonstrated a relatively consistent effect across all services, as did patient education. There was also some evidence that personalized reminders (or ones signed by the patient's physician) are more effective than generic reminders (Larson, 1982; Hardcast, 1983; Hoggs, 1998). Finally, feedback appeared to be a relatively ineffective intervention, as it was statistically beneficial only for increasing screening mammography.

Odds ratios should not be confused with risk ratios and, as pre-intervention utilization rates rise, odds ratios begin to overestimate the increase in expected improvement due to the intervention. Therefore, in Table 7 we provide the general expected improvement in outcomes as it varies both by the pre-intervention rate and the odds ratio. For example, if the pre-intervention rate of use of mammography was 40%, then implementing an intervention with an adjusted odds ratio of 2.6 (such as patient reminders) would be expected to yield an average improvement in the post-intervention rate to 63% (risk ratio=1.6). Similarly, if the pre-intervention rate of influenza immunization was 60%, then implementing an intervention with an adjusted odds ratio of 4.3 (such as provider reminders) would be expected to yield an average improvement in the post-intervention rate to 87% (risk ratio=1.5).

Table 7. Post-Intervention Rate

Pre-Intervention Rate	Odds Ratio													
	1.5	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**
20%	27%	33%	38%	43%	47%	50%	53%	56%	58%	60%	62%	64%	65%	67%
30%	39%	46%	52%	56%	60%	63%	66%	68%	70%	72%	74%	75%	76%	77%
40%	50%	57%	62%	67%	70%	73%	75%	77%	79%	80%	81%	82%	83%	84%
50%	60%	67%	71%	75%	78%	80%	82%	83%	85%	86%	87%	88%	88%	89%
60%	69%	75%	79%	82%	84%	86%	87%	88%	89%	90%	91%	91%	92%	92%
70%	78%	82%	85%	88%	89%	90%	91%	92%	93%	93%	94%	94%	95%	95%
80%	86%	89%	91%	92%	93%	94%	95%	95%	96%	96%	96%	97%	97%	97%

ORGANIZATIONAL CHANGE

Organizational change was consistently one of the most effective interventions at increasing use of clinical and preventive services. For immunizations, it was the best intervention component, with an odds ratio of 7,17. Similarly, the odds ratio was 18.1 for organizational change in colon cancer screening (FOBT). Odds ratios for improving mammography and cervical smear cytology rates were 2.26 and 2.65 respectively. Organizational change was also the most heterogeneous intervention. Table 8 contains descriptions of the interventions classified as "organizational change" which were entered into the regression models. Organizational change was always just one component of a multi-faceted intervention. It was most often used in conjunction with patient reminders. Clearly, no organizational change will be consistently effective for all services and all settings (i.e., there is no "magic bullet).

Table 8. Evidence Table
Studies that Included Organizational Change

Author, Year/ Country/ Design	Description	Target	Reimbursement system	Conditions	Intervention 1	Intervention 2	NNT
BELCHER, 1990 USA RCT	Patients were invited to attend a health promotion clinic devoted to screening, health counseling, and coordinating follow-up care.	Patients, Physicians, Nurses, Organizations	Other	Colon Cancer Screen (FOBT)	Control	Provider Education, Provider Reminder	50
					Control	Patient Education, Provider Reminder, Patient Reminder	100
					Control	Patient Education, Patient Reminder, Organizational Change	2
					Provider Education, Provider Reminder	Patient Education, Provider Reminder, Patient Reminder	-100
					Provider Education, Provider Reminder	Patient Education, Patient Reminder, Organizational Change	2
					Patient Education, Provider Reminder, Patient Reminder	Patient Education, Patient Reminder, Organizational Change	2
MORRISSEY, 1995 USA RCT	Physicians received an annual capitated payment from HCFA of $53 for a preventive care visit, and $47 for a health promotion counseling visit. These visits were primarily carried out by nurses. Practices were prompted monthly by the research team to schedule special prevention visits for the intervention group patients. Services delivered, results, and follow-up were recorded on a special multicopy form.	Patients, Physicians, Nurses, Organizations	Mixed	Pap Smear, Colon Cancer Screen (FOBT), Flu Shot, Pneumovax	Control	Patient Education, Provider Financial, Patient Financial, Organizational Change	2
					Control	Patient Education, Provider Financial, Patient Financial, Organizational Change	5
					Control	Patient Education, Provider Financial, Patient Financial, Organizational Change	2
					Control	Patient Education, Provider Financial, Patient Financial, Organizational Change	2

RCT = randomized clinical trial
CCT = controlled clinical trial
CBA = controlled before-and-after study

USA = United States of America
FOBT = fecal occult blood testing

Table 8. Evidence Table
Studies that Included Organizational Change (continued)

Author, Year/ Country/ Design	Description	Target	Reimbursement system	Conditions	Intervention 1	Intervention 2	NNT
NATTINGER, 1989 USA CCT	Before each clinic session, an assistant identified scheduled patients in need of a mammogram. A patient handout describing reasons for screening and addressing potential barriers to mammography was provided to these patients before they saw their physicians and was attached to a mammography requisition for the physician to sign.	Patients, Physicians, Organizations	Mixed	Mammogram	Control	Feedback	7
					Control	Patient Education, Provider Reminder, Patient Reminder, Organizational Change	11
					Feedback	Patient Education, Provider Reminder, Patient Reminder, Organizational Change	-23
ATRI, 1997 Other Country RCT	Receptionists took part in a two hour group training session. They were asked to contact all women due for mammogram by telephone, where possible, or by sending the women a standard letter from their general practitioner. They were asked to record calls made and letters sent.	Patients, Other Providers, Organizations	Other	Mammogram	Control	Provider Education, Patient Reminder, Organizational Change	20
BECK, 1997 USA RCT	Patients had monthly group visits with their primary care physician and nurse during which time preventive care services were addressed.	Patients, Organizations	HMO	Flu Shot, Pneumovax	Control	Patient Education, Organizational Change	6
					Control	Patient Education, Organizational Change	7
BRIMBERRY, 1988 USA RCT	Patients in one intervention group were sent a reminder letter for influenza vaccination which also informed them of the vaccination cost and that no appointment was necessary. Patients of the second intervention group received a telephone reminder with the same information.	Patients, Organizations	Mixed	Flu Shot	Control	Patient Education, Patient Reminder, Organizational Change	17
					Control	Patient Education, Patient Reminder, Organizational Change	18
					Patient Education, Patient Reminder, Organizational Change	Patient Education, Patient Reminder, Organizational Change	-250
CARGILL, 1991 USA CCT	Nurse clinicians were trained to perform FOBT, had a written protocol, and provided patient instructional material. Patients in need of colon cancer screening were referred to these nurses by clinic physicians.	Physicians, Nurses, Organizations	Mixed	Colon Cancer Screen (FOBT)	Control	Provider Education, Organizational Change	3

RCT = randomized clinical trial
CCT = controlled clinical trial
CBA = controlled before-and-after study

USA = United States of America
FOBT = fecal occult blood testing

Table 8. Evidence Table
Studies that Included Organizational Change (continued)

Author, Year/ Country/ Design	Description	Target	Reimbursement system	Conditions	Intervention 1	Intervention 2	NNT
CHAMPION, 1994 USA RCT	Patients received an in-home visit by a nurse who provided individualized belief interventions based on the Health Belief Model.	Patients, Organizations	Not Applicable	Mammogram	Control	Patient Education, Organizational Change	10
					Control	Patient Education, Organizational Change	9
					Control	Patient Education, Organizational Change	4
					Patient Education, Organizational Change	Patient Education, Organizational Change	100
					Patient Education, Organizational Change	Patient Education, Organizational Change	7
					Patient Education, Organizational Change	Patient Education, Organizational Change	7
DALES, 1979 USA CCT	Clerks telephoned patients and urged them to have annual Multiphasic Health Checkups consisting of: 1) a visit to an automated multitest lab for completion of a medical questionnaire and a battery of clinical and lab tests, 2) a recommended gynecologic exam and pap smear for women and a recommended sigmoidoscopic exam for all over 40 years old, and 3) a follow-up visit with a physician or nurse practitioner for a physical exam and review of test results.	Patients, Organizations	HMO	Colon Cancer Screen (visualization)	Control	Patient Reminder, Organizational Change	34
GONZALEZ, 1989 USA RCT	A family nurse practitioner reviewed the patient's chart before the encounter, filled out a form listing necessary tests due, and placed a prompting reminder on the front of the chart.	Physicians, Nurses, Organizations	Mixed	Pap Smear	Control	Provider Reminder, Organizational Change	3
				Mammogram	Control	Provider Reminder, Organizational Change	3
				Colon Cancer Screen (FOBT)	Control	Provider Reminder, Organizational Change	3
JANZ, 1997 USA RCT	A personal letter from their physician, along with a $15 grocery coupon, was sent to patients. For women who did not respond to the letter within two months, a trained community peer conducted a telephone counseling session.	Patients, Organizations	Mixed	Mammogram	Control	Patient Education, Patient Financial, Patient Reminder, Organizational Change	5

RCT = randomized clinical trial
CCT = controlled clinical trial
CBA = controlled before-and-after study

USA = United States of America
FOBT = fecal occult blood testing

Table 8. Evidence Table
Studies that Included Organizational Change (continued)

Author, Year/ Country/ Design	Description	Target	Reimbursement system	Conditions	Intervention 1	Intervention 2	NNT
KARUZA, 1995 USA RCT	A local physician expert led a small physician group to gain consensus and buy-in on implementation strategies for preventive care services.	Physicians, Organizations	Mixed	Flu Shot	Control	Provider Education, Feedback, Organizational Change	6
LANTZ, 1995 USA CCT	Women received a reminder letter from their primary care physician. Women received a follow-up phone call from a health educator within 7 to 10 days after the letter was mailed. The caller asked about barriers to service utilization and assisted with appt. scheduling.	Patients, Organizations	HMO	Mammogram, Pap Smear	Control	Patient Education, Patient Reminder, Organizational Change	3
					Control	Patient Education, Patient Reminder, Organizational Change	6
MANFREDI, 1998 USA RCT	All participating medical practices, including controls, were mailed a letter from HMO emphasizing cancer control and a supply of flow sheets to facilitate recording and tracking of cancer detection tests with instructions for implementation. A similar flow sheet was mailed to patients in intervention group only. Intervention practices received staff training in using the chart reminder system and 2 follow-up training visits. Physicians from intervention group were invited to a CME seminar on early cancer detection and management. The HMO revised its quality assurance procedures, via periodic chart review and provider feedback, to include updated cancer screening guidelines; intervention practices were provided with feedback from the new cancer related quality assurance reviews.	Patients, Physicians, Organizations	HMO	Mammogram	Control	Provider Education, Patient Education, Feedback, Provider Reminder, Organizational Change	12
				Pap Smear	Control	Provider Education, Patient Education, Feedback, Provider Reminder, Organizational Change	-24
				Colon Cancer Screen (FOBT)	Control	Provider Education, Patient Education, Feedback, Provider Reminder, Organizational Change	9

