Clinical Review

Effectiveness of Interventions to Enhance Physician Screening for Breast Cancer

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Background. Physician recommendation is one of the strongest predictors of mammography use. This study was designed to review research articles assessing the effectiveness of interventions to enhance physician breast cancer screening behavior.

Methods. A MEDLINE search was conducted to identify intervention studies published from January 1980 to April 1993. The search was supplemented by review of all related bibliographic references and recent listings in *Current Contents.*

Results. Effect sizes and 95% confidence intervals were calculated for the 20 controlled trials identified by the search. The majority of studies were conducted in academic settings; two were community-based. Interventions included physician reminder systems, other office systems, audit with feedback, and physician education. The majority of trials included two or more intervention modalities; 65% included physician reminder systems. In university settings, physician reminders and audit with feedback each significantly increased use of mammography and clinical breast examination by approximately 5% to 20%. In community-based settings, the effects of physician education also had a positive impact on mammography and clinical breast examination rates, which ranged from 6% to 14%. Using patient education to influence physician behavior was not effective in university settings, but had a modest impact in community trials. Generally, reminders were more cost-efficient than audit with feedback.

Conclusions. Physician-based interventions can be effective in increasing screening use. Interventions should emphasize community practices and practices caring for underserved and older populations.

Key words. Breast cancer screening; breast diseases; neoplasms; physician behavior, mammography; interventions; effectiveness. (*J Fam Pract 1995; 40:162-171*)

All health care encounters represent an opportunity to screen for breast cancer. There exists, however, an apparent paradox in cancer control practice: screening use increases with having a regular source of care, but the major reason women give for not having a mammogram is that a physician never recommended it.[1–5]

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Primary care physicians report ordering mammography for between 3% and 48% of their patients.[3,6–17] Although these self-reported rates have increased over the past decade,[6,18] providers overestimate their screening performance by a factor of two.[7,13,17,19] For example, primary care physicians estimate that they perform clinical breast examinations on 81%[13] to 99%[6,7,16] of their female patients, while they actually do so for only 39%[13] to 77%.[16,17,19] For mammography, estimates range from between 8% and 10%[7,12] to as high as 49%[6,13] to 96%,[18] whereas actual rates have been observed to range from only 2% to approximately 30%.[9,12–15,17,20]

Physician reasons for not performing cancer screening tests include disagreement with, and confusion about, professional guidelines[13,18,21]; deficient knowledge, negative attitudes, or lack of confidence[22–24]; forgetfulness and lack of time[13,22]; concerns about patient accep-

tance[13,17,25]; cost concerns[6,10,11,18,25,26]; and organizational barriers.[8,13]

These data indicate that there is a substantial discrepancy between intention and actual practice. Several categories of interventions have been developed to enhance physician use of breast cancer early-detection procedures. This paper presents a critical review of the existing data on interventions designed to enhance physician behaviors regarding breast cancer screening. The research settings and populations are highlighted to identify knowledge deficits and areas for future research.

Methods

Studies were obtained for review using a MEDLINE computerized search for citations published between January 1980 and April 1993, inclusive. Key words used in the search are summarized in the Appendix. The initial year of 1980 was selected since it coincided with the publication of formal guidelines for breast cancer screening with clinical examination and mammography.[27,28] To ensure completeness of the review,[29] bibliographic references in retrieved articles were reviewed for additional citations, and *Current Contents* from November 1992 to April 1993 was reviewed for recent articles.

Only concurrent control studies were included in the final sample. Thus, uncontrolled reports, descriptive studies, studies with historical controls and preintervention-postintervention studies, and studies of symptomatic individuals were excluded. Studies not based in the United States also were omitted because of the potential lack of generalizability to our health care system.

Data from the controlled studies including data on the type of intervention, control group, practice setting and location, characteristics of the physician and patient populations, use of follow-up, results, and resources necessary for implementation were abstracted independently in a standardized manner by two reviewers. Interrater reliability was very good; the reviewers agreed on inclusion criteria for 90% of retrieved articles and for 85% of the data abstracted from the controlled trials. Disagreements were resolved by concurrent review and consensus.

