The Effect of Medicare Reimbursement for Screening Mammography on Utilization and Payment

Nancy Breen, PhD
Eric J. Feuer, PhD
Scott Depuy, MS
Jane Zapka, ScD

For the National Cancer Institute Breast Cancer Screening Consortium

Address correspondence to Dr. Breen, Applied Research Branch, NCI/NIH, EPN 313, 6130 Executive Blvd. MSC 7344, Bethesda MD 20892-7344; tel. 301-496-4675; fax 301-435-3710; e-mail <nb19k@nih.gov>.

SYNOPSIS

Objective. In January 1991, Medicare extended its mammography benefit to reimburse for breast cancer screening mammograms. In 1991 and again in 1993, the National Cancer Institute Breast Cancer Screening Consortium (BCSC) conducted a survey to test the hypothesis that this benefit would increase mammography use among women over the age of 65.

Methods. The authors analyzed data on non-Hispanic white women ages 65 to 74 living in 11 geographic areas targeted by the BCSC for an earlier study—six that had received cancer screening educational interventions and five control subsites—to measure the impact of the newly adopted Medicare benefit on the use of mammography and use of Medicare to reimburse mammography costs.

Results. The data show little overall increase between 1991 and 1993 in reported mammography use among respondents to the survey. However, in six intervention and five control subsites there was an increase in the percentage of women who reported using public payment sources to at least partially reimburse the cost of mammograms. In three intervention subsites, the increase from 1991 to 1993 in the percentage of women using public sources of payment was greater than in the corresponding control subsites.

Conclusions. These findings suggest that public health interventions are more likely to succeed when educational promotion accompanies a financial benefit.

In January 1991, when Medicare introduced a new benefit, reimbursement for mammograms used to screen for breast cancer, the National Cancer Institute (NCI) saw an opportunity to observe an unplanned experiment: the impact of reducing cost on the use of screening mammograms. An NCI-sponsored research consortium had earlier introduced educational interventions to increase mammography use in five geographic areas of the United States (study sites). For the present study, we looked at six subsites that received educational interventions, which had been paired with five control areas that did not receive these interventions. We surveyed population-based samples of Medicare beneficiaries in these paired sets of subsites to evaluate the impact of the new benefit.

Prior to 1991, Medicare Part B had reimbursed only for mammograms performed for diagnostic purposes. There was—and continues to be—no limit to

the frequency of diagnostic mammograms for which Medicare will reimburse. The new benefit reimburses for screening mammography once every two years subject to a 20% co-payment and the woman's yearly deductible for outpatient services. Prior to the introduction of the benefit, screening mammograms were billed as diagnostic procedures or women paid for them out of pocket, paid with private insurance, or went without them. Since price may be a barrier to obtaining screening mammography[1,2] (in 1991, average charges were $91 for a screening mammogram and $121 for a diagnostic mammogram[3]) especially for low-income women,[4,5] we expected Medicare's reimbursement for screening mammography to increase mammography use in the study population.

Previous researchers had found that removing cost barriers may not be sufficient to stimulate use of mammography. Education of both patients and physicians may be an additional essential ingredient.[6] We took advantage of the existing educational intervention to examine the effect of reducing the cost barrier in the presence or absence of educational interventions.

Methods

The five study sites participating in the National Cancer Institute Breast Cancer Screening Consortium (BCSC) were suburban Los Angeles, eastern Massachusetts, eastern North Carolina, eastern Long Island, and metropolitan Philadelphia. At each site, at least two subsites participated in the earlier study of the effects of educational interventions; these were assigned to either the control or intervention condition. Each subsite consisted of one or more cities or counties.

Interventions consisted of education for patients, physicians, and radiologists; promotion of low-cost mammography; introduction of physician and patient prompting and reminder systems; and community-based public health education programs.[7] Intervention strategies were designed to avoid reaching the control subsites. Most control and intervention subsites did not abut, and did not share major media sources, although inevitably, some contamination still occurred. In one case, eastern Long Island, the control subsite was changed to another community when a local public health agency implemented its own program to promote screening mammography.