RCT = randomized clinical trial
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CBA = controlled before-and-after study

USA = United States of America
FOBT = fecal occult blood testing

Table 8. Evidence Table
Studies that Included Organizational Change (continued)

Author, Year/ Country/ Design	Description	Target	Reimbursement system	Conditions	Intervention 1	Intervention 2	NNT
MCDOWELL, 1989 Other Country RCT	For one group, physician was issued a message identifying those women visiting the center for a routine appointment who were due for screening. The next group received a reminder letter, and the third group were called on the phone by a practice nurse.	Patients, Physicians, Organizations	Other	Pap Smear	Control	Provider Reminder	42
					Control	Patient Education, Patient Reminder	8
					Control	Patient Education, Patient Reminder, Organizational Change	16
					Provider Reminder	Patient Education, Patient Reminder	10
					Provider Reminder	Patient Education, Patient Reminder, Organizational Change	26
					Patient Education, Patient Reminder	Patient Education, Patient Reminder, Organizational Change	-17
STRATON, 1995 Other Country RCT	Three interventions were studied. In the first, the medical record was tagged to remind the physician to offer a Pap smear. In the second, an invitation to make an appt. was sent. In the third, an invitation with a set appt. at a special screening clinic, staffed by women, with evening hours, was sent.	Patients, Physicians, Organizations	Other	Pap Smear	Control	Provider Reminder, Organizational Change	23
					Control	Patient Education, Patient Reminder, Organizational Change	11
					Control	Patient Education, Patient Reminder, Organizational Change	7
					Provider Reminder, Organizational Change	Patient Education, Patient Reminder, Organizational Change	22
					Provider Reminder, Organizational Change	Patient Education, Patient Reminder, Organizational Change	11
					Patient Education, Patient Reminder, Organizational Change	Patient Education, Patient Reminder, Organizational Change	21

RCT = randomized clinical trial
CCT = controlled clinical trial
CBA = controlled before-and-after study

USA = United States of America
FOBT = fecal occult blood testing

Table 8. Evidence Table
Studies that Included Organizational Change (continued)

Author, Year/ Country/ Design	Description	Target	Reimbursement system	Conditions	Intervention 1	Intervention 2	NNT
ROBSON, 1989 USA RCT	A group practice employed a health promotion nurse, whose primary task was the preventive care of adults. Nurse ran monthly computer search and contacted patients for screenings.	Patients, Organizations	Other	Pap Smear	Control	Patient Reminder, Organizational Change	4
SUNG, 1997 USA RCT	Three in-home culturally sensitive education sessions were conducted by a lay health worker who received 10 weeks of special training.	Patients, Organizations	Mixed	Mammogram, Pap Smear	Control	Patient Education, Organizational Change	9
					Control	Patient Education, Organizational Change	-29
MCAVOY, 1991 Other Country RCT	One group was mailed a leaflet and fact sheet. A research assistant visited the second and third intervention groups at home. One of these groups was shown a video, while the other was presented with a leaflet and fact sheet.	Patients, Organizations	Other	Pap Smear	Control	Patient Education, Organizational Change	4
					Control	Patient Education, Organizational Change	5
					Control	Patient Education, Organizational Change	17
					Patient Education, Organizational Change	Patient Education, Organizational Change	-25
					Patient Education, Organizational Change	Patient Education, Organizational Change	-5
					Patient Education, Organizational Change	Patient Education, Organizational Change	-7

RCT = randomized clinical trial
CCT = controlled clinical trial
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Special Interventions: Standing Orders

Seven articles assessed the effects of standing orders as an intervention to improve preventive care cancer screening or immunization rates. Three articles assessed their effects on influenza vaccination rates (Margolis, 1992; Brenton, 1998; PRO#OH025, 1996), two articles assessed their effects on pneumococcal rates (Klein, 1986; Rhew, 1999), one article assessed their effects on both influenza and pneumococcal vaccination rates (Herman, 1994), and the last article assessed their effects on mammography rates (Herman, 1995).

The first influenza-only article compared usual care with provider education, patient education, provider reminders, and patient reminders (Margolis, 1992). The intervention also included modification of organizational policies to allow nursing staff to administer influenza vaccination to patients without a signed physician order. There were two control sites, each of which was paired with an intervention site. The vaccination rates of the two control sites did not change significantly over the course of the study. Only one of the two intervention sites showed a significant increase in vaccination rates, from 56% to 72% (NNT=5 when compared with the control site). The second influenza-only article compared usual care with provider education and a number of organizational changes, including nurse standing orders (PRO# OH025). While the percentage of vaccinated patients remained unchanged in the usual care group, the rate in the intervention group increased from 15.8% to 19.4% (NNT=28 when compared with the control group).

In the third influenza-only article, patients, physicians, communities, hospitals, and long-term care facilities in Iowa were targeted with a number of interventions (Brenton, 1998). The primary intervention for the hospitals was a standing order to immunize high-risk, hospitalized patients. Even though the hospitals administered immunizations to only 7% of high-risk hospitalized patients, immunization rates in the counties where these hospitals were located increased by 12.1 percentage points (from 40.6% to 52.7%) compared with an increase of 8.9 percentage points in the control counties (from 32.8% to 41.7%). The authors believed that these hospital programs had a spillover effect on care provided in the surrounding communities.

In the first pneumococcal-only article, the effects of posters containing information about immunizing high-risk patients were compared with the effects of posters and immunization standing orders carried out by a hospital infection-control nurse (Klein, 1986). None of the patients in the poster-only group received pneumococcal vaccination, compared with 78% in the poster plus standing order group.

The second pneumococcal-only article examined three groups of interventions: patient and provider reminders, nurse standing orders with feedback and patient and provider reminders, and nurse standing orders with patient and provider reminders (Rhew, 1999). Only 5% of the patient and provider reminder groups received pneumococcal vaccination, compared with 22% of the nurse standing orders with feedback and patient and provider reminder group, and 25% of the nurse standing orders with patient and provider reminder group.

The article that assessed effects of standing orders on both influenza and pneumococcal rates contained three intervention groups (Herman, 1994). The intervention for the first group consisted of provider education only. The second group's intervention consisted of provider education and patient education. The third group's intervention consisted of provider education, patient education, provider reminders, and organizational changes, including nursing standing orders. The pneumococcal vaccination rate for the third group increased 21.6% compared with an increase of 5.1% for the second group and an increase of 3.4% for the first group. The influenza vaccination rate for the third group increased by 55.1%, compared with an increase of 44.6% for the second group and an increase of 41.7% for the first group.

The last article, which assessed the effects of standing orders on mammography rates, contained three intervention groups. All three groups received provider education (Herman, 1995). Groups two and three received patient education as well. In addition, group three's intervention also encompassed provider reminders and organizational change, including standing orders. The results showed that mammography rates increased by 17% in group one, by 31% in group two, and by 37% in group three.

In conclusion, in nearly every instance, organizational changes that included standing orders improved the rates of vaccination and mammography when compared to usual care or to other interventions. Since many of these studies had other interventions besides standing orders, the effect size for standing orders alone is unclear.

We identified a number of additional studies relevant to Question 1 that, for statistical reasons, we were unable to include in our meta-regression analysis. These studies fall into five categories:

1. mass mailings by Peer Review Organizations (PROs)
2. sigmoidoscopy studies
3. mass media studies
4. regulatory change studies
5. miscellaneous studies.

We present a qualitative summary of each of these studies below.

Mass Mailings by Peer Review Organizations

We identified five mass mailing studies performed by Peer Review Organizations that we were unable to include in our meta-regression analysis due to the large sample size. Each study was designed to increase the receipt of influenza vaccinations and was described in an NPD. Table 9 summarizes their key aspects.

The first study, a community-based randomized controlled trial, was performed in Wyoming and Montana and reported a modest but statistically significant improvement in influenza vaccinations among patients who received a personalized letter or a form letter relative to those who did not. These results were published in *Morbidity and Mortality Weekly Report* (1995) and led to four additional studies on this topic, performed by other Peer Review Organizations. None of the other four studies showed a clinically important effect for mass mailings, regardless of the number or type of mailing (e.g., personalized or form letter), or target population (e.g., all Medicare beneficiaries versus high-risk Medicare beneficiaries). We therefore conclude that mass mailings have clinically trivial effects in improving receipt of influenza vaccinations.

Table 9. Effect of Mass Mailings by Peer Review Organizations on Flu Vaccinations

State	Population	Study/Design	Intervention	Sample	Outcome
					Increase of :
Wyoming-Montana	All Medicare Beneficiaries	Community-based RCT	Personalized letter	19,850	8.7% points
			Form letter	21,250	6.5% points
			No letter	150,000	4.4% points
					Rate after Intervention:
Minnesota	All Medicare Beneficiaries	RCT	Letter + HCFA flu brochure	2,924	50.3%
			No letter	3,334	51.0%
Washington	Medicare beneficiaries who did not get flu shot in previous year	RCT	2 mailings: letter + postcard	16,082	21% (46%)*
			No mailing	16,057	20% (46%)*
New Jersey	Medicare beneficiaries with a Hospitalization for CHF, COPD, Pneumonia	RCT	Letter	16,000	23%
			Postcard	16,001	22%
			Letter + postcard	16,000	24%
			No mailing	16,001	22%
Utah-Nevada	Medicare beneficiaries who did or did not get flu shots in previous Year	RCT	Postcard; no prior year flu shot	25,000	19%
			No Postcard; no prior year flu shot	50,437	18%
			Postcard; prior year flu shot	5,000	72%
			No Postcard; prior year flu shot	36,263	71%

* represents data from personal interview; all others represent claims data

Information on two additional studies of mass mailing interventions was forwarded to us as this report was in its final assembly. The first study was a controlled before-and-after study to increase mammography rates, performed in Delaware. The intervention consisted of a statewide publicity campaign with the Lieutenant Governor of Delaware (an older woman) as spokesperson, followed by a mass mailing to female residents of one county. Women in the intervention county received a personalized letter from the Lieutenant Governor. The mammography rate in the control county increased from 30.3% to 33.6%, while the mammography rate in the intervention county increased from 23.8% to 29.9%. The difference in the increase in mammography rates between counties just reached statistical significance.

A similar subsequent study in West Virginia used the First Lady of West Virginia as the spokesperson and added a mass media campaign to a mass mailing. Upon preliminary analysis, this study appears to have had greater effectiveness than the Delaware study (Charles P. Schade, MD, MPH, personal communication). The increased benefit seen with this PRO mass mailing relative to those reported above could be due to several factors, including targeting a different service (mammography rather than influenza vaccination) and the use of a media campaign with an identifiable spokesperson. Of the influenza studies reported above, only one (Minnesota) employed any additional interventions, and they were limited to provider education in three communities.