Statistical Analysis

An intervention effect size was determined for the intervention employed in each study. For studies of multiple interventions, separate effect sizes were calculated if the outcomes of each intervention could be separated; one effect size was calculated when it was impossible to isolate the impact of a single intervention from the overall effect of multiple interventions.

For randomized trials, the intervention effect size was calculated as the difference in screening rates between the intervention and control groups at the end of the intervention period. A 95% confidence interval (CI) was determined, when it could be estimated, by using variance estimates based on the proportion of women screened and the total sample size.

$$\text{Effect size} = (p_{\text{Intervention, Post}} - p_{\text{Control, Post}})$$

$$\text{Variance (effect size)} = [p(1-p)/n]_{\text{Intervention, Post}} + [p(1-p)/n]_{\text{Control, Post}}$$

where p = percentage of women screened, and
n = number of women in sample.

Implicit in this variance calculation is the assumption that the baseline screening rates were, by design, similar for the control and intervention groups. Of the five randomized trials reporting baseline screening levels, only one reported absolute differences between control and intervention baseline screening rates of greater than 5% (but less than 10%).[30] Thus, the variance estimate for randomized trials represents an underestimation of the study's true variance, since any baseline variance is disregarded in the calculation.

For nonrandomized controlled trials, the intervention effect size was calculated as the difference in screening rates between the intervention and control groups of the difference between post- and preintervention levels. In the one instance where baseline rates were not reported,[31] an effect size was calculated using postintervention data alone (ie, assuming baseline equivalence). A 95% CI was determined, when it could be estimated, by using variance estimates based on the proportion of women screened and the total sample size.

$$\text{Effect size} = (p_{\text{Intervention, Post}} - p_{\text{Intervention, Pre}}) - (p_{\text{Control, Post}} - p_{\text{Control, Pre}})$$

$$\text{Variance (effect size)} = [p(1-p)/n]_{\text{Intervention, Post}} + [p(1-p)/n]_{\text{Intervention, Pre}} + [p(1-p)/n]_{\text{Control, Post}} + [p(1-p)/n]_{\text{Control, Pre}}$$

The variance estimate for nonrandom trials includes sources of variance related to baseline screening rates; thus, the confidence intervals for nonrandom trials tend to be larger than for randomized trials. The variance estimates for nonrandomized trials likely overestimate the study's true variance.

To evaluate the appropriateness of calculating a sum-

mary effect size estimate for each category of intervention, a formal chi-square test for heterogeneity was conducted separately for randomized and nonrandomized trials involving three or more studies based on the techniques of DerSimonian and Laird.[32] Since the statistical test requires individual variance estimates, studies from which data were not available to calculate variance were not included in the test of heterogeneity. If the null hypothesis that the studies were identical could not be rejected, a summary effect size was calculated. In cases where the studies were heterogeneous, individual study effects were described.

Based on the types of study interventions and available data, five tests of heterogeneity were conducted for mammography outcomes (physician reminder alone, physician reminder plus other modalities, audit with feedback alone, patient reminder or education alone, and patient reminder or education plus other modalities). Three tests were conducted for clinical breast examination outcomes: physician reminder alone, patient reminder or education alone, and patient reminder or education plus other modalities.

Results

General

The search retrieved 195 citations that included data on physician breast cancer screening practices. Among these, 93 (48%) were reviews, summaries of screening recommendations, editorials, or letters; 62 (32%) were descriptive studies; 15 (8%) were preintervention-postintervention studies; 14 (7%) were nonrandomized trials with concurrent controls including three community control trials; and 11 (6%) were randomized controlled trials. Five nonrandomized controlled trials were excluded because of the lack of extractable raw data on screening rates,[20,33,34] use of historical controls,[35] or use of a noncomparable unit of analysis.[36] The remaining 9 nonrandomized controlled trials and 11 randomized trials represent the final sample for the review. These 20 trials tested five intervention modalities alone or in combination. Formal tests of interstudy variation indicated that the effect sizes for the different intervention modality groups were not homogeneous across studies because of the large variance in estimates. Thus, the remainder of the discussion highlights individual study results and effect sizes. The characteristics of the final sample are summarized in Table 1.