Three of the research sites implemented only one set of intervention strategies. In the fourth location—Long Island—three intervention subsites implemented different interventions and were compared separately with the same control subsite. The fifth area—metropolitan Philadelphia—developed an intervention targeted at members of a large health maintenance organization (HMO) instead of a community-based intervention.[8,9] For the present analysis, we included only the control group (among whom were non-HMO members in the geographic area served by the HMO) because the HMO members already had a benefit for screening mammography prior to 1991. And because most HMOs across the country had already provided a screening mammography benefit prior to 1991, we excluded from our analysis all women who reported membership in an HMO. A population profile of the HMO group has been published elsewhere.[8,9]

We conducted a baseline survey in 1991 in six intervention and five control subsites. At that time, the educational components had already been completed in the intervention subsites and no interventions had occurred in control subsites. We analyzed separately the effects of the educational program and the Medicare benefit on use of mammography and method of payment by comparing results for intervention and control subsites.

Survey methods. Women ages 65 and older were drawn from the Health Care Financing Administration's (HCFA) Master File of Medicare beneficiaries. For the present analysis, we chose 74 years as our upper age limit because after age 74 mammography use declines.[10] Two independent cross-sectional surveys were conducted in each geographic area, in 1991 and 1993. From February through June 1991, we surveyed 6378 women, asking about mammography use during the two years prior to introduction of the benefit (1989 and 1990). The 1993 follow-up survey, conducted from April through mid-July 1993, asked 6502 women about mammograms during the two years after introduction of the benefit (1991 and 1992). We did not exclude people from being interviewed twice, but it was unlikely to happen because of the small number sampled relative to the large population size.

Women were eligible for the survey if they did not have a history of breast cancer, were not institutionalized, and were able to and agreed to complete a half-hour interview. Subjects were sent a letter introducing the survey, then contacted by telephone for an interview. When respondents could not be reached by telephone, follow-up questionnaires by mail or in-person interviews were attempted. Screening questions were used to determine eligibility. Data collection methods were identical in the 1991 and 1993 surveys, with the exception that a new on-line address verification tool, MetroNet, developed by a commercial vendor after 1991, was employed in 1993, which particularly increased the response rate in California. The questionnaires were identical except that a few new definitions (such as for "primary care physician") and follow-up questions to obtain more detail on income were added to the 1993 instrument in order to increase understanding and the response rate to specific questions.

As noted, HMO members in all areas were excluded from the analysis because many HMOs paid for mammograms prior to January 1, 1991, when the Medicare benefit was introduced. Thus we analyzed data from a control group but not an intervention group for the Philadelphia metropolitan area.

We analyzed data only for the largest group—white,

non-Hispanic women—because screening and reimbursement patterns differed among ethnic groups, study areas varied dramatically in their ethnic mix, and the research design was complex, This yielded sample sizes of 3504 for the 1991 survey and 3116 for the 1993 follow-up. In 1991, 1939 of the respondents resided in intervention areas and 1565 resided in control areas. In 1993, 1743 resided in intervention areas and 1373 in control areas.

Measures. We asked each woman if she had ever had a mammogram. If so, we asked how many mammograms she had ever had, when she had had them and whether the Medicare benefit paid for them. Since Medicare now reimburses for screening mammography once every two years, women were coded as having had or not having had a mammogram within the two calendar years preceding the interview date.

We did not distinguish between screening and diagnostic mammograms in the analysis given the possible ambiguity over this distinction. Women were asked whether their mammograms were performed for screening or diagnostic purposes, and the vast majority reported them as having been done as a "routine check-up." When we did a preliminary comparison of Medicare claims data with National Health Interview Survey data for the same age group, it appeared likely that a larger proportion of women submitted claims for mammograms prior to introduction of the benefit than could reasonably have been expected for diagnostic purposes alone. Since some screening mammograms were apparently being billed as diagnostic, we suspected some misunderstanding and misreporting of these categories by survey respondents.

Women were defined as having used the Medicare benefit if they reported that Medicare reimbursed any part of their most recent mammogram. We first asked, "Did you pay for that mammogram completely out of your own pocket or was at least some of the cost covered by an insurance or health plan?" Women who reported that at least some of the cost was covered were asked, "Which insurance or health plans helped to pay for that mammogram?" Precoded responses included Medicare, Medicare supplemental insurance, Medicaid, or other health insurance. Because only 1% to 5% of women across the subsites reported that Medicaid paid for their mammograms, these women were folded into the Medicare payment group in the analysis. These small numbers reflect the fact that very few noninstitutionalized Medicare recipients also receive Medicaid.