SIGMOIDOSCOPY STUDIES

Five studies on sigmoidoscopy utilization passed our screening process. This was too small a sample for calculating pooled effects or performing a meta-regression. None of these studies addressed sigmoidoscopy alone: each was designed to increase colon cancer screening with the Fecal Occult Blood Test (FOBT) as well. Moreover, several of the studies attempted to increase utilization of other preventive services (i.e., mammography and cervical smear cytology), using interventions similar to those for sigmoidoscopy and FOBT.

Table 10 summarizes the sigmoidoscopy study data. The third and fourth columns indicate the proportion of each group who received sigmoidoscopy before and after the intervention. Several studies failed to report key data, such as the sample size (Dietrich, 1992) or baseline utilization rates (Bejes, 1992; Clementz, 1990).

These studies most often targeted interventions toward physicians. For example, three studies (Bejes, 1992; McPhee, 1989; and McPhee, 1991) investigated the effect of placing physician reminder sheets in patient charts. Two of them (Bejes, 1992; McPhee, 1989) showed positive and significant results relative to the control group. The other study (McPhee, 1991) showed a positive, but not statistically significant, trend.

One study (Clementz, 1990) mailed patient reminders to asymptomatic women age 50 to 69. These individuals received both a personalized letter signed by their primary care physician and educational materials describing their general risks for colon cancer. A second reminder letter, which also included patient educational materials, was mailed four weeks after the first letter. Surprisingly, only one percent of the intervention group appeared for screening, compared with over five percent of the control group. However, this difference between the two groups was not statistically significant.

Table 10. Sigmoidoscopy Studies

Author, year	Intervention	Proportion Receiving Sigmoidoscopy		N	Significance
		Pre	Post		
Bejes, 1992	Control	NA	0.020	216	
	Physician chart reminder	NA	0.220	36	p<0.05
	Chart reminder + patient recall letter	NA	0.310	143	p<0.05
Dietrich, 1992	Control	0.200	0.240	NA	
	Physician education	0.280	0.300	NA	NS
	Office system intervention	0.250	0.310	NA	NS
	Physician Education & Office system Intervention	0.240	0.270	NA	NS
McPhee, 1989	Control	0.210	0.325	672	
	Audit & Feedback	0.202	0.310	620	NS
	Physician reminders	0.298	0.750	672	p<0.05
McPhee, 1991	Control	0.284	0.314	1200	
	Physician reminders, education	0.233	0.395	1200	NS
Clementz, 1990	Control	NA	0.053	76	
	Client mailed reminders, educational brochure	NA	0.010	102	NS

MASS MEDIA STUDIES

Due to the large population sizes targeted in media campaigns, these interventions could not be entered into the meta-regression models. Media campaigns were very rarely used without an additional patient-level intervention. For example, Bennett (1994) reported on an influenza vaccine media campaign that was used in conjunction with patient and provider education, patient and provider reminders, and a provider financial incentive. Thus, we could not come to a conclusion about the effects of media campaigns per say.

REGULATORY CHANGE STUDIES

In 1987, amendments to the Ontario Health Protection and Promotion Act led to a legal requirement for informing patients of benefits, risks, alternatives to immunization, and reportable signs and symptoms before vaccination. In their 1994 study, Charles and Lewis examined whether requiring elderly patients to sign consent forms prior to receiving the influenza vaccine affected vaccination rates. All patients 65 years of age and older who had attended the Sunnybrook Health Science Centre Family Practice Unit at the University of Toronto within three years prior to the start of the study were included unless the patient was suffering with dementia or the research team could not locate the patient's chart. All participants received a package containing information from the Ministry of Health on the influenza vaccine and a questionnaire covering demographics and previous influenza vaccination; subjects assigned to the intervention group also received and were asked to sign a consent form prior to receiving the influenza vaccination. All subjects in the intervention group who attended the clinic during the study period ($n = 52$) signed the consent form, however, one subject was reluctant to do so. The results showed that there was no statistically significant difference in vaccination rates between the intervention and control groups suggesting that requiring elderly patients to sign consent forms did not deter patients from receiving the influenza vaccine.

These results differ from another study (Patriarca et al., 1985) cited by Charles and Lewis where requiring signed consent from relatives of nursing home residents in the United states led to statistically significant lower rates of influenza vaccination. The two studies differ, however, not only in setting but also in that Charles and Lewis required elderly patients to sign their own consent forms; the two studies, therefore, may

not be comparable. Consistent with other studies, Charles and Lewis reported that vaccination rates increased significantly when study participants were mailed reminder letters and information packages were placed in patient charts.

MISCELLANEOUS STUDIES

We excluded several other studies from our regression models, mainly because they did not report results at the patient level. Although this method of reporting may have been appropriate, particularly if the unit of allocation was the provider or community, we could not include the results in our meta-regression analysis. We describe these remaining studies briefly below.

Dietrich and colleagues (1992) reported on the effects of a day-long physician educational session and an office intervention that included the use of medical record flow sheets and division of responsibilities for providing services among medical staff. Dietrich found that the office system intervention was associated with an increase in mammography and FOBT, where as education was only associated with an increase in mammography. Neither intervention was successful in significantly increasing the utilization of sigmoidoscopy. These results are in general in agreement with those of our meta-regression.

Rosser and colleagues (1991) tested computerized reminder systems used in the delivery of five preventive procedures (including cervical smear cytology and influenza vaccination) in a family practice. The patients in the first intervention group received a telephone call or letter reminding them of any overdue preventive procedures; the physicians of the patients in the second group were reminded to provide any overdue service at an office visit. Both intervention groups had significantly higher rates of utilization than did the control group. Again, these results are in general in agreement with those of our meta-regression.

A third study involved a media campaign to increase the utilization of cervical smear cytology in Victoria, Australia (Cecchini, 1989). The intervention included sending personalized letters to women inviting them in for screening. It also incorporated a general practice component, one facet of which involved face-to face educational outreach to the doctor. There was no significant difference in cervical cancer screening patterns

between the intervention region and the control region. The lack of effect of personalized patient reminders runs counter to meta-regression results.

Mandel, Franks, and Dickinson (1985) studied the effects of providing educational feedback to medical interns about preventive care deficiencies found in their charts. The two procedures relevant to this report are cervical smear cytology and FOBT. The intervention did not improve intern performance in these areas significantly. The lack of effect of feedback is consistent with our meta-regression results.

We also excluded a randomized controlled trial (Ward, 1996) of a three-day workshop designed to increase trainees' rates of smoking cessation counseling and cervical smear cytology orders because it did not report the study's sample size. The post-workshop difference between the control and intervention group was not significant, although the rate of cervical smear cytology discussions with patients did increase slightly in the intervention group.

Majeed and colleagues (1997) investigated the use of reminder letters for mammography in London area clinics. They found a statistically significant increase in the utilization of breast cancer screening in intervention practices compared to control practices. However, the absolute increase in uptake (from 53.8% to 58.5%) was small and of limited public health importance. This limited effect of patient reminders is somewhat counter to the results from our meta-regression.

Tierney, Hui, and McDonald (1986) studied the effects of monthly feedback reports, and /or of specific reminders given to physicians at the time of patient visits. Services studied included FOBT, mammography, and pneumococcal vaccination. Again, results were reported at the physician level. Staff receiving feedback more often ordered these three services than did controls. Utilization levels for physicians receiving both feedback and chart reminders was twice that of physicians receiving feedback alone. The positive effect of feedback is counter to our meta-regression results, though the positive effect of physician reminders is consistent with our results.

In 1987 RAND published findings from its Health Insurance Experiment, which was conducted from 1974 to 1982. Free care was found to have some benefit for the three screenings for early detection of cancer, compared to plans where costs were shared. For example, 65% of women aged 45-65 on the free plan had cervical smear cytology in the initial three year period, compared with 51.9% in the cost-sharing plans. The positive effect of patient financial incentives agrees with the results of our meta-regression analysis.

QUESTION 2: RELATIVE EFFECTIVENESS OF EACH INTERVENTION

What is the relative effectiveness of each intervention in improving the use of clinical preventive and screening services?

We considered two forms of evidence: direct evidence and indirect evidence. Direct evidence consisted of head-to-head comparisons of single interventions. Indirect evidence consisted of the magnitude of the odds ratios from the main meta-regression. (For example, in Table 6 for immunizations, organizational change had an adjusted odds ratio of 7.17, while provider reminder had an odds ratio of 1.66.) We identified nine studies that assessed a single intervention relative to another single intervention. Of these nine, one was a mass mailing study, previously described above. Of the remaining eight, four of them directly confirmed the order of relative effectiveness seen in the meta-regression analysis. Specifically, a study of mammography (Landis, 1992) and a study of cervical smear cytology (Binstock, 1997) both found that patient reminders were superior to provider reminders; a study of fecal occult blood testing (Thompson, 1986) found that patient reminders were superior to patient education; and a study of several preventive services (Tierney, 1986) found that reminders were superior to feedback.

Two more studies demonstrated a trend similar to that seen in our meta-regressions. One study of mammography (Sharp, 1996) found that patients receiving reminders underwent more mammograms than did patients receiving a home visit from a nurse with or without patient education, but this difference was not statistically significant. Similarly, a study of cervical smear cytology (Pierce, 1989) also found that patients receiving reminders underwent more cervical smear cytology than patients of doctors who received provider reminders, but again this difference was not statistically significant.

The last two studies showed an order of effectiveness opposite to that seen in our meta-regressions. In the first one (Moran, 1996), patient education was superior to a patient financial incentive. However, in this case the financial incentive was relatively weak: i.e., if a patient received an influenza vaccine, he or she became eligible for a lottery to receive a $50 voucher for groceries. In the second study (Mant, 1992), which addressed fecal occult blood testing, patient reminders were superior to organizational change which, in this case, consisted of having a nurse offer patients a hemoccult test during a health check up. In general, though, the direct evidence from the few studies that directly compared interventions supported the order of relative effectiveness observed in our meta-regression analyses.

EFFECTIVENESS OF MULTIPLE INTERVENTIONS

In addition to these direct, one-on-one comparisons of interventions, we also examined whether multiple interventions produced better results than single interventions. Direct evidence consisted of studies that directly compared a single intervention to that same intervention in conjunction with additional interventions. Indirect evidence consisted of the results from a meta-regression analysis in which we compared the effectiveness of a single intervention versus a control or usual care group with the effectiveness of multiple interventions against a control or usual care group for the same preventive service. We can compare the marginal effectiveness of adding an intervention component to the "average" single component intervention across our studies. Because of the paucity of direct evidence, we will discuss the indirect evidence for these comparisons first.