Physician Reminder Systems

The major assumption underlying reminder interventions is that provider forgetfulness, or a focus on acute illness, or other aspects of the practice environment are major barriers to the use of cancer screening services, as opposed to knowledge or skill deficiencies. There were 13 controlled trials that included a physician reminder intervention. The majority focused on internal or family medicine residents in academic medical centers; only one targeted physicians in private office practice.[37]

A summary of the individual effects of the reminder interventions is presented in Tables 2 and 3. With the exception of two trials that noted a negative impact of the physician reminder intervention,[30,38] the majority of studies noted a significant increase in either mammography or breast examination, or both, as a result of using diverse reminder systems. The increased rates of mammography that were noted using reminder systems alone or in combination with other modalities in academic settings ranged from 6% to 28%, with a median of approximately 20%. The magnitude of effects appeared to be similar for computerized and noncomputerized reminders. A smaller effect of 5% for mammography and 9% for breast examination was found in the one study targeting private practice settings.[37]

There are several caveats that should be noted in considering the aforementioned results, including nondocumentation of actual use or low penetration of reminders,[30,39–41] inability to segregate multidimensional intervention effects,[9,38] and selection biases.[42] Only one report controlled for potential patient-related confounders, such as symptoms and risk status. Although their calculated effect size decreased somewhat after adjustment, their adjusted effect (14%) remained significant.[14]

Only rarely did the aforementioned studies include results in a manner that allowed stratification by patient age or race. Two groups noted that physician reminders were more effective in increasing breast examinations for patients over age 60 than for those aged 60 or less.[39,43] There is only one trial (not included in the final sample) that is being conducted among the elderly; preliminary data indicate that physician reminders will increase breast examination and mammography rates for patients in this age group.[44]

In the one study that discussed race-related differences, physician reminders were equally effective among white and nonwhite patients.[43] There were little data on the persistence of reminder effects after the first year of use. There were three studies of reminders that included follow-up data.[38,42,43] Screening rates generally declined after the reminders were withdrawn.[42,43]

The design and feasibility of computerized reminder systems in preventive practice have been reviewed by

Table 1. Characteristics of the Controlled Trials (N = 20)