For each respondent, if any portion of any mammogram in the last two years was reimbursed by Medicare (or paid for by Medicaid), payment was coded as "some public contribution." Those who reported any private insurance reimbursement, even if they covered some of the cost out of pocket, were coded as "private insurance/no public contribution." The remaining respondents, who had paid for any mammograms they had received in the previous two years, were coded as "out of pocket."

Annual household income was coded as less than $15,000 or $15,000 and higher. Educational level was categorized as less than high school, high school, or more than high school. Although many variables, including marital status, have been shown to be predictors of use of screening mammograms, we chose to focus on income and education, which we expected would relate directly to payment for mammography and knowledge about the benefits of screening mammography. Women also reported whether they had a usual source of health care, a family history of breast cancer, or a personal history of benign breast lumps.

Statistical methods. Chi square tests of homogeneity were used to compare differences between 1989–1990 and 1991–1992 in mammography utilization rates and in the percent of women using Medicare to pay for mammography. We tested the effect of the new benefit separately for control and intervention subsites. Finally, we tested whether the benefit in the presence of educational interventions had the same effect as the benefit in the absence of educational interventions using the difference of differences of proportions:

Ho: $(p_{I2} - p_{I1}) - (p_{C2} - p_{C1}) = 0$ versus Ha: $(p_{I2} - p_{I1}) - (p_{C2} - p_{C1}) > 0$, where C represents the control subsites, I represents the intervention subsites, 1 represents the baseline survey, and 2 represents the follow-up survey.

Results

Response rates. The response rate was conservatively defined as the number of completed interviews divided by the sum of the number of sample members known to be eligible and the number for whom eligibility could not be determined. The overall response rate across geographic sites for the 1991 survey was 76% (with a range from 62% to 85%), and for the 1993 survey it was 79% (range 73% to 85%). In 1991, 82% of interviews were completed by telephone, 15% in person, and 3% by mail. In 1993, 80% of interviews were completed by telephone, 17% in person, and 3% by mail.

Fourteen percent of the 1993 sample was ineligible, compared to 12% in 1991. Of ineligible women in 1991, 37% were institutionalized, bed bound, cognitively impaired or otherwise permanently incapacitated; 30% had a personal history of breast cancer; and 22% had moved out of the area. Of ineligible women in 1993, 42% were institutionalized, bed bound, cognitively impaired or otherwise permanently incapacitated; 26% had a personal history of breast cancer; and 23% had moved out of the area. Ten percent of the 1993 sample refused to be interviewed, as did 11% in 1991.

Characteristics of the study population. Population characteristics by subsite are shown in Table 1. In both 1991 and 1993, at least 90% of the women in each area reported having a usual source of health care. The mean age did not differ significantly between 1991 and 1993. The percentage of

Table. Characteristics of respondents to survey of mammogram use, 1991 and 1993

Area and year of survey	Number	Mean age	SD	Income <$15,000 annually Percent[a]	< High school graduate Percent	= High school graduate Percent	No usual health care source Percent	Family history of breast cancer Percent	Personal history of benign lump Percent	Married or living as Percent
Suburban Los Angeles, California										
Control subsite										
1991	141	70.6	2.1	20	4	21	9	8	17	53
1993	103	70.2	2.1	25	7	24	9	13	20	52
Intervention subsite										
1991	117	70.6	2.1	37	12	45	5	15	20	46
1993	68	70.6	2.2	26	13	37	7	22	16	43
Eastern Massachusetts										
Control subsite										
1991	372	70.5	2.2	67	23	52	10	10	13	47
1993	371	70.6	2.2	55	22	49	8	14	19	50
Intervention subsite										
1991	376	70.6	2.1	60	30	44	8	13	16	49
1993	391	70.5	2.2	57	24	42	7	15	18	50
Eastern North Carolina										
Control subsite										
1991	303	70.4	2.3	57	37	30	4	12	18	47
1993	261	70.4	2.1	51	33	27	5	16	21	48
Intervention subsite										
1991	376	70.3	2.1	53	23	33	8	13	20	53
1993	272	70.5	2.3	47	23	31	7	13	19	52
Eastern Long Island, New York										
Control subsite										
1991	389	70.3	2.2	36	14	45	8	13	17	58
1993	388	70.5	2.2	29	13	42	7	10	16	56
Intervention subsites										
1991	1070	70.4	2.2	49	26	48	9	11	13	52
1993	1012	70.5	2.2	39	22	51	9	13	17	47
Metropolitan Philadelphia, Pennsylvania										
Control subsite										
1991	360	70.4	2.2	53	31	47	8	12	17	49
1993	250	70.7	2.2	41	25	45	6	10	14	52