Table 11 presents the results of our meta-regression analysis comparing the adjusted odds ratios of single interventions to multiple interventions for each service. There was no statistical difference between the odds ratios for single interventions versus multiple interventions for either immunizations or mammography, indicating that multiple interventions did not achieve greater effectiveness than did single interventions, relative to control or usual care. For cervical smear cytology, however, the difference between the average adjusted odd ratios for single interventions and for multiple interventions was statistically different, with a marginal odds ratio of 1.25 (95% confidence interval: 1.14 to 1.37). We note that as expected, this marginal

odds ratio is the ratio of individual odds ratios versus control (1.98/1.58=1.25). This result indicated that for cervical smear cytology, multiple interventions did achieve more benefit than single interventions alone, but the effects were not additive (i.e., the incremental effects diminished as additional interventions were added). Similarly, the difference between the average adjusted odds ratios for colon cancer was also statistically significant, producing a marginal odds ratio of 2.50 (95% confidence interval: 2.08 to 3.00). This result indicated, however, that for colon cancer, interventions with multiple components achieved much more effectiveness than did interventions with single components, and that the effect was additive.

Table 11. Effectiveness of Single versus Multiple Interventions

	Average Adjusted Odds Ratio* (95% Confidence Interval)				**Marginal Odds Ratio** (95% Confidence Interval)	
	Single Interventions		***Multiple Interventions***			
Immunizations	2.38	(2.19 – 2.59)	1.94	(1.86 – 2.04)	not statistically different	
Mammography	1.59	(1.42 – 1.78)	1.69	(1.59 – 1.80)	not statistically different	
Cervical Smear Cytology	1.58	(1.45 – 1.73)	1.98	(1.88 – 2.08)	1.25	(1.14 – 1.37)
Colon Cancer Screening (FOBT)	1.43	(1.22 – 1.68)	3.58	(3.25 – 3.95)	2.50	(2.08 – 3.00)

*Adjusted odds ratio from meta-regression.

Table 12 presents each intervention, by preventive service, that had a statistically significant marginal adjusted odds ratio greater than one. These are the only interventions that, on average, would be expected to produce statistically significant improvements when added to an "average" intervention across studies which did not contain that particular component.

Table 12. Marginal Effectiveness of Specific Interventions

Immunizations			Mammography			Cervical Smear Cytology			Colon Cancer Screening (FOBT)		
Intervention	**Odds Ratio**	**95% Confidence Interval**	**Intervention**	**Odds Ratio**	**95% Confidence Interval**	**Intervention**	**Odds Ratio**	**95% Confidence Interval**	**Intervention**	**Odds Ratio**	**95% Confidence Interval**
Organizational Change	2.93	2.38 – 3.61	**Patient Financial Incentive**	1.81	1.23 – 2.67	**Patient Financial Incentive**	2.01	1.64 – 2.46	**Organizational Change**	7.06	5.36 – 9.30
Provider Reminder	1.77	1.49 – 2.09	**Patient Reminder**	1.31	1.12 – 1.53	**Organizational Change**	1.71	1.52 – 1.92	**Provider Education**	1.56	1.26 – 1.94
Patient Financial Incentive	1.43	1.24 – 1.64				**Patient Reminder**	1.18	1.05 – 1.34	**Patient Reminder**	1.45	1.09 – 1.94

*Marginal odds ratio from meta-regression.

Our interpretation of the direct evidence for the effectiveness of single versus multiple interventions was again limited by lack of data. We did identify 32 studies that compared a single intervention to that same intervention plus a second intervention, generating a total of 39 comparisons. Among these 39 comparisons, 24 favored multiple interventions, 13 showed no difference, and two favored the single intervention. The interpretation of these results, however, is complex because interventions vary considerably in their effectiveness and intensity is hard to measure.

To better understand the interactions among different interventions, we classified the interventions as either "strong" (e.g., organizational change, financial incentives, patient reminders, and provider reminders) or "weak" (e.g., feedback, patient education, and provider education). Using this classification system, we predicted that adding a strong intervention to either another strong one or to a weak one would produce significant, positive effects; that adding a weak intervention to a strong one would produce little effect; and that adding a weak intervention to another weak one would produce variable effects. The results of our analysis supported these predictions. All 11 comparisons that added a strong intervention to another strong intervention reported significant benefits. Similarly, five of the seven comparisons that added a strong intervention to a weak one also reported significant benefits. As expected, eight of the ten comparisons that added a weak intervention to a strong one reported no benefit, while two reported some benefit. Finally, of the two comparisons in which a weak intervention was added to another weak intervention, one reported a benefit and one did not.

QUESTION 3: IMPORTANT COVARIATES

How do important covariates, such as the target population (e.g., low-income or other vulnerable populations) or the setting in which the intervention is applied (e.g., academic versus non-academic practice, managed care versus fee-for-service systems), impact the effectiveness of the interventions?

As mentioned above, in assessing the degree to which important covariates (e.g., target population, intervention setting) impact the effectiveness of interventions, we considered both direct and indirect evidence. We defined direct evidence as a head-to-head comparison of the intervention in a study of eligible design, such as a clinical trial or controlled before and after study. We defined indirect evidence as the results of a meta-regression analysis examining the covariates of interest in a covariate by treatment interaction.

We were unable to identify any studies that met our criteria for direct evidence; furthermore, there was insufficient data to include the covariates in a covariate by treatment interaction in our meta-regression model. Therefore, we included the covariates as single variables in a regression model across all interventions for each preventive or screening service. Even with this adjustment, we were unable to assess each variable for each service, due to insufficient data. Table 13 presents the results for those variables that we could assess. In this table we present the marginal odds ratio for the "average" intervention applied in various settings as compared with the "average" intervention applied elsewhere. For example, the odds of receiving mammogram screening if the "average" intervention is applied to low-income populations is 0.82 times the odds for non-low-income populations, and this decrease in odds is statistically significant as the 95% confidence interval does not cross one. Unfortunately, these results do not seem to produce any consistent pattern. Hence, we do not believe firm conclusions can be drawn regarding the effectiveness of these interventions across patient populations or service delivery settings.

Table 13. Important Covariates

	Marginal Odd Ratio (95% Confidence Interval)			
	Immunizations	**Mammography**	**Cervical Smear Cytology**	**Colon Cancer Screening (FOBT)**
Low-income Populations	---	0.82 (0.70 - 0.95)	---	---
African American Populations	---	---	---	---
Hispanic Populations	---	---	---	---
Other Minority Populations	---	---	---	---
HMO settings*	---	0.95 (0.84 - 1.08)	0.72 (0.65 - 0.80)	0.45 (0.37 - 0.55)
Non-academic settings**	0.51 (0.46 - 0.57)	1.02 (0.91 - 1.16)	1.37 (1.21-1.54)	2.65 (2.18 - 3.23)
Rural setting***	---	---	0.79 (0.63 - 1.00)	---

* HMO compared to fee-for-service setting
** Non-academic compared to academic healthcare setting
*** Rural compared to urban or suburban
--- Insufficient data for meta-analysis

VULNERABLE POPULATIONS

Below, we provide a qualitative summary for studies involving the following vulnerable populations:

- African-Americans
- Hispanic populations
- Native Americans
- Rural populations.

We did not identify any eligible studies specifically addressing the following vulnerable populations:

- Other minority populations
- Nursing home populations
- Persons 85 and older.

African-Americans

There were 19 articles on interventions targeted toward improving service delivery to African Americans. These involved 42 interventions on flu vaccine, 14 on mammography, and 9 on cervical smear cytology, and one article on pneumococcal vaccination. We found no interventions designed to increase use of colon cancer screening. Thirty-seven interventions used patient education, 36 used patient reminders, 28 used provider education, 28 used mass media, 24 used organizational change, 19 used provider reminders, eight used detailing, seven used patient financial incentives, four used financial incentives for organizations, and one used audit and feedback. These groups are not mutually exclusive; many studies looked at several services or involved multiple types of interventions simultaneously. The most effective interventions are described below.

In Texas and Mississippi, Peer Review Organizations worked with Historically Black Colleges and Universities (HBCUs) in coalitions to improve the utilization of influenza vaccine among African Americans. These interventions included working with churches, free clinics, and local community-based organizations to raise awareness about the influenza vaccine. A telephone survey and focus groups were used to identify barriers and misconceptions about the vaccine. The Texas Medical Foundation reported an increase in utilization of the flu vaccine by over 10% after intervention; the Mississippi Foundation for Medical care reported increases as high as 23% in influenza vaccine utilization after intervention.

In two eastern North Carolina communities, Fletcher et al. (1993) conducted a controlled intervention program to increase the use of mammography screening for breast cancer. The intervention consisted of a provider education component, provider reminders (including a simple prompting system and periodic newsletters), patient financial incentives in the form of coupons for free or half price mammograms, and a mass media campaign using newspaper, radio, television, and community speakers. In particular, African American women were targeted for intervention by a Minority Task Force that was chaired by an African American radio commentator and included six African American women well-known in the community. The experimental community showed a 20% increase of women reporting having undergone a mammogram in the

previous year, compared with less than a 10% increase in the control community. The authors reported, however, that there was less of an increase for African American women than for white women.

Mandelblatt et al. (1993) conducted a quasi-experimental study at two urban public hospital primary care clinics in New York City to increase screening rates for cervical and breast cancers. Approximately 80% of participants at the control site and over 90% of participants at the intervention site were African American. Prior to the start of the study, and independent from the study intervention, the control hospital had already implemented a checklist summarizing the health maintenance protocol that was attached to all charts as a reminder to providers. At the intervention hospital, eligible elderly women arriving for routine visits were approached by nurse practitioners and offered screening. By the conclusion of the study, the intervention group showed a significant increase in screening rates compared to the control group. At the intervention hospital, the annual rate of cervical smears increased from a baseline rate of 17.8% to 56.9%; mammographies increased from 18.3% to 40.0%. By comparison, at the control hospital cervical smear rates increased from 11.8% to 18.2%, while rates of mammographies showed no increase.

In a randomized controlled trial, Sung et al. (1997) implemented an intervention to increase cancer screening rates among inner-city African American women. Participants were recruited through a variety of local community-based organizations catering to inner-city, African American women. The intervention group received multiple visits from a lay health worker (LHW), who had been recruited from the National Black Women's Health Project. The LHW visited subjects in their homes and provided information on breast and cervical cancer and their screening procedures. All materials were presented from a culturally relevant perspective. After the intervention, the slight increases in cervical smear rates were similar among both the control and intervention subjects. Mammography rates in the intervention group, however, were three times that observed in the control group, resulting in a 9.8% difference in change ($p < 0.05$) between the two groups.

An article appeared just as this document was going to press that reported the results of a randomized clinical trial of a low-literacy patient education tool on pneumococcal vaccination rates (Jacobson, 1999). The study

was conducted at an urban public teaching hospital serving a predominately indigent, low-literate, African-American population. Among 221 persons receiving the intervention, 20% received the vaccination, compared to 4% of 212 persons who received an educational brochure about nutrition ($p<0.001$).

Hispanic populations.

We identified four studies of interventions targeted to improve cancer screening among Hispanics; however, we were unable to identify any studies targeted to improve vaccination rates.