Variable	%* (No.)	Reference†
Type of intervention		
Physician reminder		
Computerized	35 (7)	14, 30, 37, 40, 41, 43, 61
Noncomputerized	30 (6)	9, 38, 39, 42, 54, 56
Office system‡	10 (2)	31, 48
Audit with feedback	15 (3)	14, 41, 49
Physician education	30 (6)	9, 38, 48, 54, 55, 56
Patient or public reminder or education	45 (9)	30, 31, 49, 55, 56, 58, 59, 60, 61
Number of intervention modalities		
Single	35 (7)	37, 39, 40, 42, 43, 59, 60
Multiple	65 (13)	9, 14, 30, 31, 38, 41, 48, 49, 54, 55, 56, 58, 61
Number of preventive services§		
1	30 (6)	31, 43, 49, 54, 55, 56
2–7	30 (6)	14, 30, 38, 42, 58, 59
≥8	40 (8)	9, 37, 39, 40, 41, 48, 60, 61
Physician population		
Residents	70 (14)	9, 14, 30, 38, 39, 40, 41, 42, 43, 49, 54, 58, 60, 61
Faculty (university practice)	15 (3)	40, 43, 59
Office practice	25 (5)	31, 37, 48, 55, 56
Physician specialty		
Family practice	45 (9)	30, 31, 37, 43, 48, 55, 56, 59, 60
Internal medicine	65 (13)	9, 14, 38, 39, 40, 41, 42, 48, 49, 55, 56, 58, 61
Obstetrics and gynecology	10 (2)	55, 56
Setting		
University hospital outpatient department	80 (16)	9, 14, 30, 31, 38, 39, 40, 41, 42, 43, 49, 54, 58, 59, 60, 61
Community office practice	25 (5)	31, 37, 48, 55, 56
Design‖		
Randomized controls	55 (11)	14, 30, 37, 39, 40, 41, 43, 48, 58, 59, 61
Nonrandomized controls		
Practice-based	35 (7)	9, 31, 38, 42, 49, 54, 60
Community-based	10 (2)	55, 56
Scope		
Single institution	70 (14)	9, 14, 30, 39, 40, 41, 42, 43, 49, 54, 58, 59, 60, 61
Multiple institution, same locale	5 (1)	31
Communities or counties	15 (3)	37, 55, 56
State or multistate	5 (1)	48
Duration of study, mo		
1–3	10 (2)	31, 54
4–6	40 (8)	9, 38, 42, 43, 49, 59, 60, 61
7–12	40 (8)	14, 30, 37, 39, 41, 48, 56, 58
13–24	5 (1)	40
≥24	5 (1)	55
Follow-up of effects¶		
Yes	25 (5)	38, 42, 43, 54, 60
No	75 (15)	9, 14, 30, 31, 37, 39, 40, 41, 48, 49, 55, 56, 58, 59, 61
Physician sample size#		
1–9	5 (1)	59
10–14	5 (1)	54
15–34	15 (3)	43, 58, 60
35–49	25 (5)	30, 37, 38, 42, 49
≥50	35 (7)	14, 39, 40, 41, 48, 55, 56
Unknown	15 (3)	9, 31, 61
Patient age group, y		
18–39	15 (3)	31, 58, 60
40–49	45 (9)	14, 30, 31, 37, 43, 48, 58, 60, 61
50–74	80 (16)	14, 30, 31, 37, 40, 41, 42, 43, 48, 49, 55, 56, 58, 59, 60, 61
≥75	20 (4)	14, 31, 58, 60
Unknown	20 (4)	9, 38, 39, 54
Patient race/ethnicity		
≥30% white	40 (8)	14, 31, 37, 42, 43, 49, 56, 61
≥30% black	35 (7)	30, 40, 42, 43, 49, 56, 61
≥30% Hispanic	0 (0)	None
≥30% Asian	30 (6)	9, 14, 38, 39, 40, 54
Not stated	30 (6)	41, 48, 55, 58, 59, 60
Patient income level		
Lower	25 (5)	14, 30, 43, 49, 56
Middle	15 (3)	14, 37, 55
Upper	0 (0)	None
Not stated	65 (13)	9, 31, 38, 39, 40, 41, 42, 48, 54, 58, 59, 60, 61

**Percentages may not total 100% because of rounding, overlapping categories, and data not provided by the cited trials.*
†Each article may be cited in more than one category.
‡May include physician reminders, as well as other office-based strategies.
§May have included cancer screening, vaccination, smoking cessation counseling, or other prevention activities.
‖Unit of randomization or allocation to intervention or control may have been by patient, physician, or practice.
¶Follow-up is defined as a measurement of persistence of effects after the intervention period has ended.
#Physician sample size is per study, not per intervention or control group.

Frame.[45] The overwhelming majority of the aforementioned interventions required the use of a micro- or minicomputer and software, and data entry personnel for initial and ongoing operation. However, the costs associated with a computer reminder system for several cancer screening tests, including breast cancer, are low: approximately $18 per additional test ordered over baseline.[46] Computerized systems have also been found to be acceptable to physicians and staff.[45,47]

Office Systems

Two studies[31,48] examined the use of an administrative office system; however, these office systems also may have

Table 2. Effects of Interventions to Increase the Use of Mammography to Screen for Breast Cancer