NOTES:

1. Survey respondents were non-Hispanic white women ages 65 to 74 years, not institutionalized, capable of responding to the questions, with no prior history of breast cancer, and not members of an HMO.

2. Data were collected for the two calendar years prior to each survey. Thus the 1991 survey asked about the years 1989-1990 and the 1993 survey asked about the years 1991 and 1992.

3. Missing responses were excluded from both numerators and denominators in calculations of percentages.

[a]Across control areas, percentages of missing responses to the income question ranged from 23% to 28% for the 1991 survey and from 20% to 28% for the 1993 survey. Percentages of missing responses for other variables ranged from 0% to 3% for the 1991 survey and from 0% to 4% for the 1993 survey. Across intervention areas, percentages of missing responses to the income question ranged from 23% to 24% for the 1991 survey and from 22% to 23% for the 1993 survey. Percentages of missing responses for other variables ranged from 0% to 3% for the 1991 survey and from 0% to 1% for the 1993 survey.

SD = Standard deviation

women in households with income under $15,000 decreased in all but one community, possibly due to a 6% rise between 1991 and 1993 in the Consumer Price Index, to which Social Security is indexed, which may have contributed to a rise in income among the elderly. However, differences in income between 1991 and 1993 were not significant except in Massachusetts, where missing responses to that question were 22% of the total. In short, no systematic variation between 1991 and 1993 could be discerned with regard to population characteristics, making the two

independent cross-sectional sample waves suitable for comparison.

Mammography use. Figure 1 shows the percentage of women who reported having had a mammogram during the previous two years. In every subsite the rates reported in 1993 (rates for 1991–1992) were equal to or higher than those reported in 1991 (1989–1990 rates).

None of the intervention groups showed a statistically significant increase in use of mammography between 1989–1990 and 1991–1992. Since we expected the benefit to increase utilization but found little evidence of increases, we examined the data by income and education to see if certain subgroups increased their utilization. We computed the percentage increase for all subsites by income (< $15,000 yearly versus ≥ $15,000 yearly) and educational level. The subgroup analysis by income did not show any significant increase. However, in two Long Island intervention communities—Islip and Brookhaven—mammography use among women with more than a high school education increased significantly: from 51% to 74% in Islip (P=0.002) and from 55% to 70% in Brookhaven (P=0.031).

In control areas, significant increases in mammography use occurred in eastern Massachusetts (from 61% to 69% [P=0.031]), eastern North Carolina (from 44% to 60% [P<0.001]), and eastern Long Island (from 53% to 60% [P=0.032]). Subgroup analyses showed that the increase in mammography use in the Massachusetts control areas were driven by a significant increase for higher-income women (from 65% to 78% [P=0.025]); for lower-income women, the increase from 58% to 63% was not significant. In North Carolina control areas a significant increase occurred for both income groups (from 58% to 76% [P>0.01] for higher-income women and from 33% to 49% [P=0.01] for lower income women).

Method of payment for mammography. Figure 2 shows that more women reported having received at least partial Medicare or Medicaid reimbursement for mammography in 1993 than in 1991, particularly in the intervention subsites. Significantly more women used public sources of payment in 1993 than in 1991 in intervention subsites in eastern Massachusetts (an increase from 50% in 1991 to 72% in 1993 [P<0.01]) and eastern North Carolina (from 34% to 62% [P<0.01]), in Smithtown, Long Island (from 57% to 82% [P<0.01]) and in Brookhaven, Long Island (from 67% to 79% [P<0.01]). In all areas except Brookhaven, the rise was significant for both income groups (data not shown). In Brookhaven, a statistically significant increase occurred only among higher-income women (from 62% of higher-income women using public sources of payment in 1991 to 84% in 1993 [P=0.001] and an increase from 78% to 79% for lower-income women). Use of Medicare payment rose among all educational groups in eastern Massachusetts. In Smithtown, use increased only among less educated groups. In North Carolina and Brookhaven, use increased only in groups with more than a high school education (data not shown).