The first study (Suarez, 1997) was a three-year community-based intervention implemented at two sites in Texas. The goal was to increase the use of mammography and cervical smear cytology. The intervention community received a variety of mass media campaigns, the use of culturally appropriate role models to deliver educational messages, and outreach activities by the local public health department. Across both services and all age groups, the intervention failed to have a statistically significant effect. However, the overall secular trend was toward an increase in screening rates in both communities, for both services. Among the subgroup of women age 65 or older, the intervention did have a positive effect on use of cervical smear cytology (difference in intervention versus control community, +11.2 percentage points), but a negative effect on the use of mammography (difference in intervention versus control community, -14.3 percentage points). The authors hypothesized that the failure of their intervention was due to lack of focus and contamination of their intervention by other programs.

The second study (PRO# FL68E052, 1998) attempted to increase mammography rates in five counties in south Florida by using community-based interventions. Three communities received the following interventions:

1. patient education (i.e., letters addressing the potential barriers to and myths about mammography were sent to Hispanic women),
2. provider education (e.g., letters were sent to doctors urging them to educate their patients about the importance of mammography, and physician-written articles on the importance of mammography were distributed through a variety of channels), and

3. a wide-ranging mass media campaign.

One of the three intervention counties experienced a statistically significant increase of 10 percentage points (from 77% to 87%) in the two-year rate of use of mammography. There was no statistically significant change in the use of mammography in any of the other counties, and no change in the combined measure of effect of the interventions.

In the third study, Navarro and colleagues (1995) reported on the "Por La Vida" intervention program in San Diego, CA. This program employed lay community workers ("consejeras") to conduct educational group sessions aimed at increasing utilization of cervical smear cytology and mammography among Latinas. Data collected at baseline suggested that lack of knowledge, costs of cancer screening tests, and lack of a regular health care provider were major obstacles to utilization. Subjects who attended a multi-session group program on community living skills served as a control. Utilization of cervical smear cytology increased from 80.4% to 93.5% in the intervention group, while the percentage of women over age 40 who reported ever having a mammogram rose from 51.8% to 64.3%.

The fourth study (Manfredi, 1998) evaluated an HMO-sponsored intervention to improve utilization of cervical smear cytology, mammography, and FOBT in private physician practices located in African-American and Hispanic Chicago neighborhoods. The multi-faceted intervention included an office chart reminder system, patient health maintenance card, on-site training, a physician continuing medical education seminar, and quality assurance visits with feedback to physicians. The intervention was successful in increasing utilization of FOBT and cervical smear cytology, but not at increasing mammography rates. Results were not reported by race/ ethnicity.

Native Americans.

One study (Dignan, 1996) reported on a five year, National Cancer Institute-funded trial of health education designed to increase the use of cervical smear cytology by Native American women in North Carolina. The intervention was an individualized health education program delivered by female Cherokee lay persons.

Social learning theory provided the foundation for the program, which also incorporated the health belief model, the minority health communication model and the communication-behavior change model. At post test, 73.2% of the women who received the education program reported having received a cervical smear cytology following the intervention, compared with 64.0% of the control subjects.

Rural populations

Interventions in rural areas were less successful than those focusing on urban or suburban populations. There were 17 articles on interventions in rural areas. These articles described four interventions on influenza vaccine, nine on mammography, six on cervical smear cytology and five on colon cancer screening. We found no interventions designed to increase use of pneumococcal vaccine. Seven interventions used provider education; ten used patient education, twelve used provider reminders, fourteen used patient reminders, seven used organizational change, and five used patient financial incentives. (These groups are not mutually exclusive; many studies involved several services or multiple types of interventions.) Patient financial incentives were the most successful interventions with rural populations. Several examples are described below.

As part of a demonstration project in five rural counties in northwest Pennsylvania, a group of Medicare beneficiaries completed a health risk appraisal and were randomized to three groups. The first group served as a control; the other participants were mailed a voucher redeemable for a free flu shot either from a community hospital (Group 2) or primary care physician (Group 3). Immunization rates rose significantly from 41.2% to 63.6% in Group 2 and from 41.3% to 69.1% in Group 3.

Stoner and colleagues (1998) reported on a voucher intervention which took place in two farming communities in southern Minnesota. A 90 minute seminar to educate local physicians on mammography techniques and guidelines was held in each county. A community mailing with information about risk factors, screening techniques and the location of nearby mammography facilities was initiated in each county. In one county women received vouchers for a free mammogram in their mailed packets. In the voucher county, mammography screening rates increased from 62% to 76% .

Plaskon and Fadden (1995) studied patients in a poor rural family practice in a geographic area known for high rates of colorectal cancer. All patients in the study received a talk by their physician on the symptoms, prevention, and treatment of colon cancer. Upon leaving the office, persons in the experimental group received educational materials and a free FOBT kit from the receptionist, while the control group received only the educational materials and information on how to request an FOBT kit from a clinic or pharmacy. In the following year, 51% of the experimental group self-reported having utilized FOBT compared to none of the control group. Still, it is not clear whether removing the financial barrier led to increased utilization, as removing the need to ask for an "embarrassing" item may have been the main factor.

REIMBURSEMENT SYSTEMS

HMO versus Fee for Service

The majority of studies took place in mixed reimbursement settings. We did not find any studies that directly compared fee for service (FFS) with health maintenance organizations (HMOs). The number needed to treat (NNT) ranged from 6 to 250 for FFS interventions and from 4 to 100 in HMO interventions, with the exception of two interventions in FFS studies and two interventions in HMO studies which had negative NNTs. Examples of successful HMO interventions are described in the next paragraph.

One HMO study (Cherkin, 1990) evaluated the effectiveness of patient financial incentives as a single intervention. The intervention group showed no clinically meaningful increase in cervical smear cytology rates. In fact, the control group had an increase of approximately five percentage points over their baseline rate while the intervention group had an increase of less than two percentage points. Another HMO study (Trock, 1993) found a significant increase in mammography utilization through the use of provider and patient education and patient reminders. The control group increased utilization from 39% to 49% while the intervention group increased utilization from 41% to 68%.

A majority of the remaining HMO studies did not report baseline rates, thus making it difficult to draw any meaningful conclusions for the HMO population.

QUESTION 4: COST EFFECTIVENESS

What is the relative cost effectiveness of each intervention in increasing the use of clinical preventive and screening services?

Few studies that met our screening criteria provided data on the costs of interventions; even fewer provided cost-effectiveness data. Because of the paucity of relevant information, we were unable to perform quantitative analyses of the relative cost-effectiveness of the various interventions. Instead, we summarize the results of these studies in narrative format below, along with data presented in Table 14. A number of studies reported results on more than one condition.

INFLUENZA AND PNEUMOCOCCAL VACCINATIONS

Twelve studies on improving influenza or pneumococcal vaccination rates provided cost data. However, only four of them contained cost-effectiveness analyses. Two of these four studies (Rosser, 1991; McDowell, 1986) examined the cost-effectiveness of computerized physician reminders, patient letter reminders, and patient telephone reminders. Both concluded that computerized physician reminders were the most cost-effective of the three interventions. The two studies reached opposite conclusions on the cost-effectiveness of telephone reminders versus letter reminders. The third cost-effectiveness study (Morrissey, 1995) reported that full Medicare reimbursement for preventive care services, in combination with provider reminders and an organizational change that enabled nurses to perform many preventive care functions, resulted in Medicare charges that were lower than average. Hospital admissions and lengths of stay also decreased relative to usual care. The fourth study (Beck, 1997) reported that elderly HMO patients who attended a cooperative health care clinic where influenza and pneumococcal vaccinations were routinely administered experienced fewer hospitalizations and incurred lower skilled nursing facility costs than control subjects. The direct cost savings of this health care program was $14.79 per patient per month.

One study reporting the effectiveness of mailed patient reminders (Nexoc, 1997) found that vaccination rates were higher when the reminders were used in conjunction with free or low cost vaccinations. A different

study (Lave, 1996) also found that waiving fees for preventive care services produced an increase in influenza vaccination rates.

Several of the remaining studies provided cost information on various interventions used to increase immunization rates. For example, the physicians in one study (Kouides, 1998) were paid $0.80 per influenza vaccination if their vaccination rate was ≥ 70% and $1.60 per vaccination if their rate was ≥ 85%. This financial incentive, combined with frequent feedback, resulted in immunization rates that were statistically significantly higher than control. Another study (Belcher, 1990) reported that the cost of influenza vaccination offered through a health promotion clinic was $11 per patient, while a different study (Hutchinson, 1989) reported that a computerized provider reminder system incurred $15,200 Canadian in start-up costs. In addition, two studies provided cost information on the use of patient reminders to increase immunization rates: one (Smith, 1999) reported that the cost per mailed patient reminder was $1.26, while the other (Buchner, 1987) reported direct costs of $0.30 per reminder.

MAMMOGRAPHY

Eleven studies on improving mammography rates also provided cost data. Six of them were cost-effectiveness studies; these generally characterized cost effectiveness in terms of cost-per-additional mammogram or cost per additional woman screened. For example, the first cost-effectiveness study (Atri, 1997) reported that provider education, patient reminders, and organizational change cost £13 per additional woman screened. The second cost-effectiveness study (King, 1994), which provided free mammograms, reported the following costs per additional woman screened:

1. $0.91 for a patient reminder letter,
2. $2.73 for a second reminder letter,
3. $3.68 for a letter suggesting a preventive office visit, and
4. $4.92 for a patient reminder phone call.

The third cost-effectiveness study (Mohler, 1995), which also examined the effectiveness of different forms of patient remainders, found that, in terms of cost per additional mammogram, the most cost effective patient

reminder was a phone call by a medical assistant ($3.00), followed by a reminder letter ($13.57), and then a physician phone call ($51.82). Another study (Majeed, 1997) that employed reminder letters targeted to patients in need of a mammogram reported that the marginal cost of each additional woman screened was £7.

Another cost-effectiveness study (Stevens, 1997) found that academic detailing was both expensive and ineffective: although the intervention cost $34 Australian per physician visited, it produced no difference in mammography rates relative to usual care. The final cost-effectiveness study (Morrissey, 1995) reported that full Medicare reimbursement for preventive care services, in combination with provider reminders and an organizational change that enabled nurses to perform many preventive care functions, resulted in Medicare charges that were lower than average. Hospital admissions and lengths of stay also decreased relative to usual care.

Several of the remaining studies on mammography reported only cost data. For example, one study (Frame, 1994) found that the cost of patient reminders was over twice that of provider reminders. Another study (Brady, 1988) reported that the cost of the self-audit portion of a provider audit and feedback intervention was about equal to the cost of the feedback portion of the intervention. According to a different article (Lurie, 1987), undergoing a pap smear and mammogram every three years incurs, on average, $97 in insurance costs.

One of the last two studies (Lane, 1991) reported no differences among mammography rates in areas providing free mammography, low-cost mammography, and usual-cost mammography. The final study (Burton, 1997) found that Part A Medicare claims for patients receiving an intervention of patient financial incentives, provider financial incentives, and patient reminders were less than those of the usual care group. However, there were no differences in Part B claims, and a regression model showed no differences in Parts A or B claims during the third and fourth years after the intervention.