Intervention	Control Group	Study Setting	Sample Size		Estimated Effect Size		Reference
			Control	Intervention	% Women Impacted	(95% CI)	
Physician reminder systems							
Physician reminder*	Random	University	N/A	N/A	6	(NE)	40
Physician reminder*	Random	University	1539	1539	17	(14.5, 19.5)	41
Physician reminder*	Random	University	85	76	20	(7.5, 31.9)	61
Physician reminder*	Random	University	623	639	6	(1.3, 10.7)	43
Physician reminder*	Random	University	266	345	4	(−3.4, 11.2)	30
Physician reminder*	Random	University	432	432	16	(9.4, 22.6)	14
Physician reminder	Random	University	116	116	20	(10.0, 30.0)	39
Physician reminder*	Random	Community	710	710	5	(0.2, 10.2)	37
Physician and patient reminder*	Random	University	266	332	−0.3	(−7.5, 6.9)	30
Physician and patient reminder*	Random	University	85	61	21	(7.2, 33.8)	61
Physician reminder and education	Concurrent	University	138	290	28	(21.7, 34.3)	9
Office systems							
Administrative office system	Random	Community	N/A	N/A	20	(NE)	48
Administrative office system and physician education	Random	Community	N/A	N/A	21	(NE)	48
Scheduling and patient reminder	Concurrent	Community	344	343	19†	(12.1, 26.1)	31
Audit							
Audit	Random	University	1539	1539	15	(12.6, 17.4)	41
Audit	Random	University	432	432	21	(14.7, 27.6)	14
Audit with Feedback	Concurrent	University	227	152	24	(10.7, 36.7)	49
Physician education							
Physician education	Random	Community	N/A	N/A	14	(NE)	48
Physician education and reminder	Concurrent	University	N/A	N/A	8	(NE)	54
Physician education, physician reminder, and public education	Concurrent	Community	484/487§	484/486	10‡	(1.4, 18.6)	56
Physician and public education	Concurrent	Community	N/A	N/A	10‖	(NE)	55
Patient reminder and education							
Patient reminder¶	Random	University	130	98	−1	(−11.2, 9.2)	58
Patient reminder	Random	University	266	329	−6	(−13.3, 0.5)	30
Patient reminder and education	Random	University	76	102	−10	(−23.0, 2.4)	59
Patient reminder and education	Concurrent	University	227	129	13	(−0.6, 27.4)	49
Patient reminder	Concurrent	University	73	142	7	(−12.2, 27.0)	60

**Computer-generated.*
†Based on post-test alone.
‡Based on patient self-report.
§Pre- and post-test numbers.
‖Based on physician self-report.
¶Both control and intervention groups received physician reminders.
CI denotes confidence interval; N/A, not available; NE, cannot be estimated from the raw data.

included the use of physician reminders. The systems were designed to create routine procedures that result in increased cancer screening: for example, scheduling a mammography appointment for a patient before she leaves the office. Both studies reported increases in either mammography or breast examination or both, averaging a 20% effect for mammography and a 15% effect for clinical breast examination.

Physician Audit with Feedback Interventions

In contrast to reminders, which are an immediate visit-based cue, audit with feedback interventions provide cues given outside the patient-physician encounter. One concurrent and two randomized controlled trials included audit with feedback strategies; all were conducted in academic hospital settings with internal medicine residents; and all reported a significant increase in mammography screening,[14,41,49] breast examination,[14] or both. When audit with feedback was compared with computer reminders, the two modes were found to be equally effective.[14,41]

All three trials contained sufficient data to assess effect size (Tables 2 and 3). The overall range of mammography and clinical breast examination effect sizes were 15%

Table 3. Effects of Interventions to Increase the Use of Clinical Breast Examination to Screen for Breast Cancer

Intervention	Control Group	Setting	Sample Size		Estimated Effect Size		Reference
			Control	Intervention	% Women Impacted	(95% CI)	
Physician reminder systems							
Physician reminder*	Random	University	432	432	22	(15.8, 27.6)	14
Physician reminder	Random	University	132	132	18	(6.4, 29.6)	39
Physician reminder*	Random	Community	710	710	9	(3.4, 13.8)	37
Physician reminder	Concurrent	University	119/119	657/131	4	(−10.9, 18.9)	42
Physician reminder and education	Concurrent	University	28/32	31/40	−24	(−56.8, 8.8)	38
Office systems							
Administrative office system	Random	Community	N/A	N/A	14	(NE)	48
Administrative office system and physician education	Random	Community	N/A	N/A	15	(NE)	48
Audit							
Audit	Random	University	432	432	23	(16.8, 28.6)	14
Physician education							
Physician education	Random	Community	N/A	N/A	6	(NE)	48
Patient reminder and education							
Patient reminder and education	Random	University	76	102	−11	(−25.6, 2.8)	59
Patient reminder†	Random	University	118	84	23	(9.5, 36.5)	58
Patient reminder	Concurrent	University	73	142	24	(4.6, 43.8)	60