Among the control subsites, significant increases in use of public payment for mammography were detected in eastern Massachusetts (from 50% in 1991 to 60% in 1993, P=.024) and Metropolitan Philadelphia (from 56% to 68%, P=.027). In Eastern Massachusetts, the increase in the proportion of women who were at least partially reimbursed by Medicare rose significantly only in the low-income group (from 57% to 70% [P=.044] for low-income women and from 47% to 56% higher-income women). In the other control areas, including the Philadelphia control group, there were no significant increases when analyzed separately by income level. No area showed a statistically significant increase when utilization rates were examined by educational level.

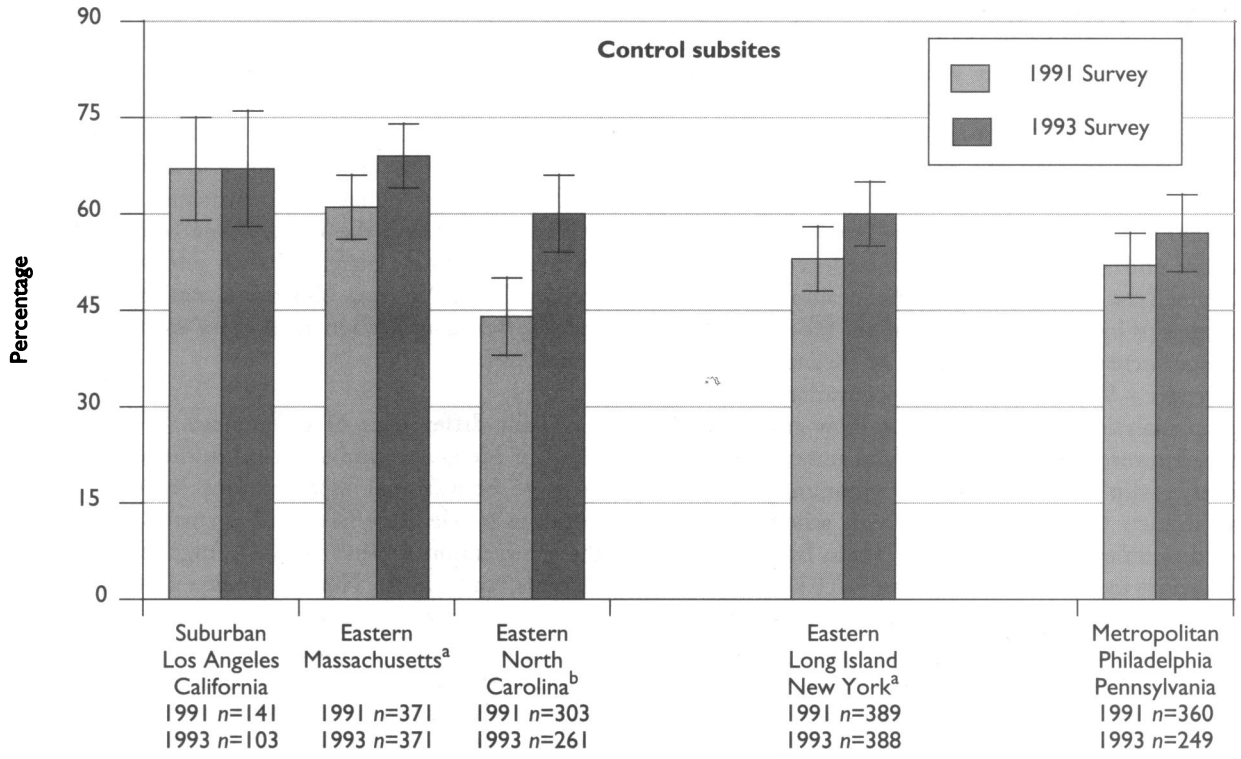
Tests for differences of differences. We compared the effect of Medicare reimbursement in the absence and presence of educational interventions by testing whether increases in Medicare/Medicaid payment differed between the intervention subsites (in Los Angeles, eastern Massachusetts, and eastern North Carolina as well as the three Long Island communities) and their corresponding control subsites. In three of the six comparisons tested, the increase in use of Medicare payment was significantly larger in intervention subsites than in control subsites: in eastern Massachusetts, the increase from 1991 to 1993 for the intervention community was 12 percentage points greater than the increase for the control community (P=0.03), in Eastern North Carolina the increase for the intervention community was 24 percentage points greater than for the control community (P<0.01), and in Smithtown the increase for the intervention community was 18 percentage points greater than for the control community (P=0.01).