Cervical Smear Cytology

Eleven articles on improving cervical smear cytology rates also provided cost data. However, only four of these provided cost-effectiveness results. One of these (McDowell, 1989), which reported costs-per-

additional cervical smear obtained, found that computerized physician reminders were more cost-effective than nurse telephone reminders to patients, which were more effective than reminder letters to patients. A subsequent update of this study (Rosser, 1991) confirmed that computerized physician reminders were the most cost-effective of the three interventions; however, the update found that patient letter reminders were more cost effective than telephone reminders. A third study (Binstock, 1997), which also reported cost per additional cervical smear obtained, ranked interventions in the following order, from most cost effective to least cost effective: computerized provider reminder ($2.99), patient reminder letter ($4.76), patient telephone reminder ($7.99), and provider memo listing patients in need of a cervical smear ($22.96). The final cost-effectiveness study (Morrissey, 1995) reported that full Medicare reimbursement for preventive care services, in combination with provider reminders and an organizational change that enabled nurses to perform many preventive care functions, resulted in Medicare charges that were lower than average. Hospital admissions and lengths of stay also decreased relative to usual care.

Several of the remaining studies on cervical smear cytology reported only cost data. For example, one study (Frame, 1994) found that the cost of patient reminders was over twice that of provider reminders, while another study (Stevens, 1997) reported that the cost of academic detailing was $34 Australian per physician visited. A third study (Robson, 1989) reported that a computer system that enabled a health promotion nurse and physician to assess health risk factors incurred £12,000 in start-up costs and £2,000 in maintenance costs per year. A fourth study (Lurie, 1987) reported that undergoing a cervical smear and mammogram every three years incurs, on average, $97 in insurance costs.

The last few studies on cervical smear cytology reported preventive care rates and/or claims data. One study (Keeler, 1987) showed that there was no difference in cervical smear rates between free care and cost-sharing care. This finding was corroborated by another study (Cherkin, 1990) which also reported no difference in cervical smear rates among patients with a $5 office visit co-pay compared with patients with no co-pay. The final study (Burton, 1997) found that Part A Medicare claims for patients receiving an intervention of patient financial incentives, provider financial incentives, and patient reminders were less than those of the usual care

group. However, there were no differences in Part B claims, and a regression model showed no differences in Parts A or B claims during the third and fourth years after the intervention.

Colon Cancer Screening

Seven articles on colon cancer screening also provided data on costs. Two of them were cost-effectiveness studies reporting the cost per additional patient screened. The first cost-effectiveness study (Freedman, 1994) reported that returning FOBT cards by mail without prepaid postage ($1.61) was more cost-effective than returning them by mail with pre-paid postage ($1.71), which in turn was more cost-effective than returning them in person ($2.24). The second cost-effectiveness study (Morrissey, 1995) is described above.

The remaining five studies on colon cancer screening reported only cost data. For example, one study (Dales, 1979) reported that a periodic multiphasic health checkup (which included screening sigmoidoscopy) had a cost savings that ranged from $42 to $392 per patient per year over 11 years. This benefit was primarily due to improved earnings among patients in the intervention group. Another study (Frame, 1994) found that the cost of patient reminders was double that of provider reminders. A third study (Belcher, 1990) reported that the cost of a health promotion clinic FOBT was $24 per patient. A fourth study (Thompson, 1986) reported that patient reminders for FOBT cost $0.95 each for postcard reminders, $5.10 each for phone call reminders, $1.25 each for in-person nurse reminders, and $5.20 each for in-person physician reminders. The last study (Winickoff, 1984) reported that the cost of a computerized audit of patient preventive care needs cost $15 per hour when conducted for 15 hours per month.

Conclusions from Cost-Effectiveness Studies

Taking the cost-effectiveness studies of all conditions together, computerized provider reminders appear to be more cost effective when compared with various types of patient reminders. This assumes the existence of a computer system, and does not include start-up costs. It is unclear whether letter or telephone reminders to patients are more cost effective. Full reimbursement, provider reminders, and organizational change that allowed nurses to have a more active role in performing preventive care services decreased costs and improved patient outcomes. Academic detailing was costly and did not prove effective in one study.

Providing a cooperative health care clinic (where influenza and pneumococcal vaccinations were part of the health care program) was cost-effective for caring for elderly HMO patients.

Table 14: Evidence Table
Studies that Included Cost-Effectiveness
Influenza Vaccination

Author	Year	Country	Design	Target	Intervention	Cost-Effectiveness*
BECK	1997	USA	RCT	Patients, Organizations	Cooperative health care clinic	Lower skilled nursing facility costs and fewer hospitalizations compared with usual care
MCDOWELL	1986	Other Country	RCT	Patients, Providers	Computerized physician reminders	Computerized physician reminder > patient phone reminder > patient letter reminder
					Patient letter reminders	
					Patient phone reminders	
MORRISSEY	1995	USA	RCT	Patients, Providers, Organizations	Full reimbursement for preventive care services, provider reminders, organizational change	Lower charges, fewer hospital admissions and shorter lengths of stay compared with usual care
ROSSER	1991	Other Country	RCT	Patients, Providers	Computerized physician reminders	Computerized physician reminder > patient letter reminder > patient phone reminder
					Patient letter reminders	
					Patient phone reminders	

* cost/additional patient screened or immunized unless otherwise specified
RCT = randomized clinical trial
CCT = controlled clinical trial
CBA = controlled before-and-after study
USA = United States of America
FOBT = fecal occult blood testing

Table 14: Evidence Table
Studies that Included Cost-Effectiveness (continued)
Mammography

Author	Year	Country	Design	Target	Intervention	Cost-Effectiveness*
ATRI	1997	Other Country	RCT	Patients, Providers, Organizations	Provider education, patient reminders, organizational change	£13
KING	1994	USA	RCT	Patients	Patient letter reminder	Patient letter reminder > two patient letter reminders > preventive office visit suggestion > patient phone reminder
					Two patient letter reminders	
					Patient letter suggesting a preventive care office visit	
					Patient phone reminder	
MAJEED	1997	Other Country	CCT	Patients, Organizations	Patient reminder letter	£7
MOHLER	1995	USA	RCT	Patients	Reminder phone call by medical assistant	Reminder phone call by medical assistant > patient reminder letter > reminder phone call by physician
					Patient reminder letter	
					Reminder phone call by physician	
MORRISSEY	1995	USA	RCT	Patients, Providers, Organizations	Full reimbursement for preventive care services, provider reminders, organizational change	Lower charges, fewer hospital admissions and shorter lengths of stay compared with usual care
STEVENS	1997	Other Country	RCT	Providers	Academic detailing	Australian $34/physician visited; not effective

* cost/additional patient screened or immunized unless otherwise specified
RCT = randomized clinical trial
CCT = controlled clinical trial
CBA = controlled before-and-after study
USA = United States of America
FOBT = fecal occult blood testing

Table 14: Evidence Table
Studies that Included Cost-Effectiveness (continued)
Cervical Smear Cytology

Author	Year	Country	Design	Target	Intervention	Cost-Effectiveness*
BINSTOCK	1997	USA	RCT	Patients, Providers	Computerized provider reminder	Computerized provider reminder > patient letter reminder > patient phone reminder > provider memo with list of patients needing pap smear
					Patient letter reminder	
					Patient phone reminder	
					Provider memo with list of patients needing pap smear	
MCDOWELL	1989	Other Country	RCT	Patients, Providers, Organizations	Computerized physician reminders	Computerized physician reminder > patient phone reminder > patient letter reminder
					Patient letter reminders	
					Patient phone reminders	
MORRISSEY	1995	USA	RCT	Patients, Providers, Organizations	Full reimbursement for preventive care services, provider reminders, organizational change	Lower charges, fewer hospital admissions and shorter lengths of stay compared with usual care
ROSSER	1991	Other Country	RCT	Patients, Providers	Computerized physician reminders	Computerized physician reminder > patient letter reminder > patient phone reminder
					Patient letter reminders	
					Patient phone reminders	

* cost/additional patient screened or immunized unless otherwise specified
RCT = randomized clinical trial
CCT = controlled clinical trial
CBA = controlled before-and-after study
USA = United States of America
FOBT = fecal occult blood testing

Table 14: Evidence Table
Studies that Included Cost-Effectiveness (continued)
Colon Cancer Screening (FOBT)

Author	Year	Country	Design	Target	Intervention	Cost-Effectiveness*
FREEDMAN	1994	USA	RCT	Patients	Return FOBT cards by mail without prepaid postage	Returning FOBT cards by mail without prepaid postage > returning FOBT cards with prepaid postage > returning FOBT cards in person
					Return FOBT cards by mail with prepaid postage	
					Return FOBT card in person	
MORRISSEY	1995	USA	RCT	Patients, Providers, Organizations	Full reimbursement for preventive care services, provider reminders, organizational change	Lower charges, fewer hospital admissions and shorter lengths of stay compared with usual care

* cost/additional patient screened or immunized unless otherwise specified
RCT = randomized clinical trial
CCT = controlled clinical trial
CBA = controlled before-and-after study
USA = United States of America
FOBT = fecal occult blood testing

QUESTION 5: ELEMENTS INSTRUMENTAL TO THE SUCCESS OF EACH INTERVENTION

What elements appear to be instrumental in determining the success of each intervention?

As discussed previously, we focused our attention on factors postulated to be essential to the success of the interventions as data limitations prevented us from conducting a complete analysis of intensity and baseline utilization rate effects. We considered eight possible factors: use of social influence, e.g., opinion-leader involvement; marketing or outreach; high visual appeal and clarity; collaboration and teamwork; design based on needs, barriers, incentives, assessments, or theory; top management buy-in and support; and active learning strategies. Not all screening settings allowed all factors to be modeled due to data sparseness. We fit a similar model in each setting to the intervention component model discussed in the context of the first two research question. The results are shown in Tables 15 which is akin to Table 6.

Table 15: Effectiveness of Factors to Improve the Use of Clinical and Preventive Services presents the results of the meta-regression analysis for immunizations, mammography, cervical smear cytology, and colon cancer screening. The table reports the odds ratio for improvement in the receipt of the screening or preventive service for each factor versus the control or usual care situation, adjusted for other factors and study level differences, and ordered within service from the most effective to the least. It also presents the 95% confidence interval. Not all factors tested significantly improved screening rates. We did notice some consistent patterns across the four regressions. For example, collaboration and teamwork was the most positive factor when compared with the control or usual care setting for all services except mammography. Design based on theory, etc. was also significant for every service and had a relatively consistent effect. Other factors did not show consistent patterns.