**Computer-generated.*
†Both control and intervention groups received physician reminders.
CI denotes confidence interval; N/A, not available; NE, cannot be estimated from raw data.

to 24%. One study[14] reported adjusted results and controlled for baseline behavior and the characteristics of physicians and patients; their adjusted rate was similar to our overall effect size reported.

As with reminder systems, the most common study weakness included failure to control for baseline differences in nonrandomized studies[49] or to report the independent effects of patient age on intervention effects. One study involving a low socioeconomic class population did, however, make two interesting observations: the intervention was equally effective across racial groups, and patients of female residents were more likely to have tests ordered than those of male residents, regardless of study arm.[49]

The long-term effects of audit with feedback on physician practice were not evaluated in any of the research. In terms of feasibility, Nattinger and colleagues[49] found that their audit with feedback interventions were labor intensive, requiring both a research study assistant and computerized information system for implementation. Other researchers have had similar experience. For example, Bird et al[46] noted that an audit with feedback intervention was acceptable to the residents, but was more logistically difficult to implement than was foreseen, requiring more than five times the number of sessions anticipated, at a cost of approximately $50 per additional screening test ordered over baseline.[46]

Physician Education

There is a paucity of controlled trials of medical educational strategies.[50] Educational programs in a variety of disciplines have produced inconsistent effects on provider behavior or patient outcomes.[50–53] In this review, there were six controlled trials that included educational strategies; two studies used education as the major intervention[54,55]; the remainder included educational components with other concurrent interventions.[9,38,48,56] Three were community-based studies[48,55,56]; the rest took place in academic residency programs. The one community-based study with sufficient data to calculate a confidence interval found a significant increase in mammography rates[56] (Table 2). Effects were similar for educational interventions alone or education combined with other modalities.

As with the previous interventions discussed, the reports focusing on educational strategies were limited by inability to separate the impact of the education component.[9] None of the studies presented data in a manner that allowed stratification of results by characteristics of the provider or patient populations. As with other interven-

tions, educational strategies may not have lasting effects.[57] In one study where the educational strategy was the sole intervention, significant increases in mammography use persisted for 6 months postintervention.[54]

While most of the community-based physician education programs required some time away from practice, the incorporation of this activity into routine continuing medical education activities enhanced the feasibility of the intervention.

Patient Education and Reminders

Nine studies examined the impact of either patient education or patient reminders on screening rates. In four studies, the result of this intervention mode was separable from other intervention strategies.[49,58–60] Overall, six studies reported increased mammography rates,[49,60] although four were used in combination with other interventions.[31,55,56,61] Two studies reported significant effects of the single intervention: an approximate 20% increase in breast examination rates.[58,60]

Summary of Intervention Effects

Overall, the strongest evidence to support the use of particular interventions to increase levels of breast cancer screening by primary care physicians was found in the use of reminders and audit with feedback in academic centers and, to a lesser extent, office-based systems (which may include physician reminders) in community-based practice settings. Physician education and patient education (targeted to physician action) within both academic and office practices also appear to be effective in changing behavior. In general, there is less evidence supporting the effect of interventions to increase clinical breast examination rates, as compared with interventions to increase mammography rates. When costs and feasibility are considered, reminders appear to be superior to audit with feedback strategies. At present, there are insufficient data to recommend targeting any intervention to specific age or race populations.

Discussion

This review demonstrates that several interventions, most notably reminders and audit with feedback, can significantly increase physician use of mammography, whereas others, such as physician and patient education, are somewhat less effective. The findings from the review also highlight several important issues. First, the most important finding was that while 70% to 80% of ambulatory care takes place in nonhospital community-based office practice (personal communication, Cheryl Nelson, National Center for Health Statistics, 1991), only 30% of controlled trials occurred in this environment.