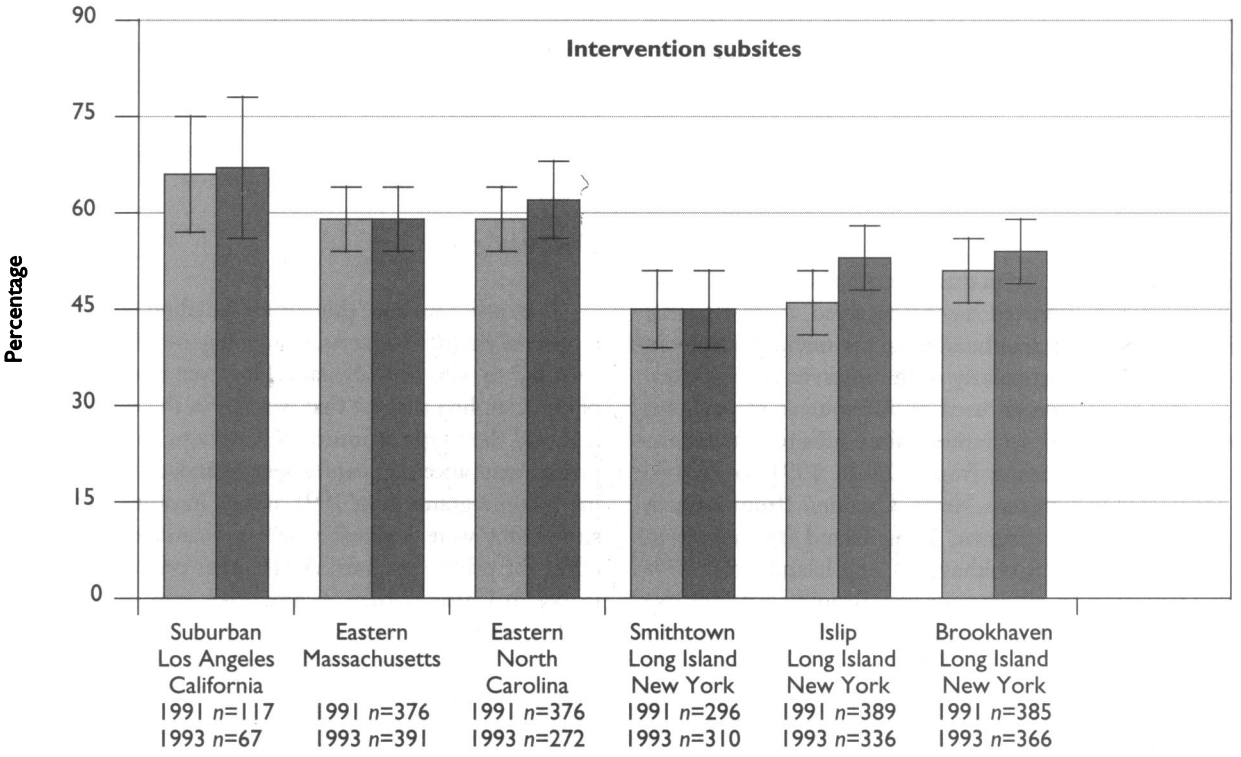
Discussion

Like other surveys, this survey relied on respondents' self-reports of payment sources, which may not always have corresponded to who actually paid. However, our data for eastern North Carolina suggest that women in this survey accurately reported their type of insurance coverage. In North Carolina, private insurance companies were mandated to cover screening mammograms as of 1991, unlike in other states in which study sites were located, where a mandate was already in effect for private insurers. A far larger percentage of women in North Carolina than in any other state reported out-of-pocket payments for mammograms received in 1989 and 1990, and this percentage declined, while the Medicare percentage increased, from 1991 to 1993. Thus, in North Carolina, changes in women's self-reports paralleled changes in reimbursement.