Table 15. Effectiveness of Specific Factors To Improve the Use of Clinical Preventive and Screening Services

Immunizations			Mammography			Cervical Smear Cytology			Colon Cancer Screening (FOBT)		
Intervention	Odds Ratio	95% Confidence Interval	Intervention	Odds Ratio	95% Confidence Interval	Intervention	Odds Ratio	95% Confidence Interval	Intervention	Odds Ratio	95% Confidence Interval
Collaboration/ Teamwork	6.03	3.04 - 11.9	**Design/ Theory**	1.96	1.78 – 2.16	**Collaboration/ Teamwork**	4.76	3.94 – 5.76	**Collaboration/ Teamwork**	5.17	3.66 - 7.32
Design/ Theory	1.60	1.51 - 1.70	**Marketing/ Outreach**	1.23	0.83 – 1.81	**Learning Strategies**	2.25	1.85 – 2.74	**Learning Strategies**	4.00	2.36 - 6.79
High Visual Appeal/ Clarity	1.37	0.83 - 2.27	**Learning Strategies**	1.16	0.84 – 1.59	**High Visual Appeal/ Clarity**	1.86	1.58 – 2.18	**Design/ Theory**	2.14	1.83 - 2.50
Learning Strategies	0.59	0.31 - 1.14	**Use of Social Influence**	1.10	0.84 – 1.45	**Design/ Theory**	1.48	1.34 – 1.63	**High Visual Appeal/ Clarity**	1.33	0.94 - 1.88
Use of Social Influence	0.38	0.22 – 0.66	**High Visual Appeal/ Clarity**	1.07	0.82 – 1.40	**Use of Social Influence**	0.61	0.51 – 0.72			
			Collaboration/ Teamwork	0.98	0.75 – 1.29						

EDUCATIONAL INTERVENTIONS EFFECTIVENESS BY YEAR

The success of an intervention designed to increase the utilization of a preventive service may be affected by the baseline rate of utilization for the service. For example, when a service is offered for the first time (baseline rate = 0) it is relatively easy to attract users because the entire eligible population is being targeted. However, if a service has been offered for many years and utilization is high, it may be a real challenge to recruit the few remaining individuals because they are the most difficult populations.

Since baseline utilization data was not available for all studies, we used year of publication as a proxy. We hypothesized that, as time progressed, and as widespread knowledge and acceptance of the preventive services increased, interventions involving education (both patient and provider) would be less successful because the majority of the target population had already been reached. To measure intervention effectiveness, we used Number Needed to Treat (NNT). Lower NNTs indicate more effective interventions; negative NNTs indicate that the control group did better than the intervention group. Figures six through nine display the NNTs for each educational intervention (compared with control group) by publication year. Events that may have increased knowledge about a particular service are marked in red on the timeline and described in a box below the figure.

Figure six shows the effectiveness of patient and provider education on the utilization of vaccines for influenza and pneumococcal pneumonia. Educational interventions regarding pneumococcal vaccine have become less successful over time. A similar trend can be seen for influenza vaccine. Figure seven displays a similar trend for interventions designed to increase the use of mammography through both patient and provider education.

Regarding cervical smear cytology and colon cancer screening, trends were less clear. Data on these studies are displayed in Figures eight and nine respectively.

Figure 6. Immunizations
Control vs. Educational Intervention
Study Effectiveness by Year

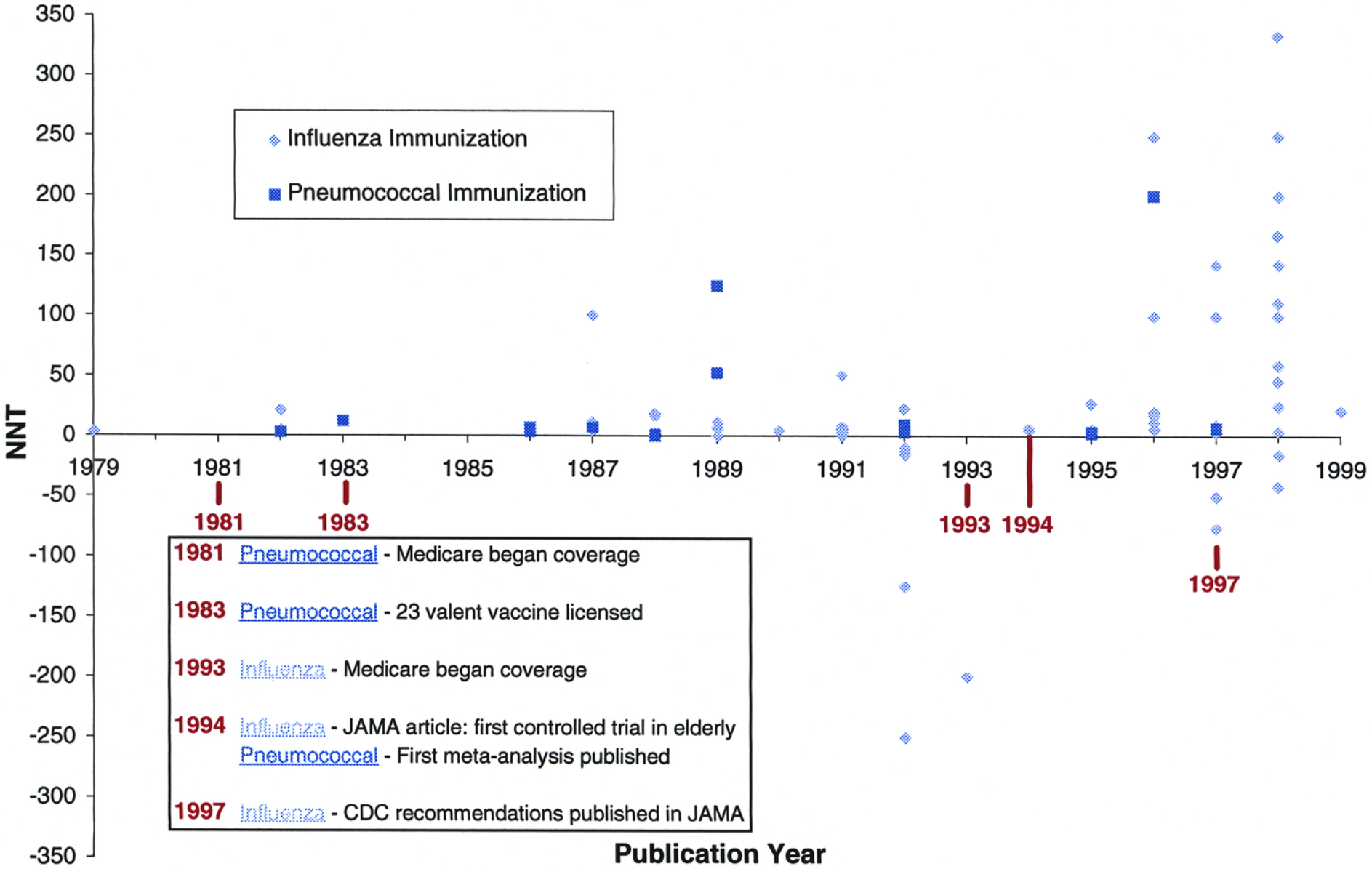


Figure 7. Mammography
Control vs. Educational Intervention
Study Effectiveness by Year

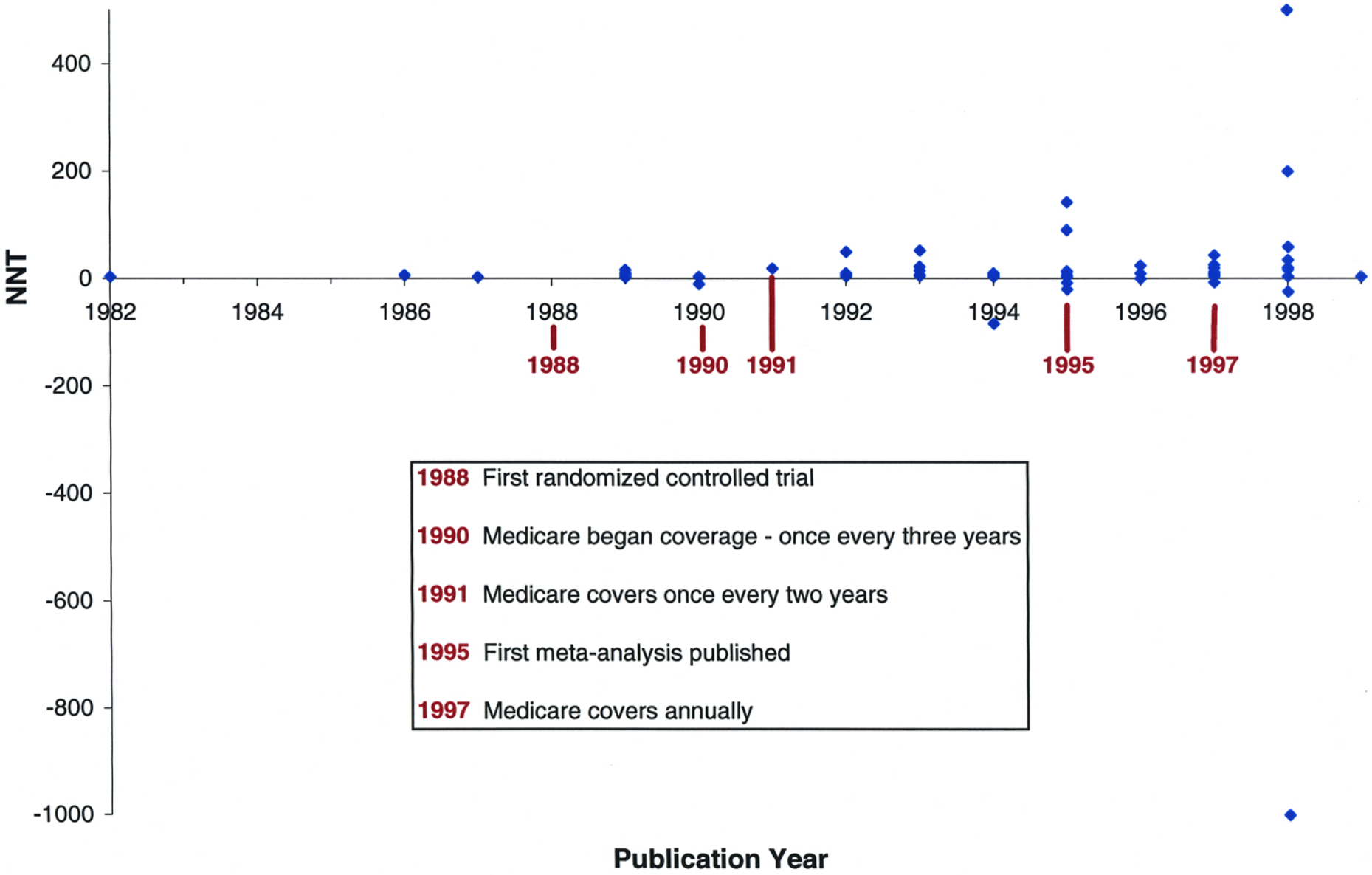


Figure 8. Cervical Smear Cytology Control vs. Educational Intervention Study Effectiveness by Year