Second, there were little data on the variation in intervention effectiveness across physician and patient groups. Previously, physician performance of breast cancer screening had been observed to vary by patient age,[8,13,25,62–65] race,[66] and insurance status.[67] Rates also vary by provider sex,[8,22,68] age,[69] specialty,[21,63,65,69–71] and years since graduation.[71] However, when studies adjusted results for the characteristics of patients[14,30,39,43] or providers,[49] interventions appeared to be equally effective across patient race or provider sex groups. Since the conclusions for provider and patient subgroups are based on a small sample of studies, it will be important to verify these findings in other studies and settings.

Cost and feasibility are a third issue that must be considered before recommending implementation of specific physician-directed interventions. For example, while reminder systems and audit with feedback produce similar significant increases in screening behavior, Bird and colleagues[46] noted that the cost of audits was approximately $50 per additional test ordered over baseline, compared with $18 for a computerized reminder system. Faculty time required for conducting the audit and feedback interventions also was higher than anticipated in two university settings.[46,49] Clearly, cost-efficient and effective alternatives, such as nurse-based interventions[72–74] or integration into existing quality-assurance programs, should be explored. The impact of ongoing changes in federal and private insurance financing of preventive services also should be assessed.

Finally, the long-term durability of interventions need to be determined. When persistence of effect has been evaluated, effects tend to return to baseline after withdrawal of the intervention.[42,43] This finding has been noted in previous research.[42,57,75] For example, McDonald et al[75] have observed that although screening rates can be doubled with a reminder system, rates return to baseline after reminders are withdrawn.[75] It has been suggested that the novelty of reminders may wear off after the initial test period and may require either intermittent reinforcement or use on a continuous basis.[42,75]

There are several caveats that should be considered when interpreting the results of this review: lack of interstudy comparability, publication bias, external validity of results, focus on physician behavior, and choice of outcome measures. The wide range of research designs, content of interventions, sample sizes and variability, settings, populations, and criteria for outcome measures did not permit pooling of data across studies using standard meta-analytic techniques.

This review included results only from published tri-

als. It is possible that trials that failed to detect a significant impact of a given intervention were less likely to be published than those that reported positive findings, resulting in an overestimation of the effectiveness of the intervention.

This review focused on only one component in the complex process of cancer control: the physician. Physician-based strategies have the potential to reach only the women who are registered for care, particularly those who keep scheduled appointments. Women who do not receive care for reasons of poverty or other access barriers, or attitudes that interfere with health care utilization will not be reached by such interventions. Moreover, among women who do present for care, ultimate screening outcomes depend on a complex interaction between women's attitudes and behaviors, access to services, and the attitudes and practices of their health care providers.

Finally, the estimates of primary care–based intervention effects on breast cancer screening rates determined from this review cannot be directly extrapolated to projected rates of reduction in morbidity or mortality resulting from this disease. Rather, the review allows for an estimation of the relative efficacy of interventions that can be expected in particular practice settings.

Overall, the intervention literature reviewed suggests that physician-directed interventions, such as reminders or audit with feedback, can improve screening use. Since physician recommendation is a strong predictor of breast cancer screening participation,[1–5] the patient-physician encounter represents a pivotal point in improving access to and utilization of screening. Thus, primary care case-finding activities have the potential to decrease the burden of breast cancer morbidity and mortality. This potential has yet to be fully realized.

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Appendix

Key Words Used in a Literature Search of MEDLINE for Breast Cancer Screening Intervention Studies Published Between January 1980 and April 1993, Inclusive

Primary care	Breast
Gynecologists	Clinical breast examination
Family physicians	Mammography
Internists	Screening
Physicians	Cancer prevention
Patterns of practice	Periodic health examination
Physician's behaviors	Preventive medicine
Physician compliance	Cancer screening
Physician's practice patterns	Preventive health care services
Generalists	Health maintenance
Subspecialists	
House staff	
Residents	