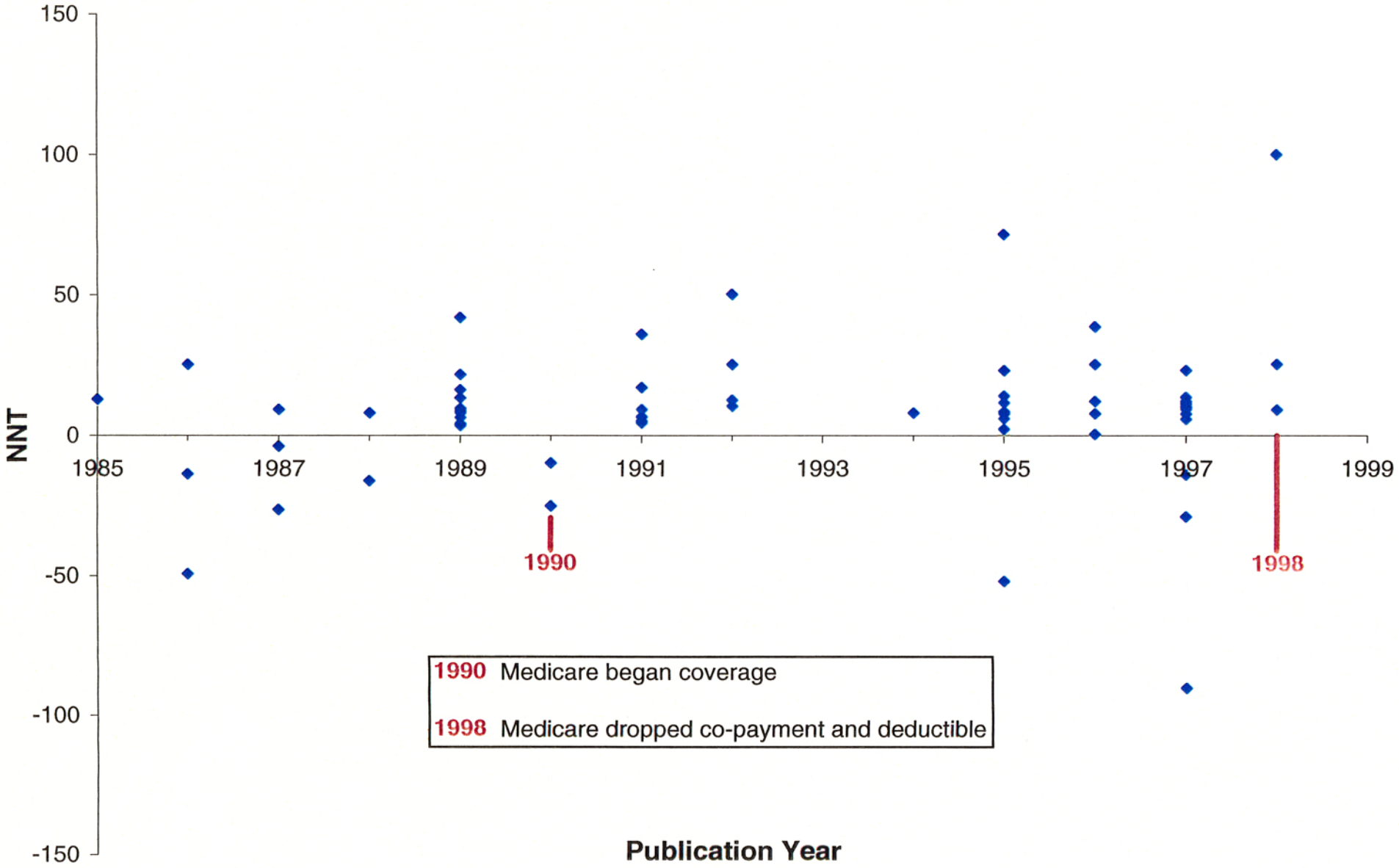
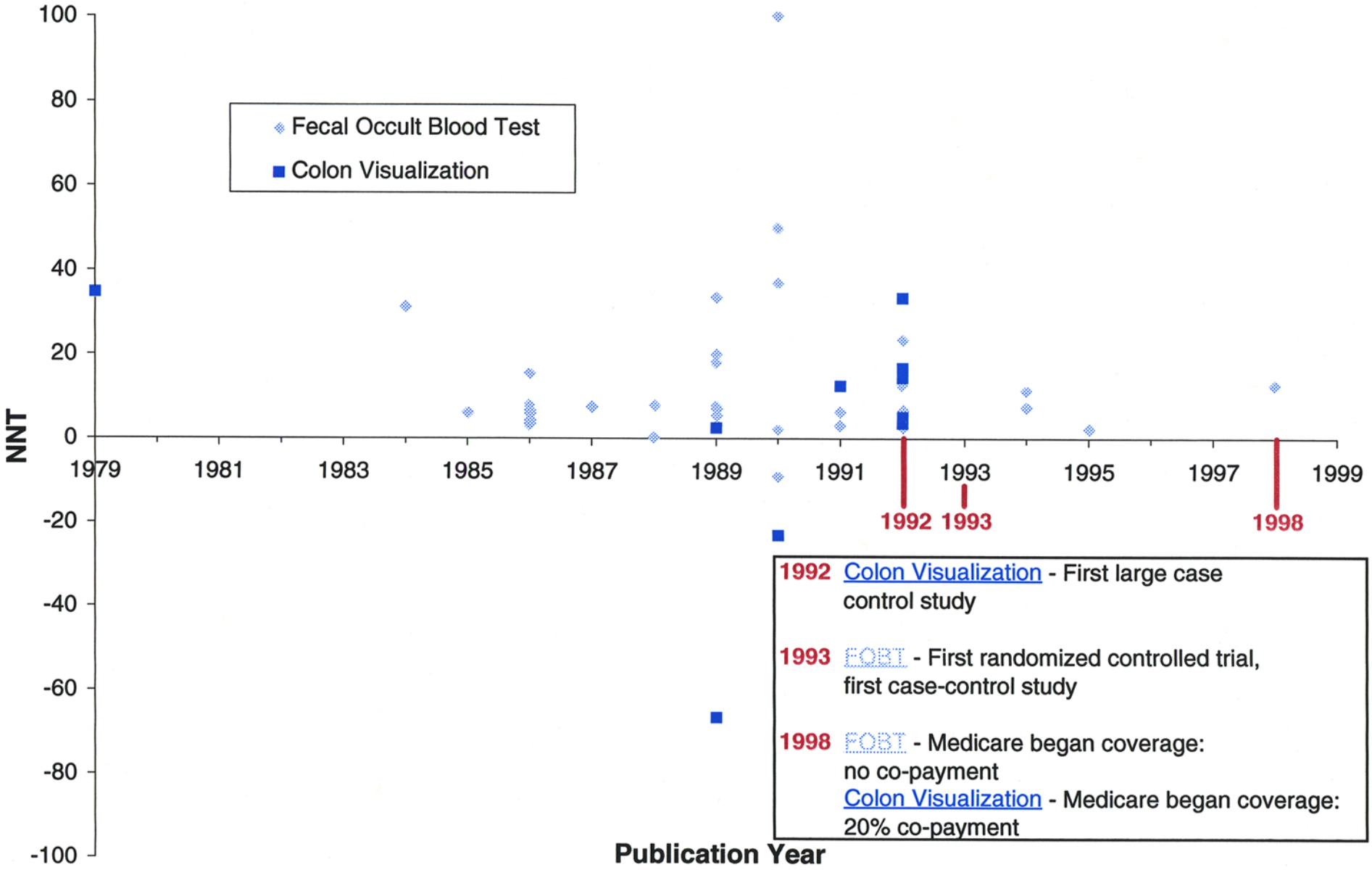


Figure 9. Colon Cancer Screening Control vs. Educational Intervention Study Effectiveness by Year



LIMITATIONS

The primary limitation of this systematic review, which is common to all such reviews, is the quantity and quality of the original studies. Even more so than reviews of single therapies for single conditions (i.e., coronary revascularization for coronary artery disease; pharmaceutical therapy for rheumatoid arthritis), the studies presented here are extremely heterogeneous in terms of both the interventions that were tested and the specific populations or health care systems being studied. Furthermore, many of the study level variables are highly idiosyncratic and inter-correlated (e.g., a study of patient and provider education with nurse standing orders is also a study of mammography use in low-income African-American women). This correlation between intervention level variables and population makes the assessment of the effect of the individual components challenging. Due to sample size limitations, we were only able to model intervention components as main effects in our meta-regression analysis. As a result, we can not distinguish the independent effects of various other intervention components.

We also made no attempt to give greater importance to studies that had better design and certain characteristics that have been postulated to give more valid results. This was because for these type of studies there is a lack of empirical evidence between study characteristics and bias.

This study is also limited by the inability of our analysis to account for the clustering of patients in those studies that allocated interventions at the provider or community level. Failing to account for clustering will tend to underestimate the variance (and hence overestimate the statistical significance) of our results. However, rejecting all studies that did not account for clustering would have meant rejecting more than one-third of the available study sample. We decided to include such studies as a result, and acknowledge that while our resulting estimates of the intervention effect are probably unbiased, we have probably underestimated the uncertainty in those estimates.

Finally, this study assumes that interventions will achieve equal success when targeted towards adults of any age. Our expert panel stated this assumption on March 17, 1999. We were not able to empirically test this assumption due to insufficient data. Most of the interventions for pneumococcal and influenza vaccines were targeted toward persons over 65 years of age, while most cancer screening interventions targeted adults under age 65.

CONCLUSIONS

Keeping in mind the limitations noted, and that knowledge of local barriers and opportunities to improve services is likely to be a key ingredient in designing effective interventions, we draw the following conclusions from the literature:

1. Organizational change and financial incentives are the interventions that were most consistent at producing the largest improvements in use of all preventive and screening services.

2. Patient reminders are also consistently effective across all preventive and screening services, although in general, they were less so than organizational change or financial incentives. Patient reminders that are personalized or signed by the patient's physician are more effective than reminders that are generic.

3. Provider reminders are very effective at improving receipt of immunizations and show consistent but moderate effectiveness at improving the use of cancer screening services.

4. Patient education is consistently less effective than organizational change and reminders. The effect of patient education, while still significant, is modest.

5. Feedback is of limited, if any, effectiveness.

6. Mass mailings by PROs to improve influenza immunizations have been shown to produce clinically trivial effects when unaccompanied by other interventions.

7. Multiple interventions are more effective than single interventions, although highly successful single interventions exist. Adding organizational change or reminders to an "average" intervention produces the greatest increase in effectiveness. However, the relative cost effectiveness of adding interventions has not been established.

8. Computer-assisted provider reminders are more cost-effective than patient reminders in the few studies that have addressed this issue.

9. There are insufficient data to draw conclusions about which interventions are most effective for special populations, geographic settings, or delivery systems.

10. There are insufficient data to draw conclusions about the effect of pre-intervention rates, intensity of interventions, or other factors in determining the success of interventions.

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