Data from 1987, 1990, and 1992, years for which National Health Interview Survey estimates are available, show an initial doubling in annual mammography rates for women 40 years and older across the country, from approxi-

Figure 1. Percentage of women reporting a mammogram during the two calendar years prior to each survey. Error bars represent 95% confidence intervals.

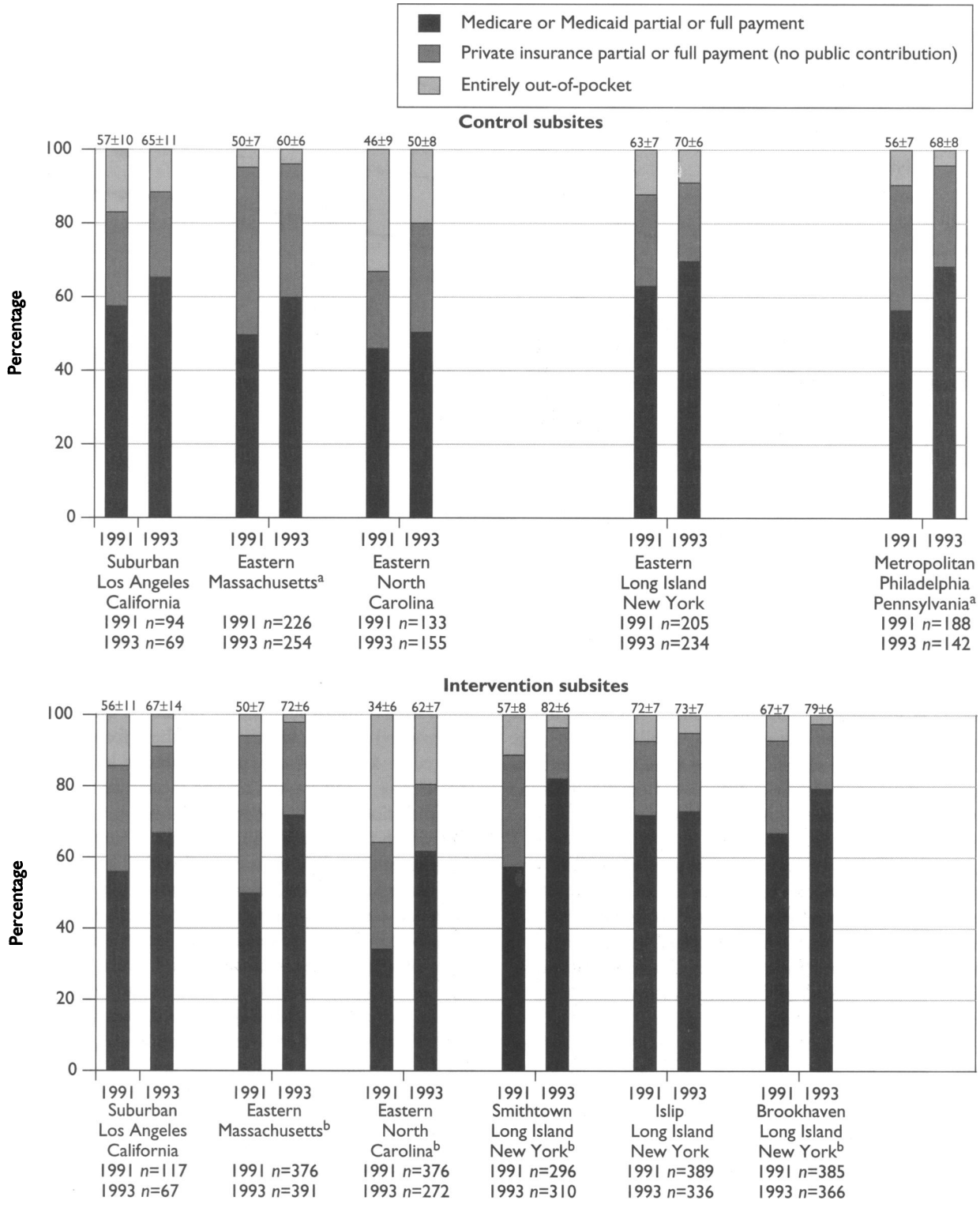




[a]Significant difference between 1991 and 1993 in reported rates of use ($P < 0.05$).

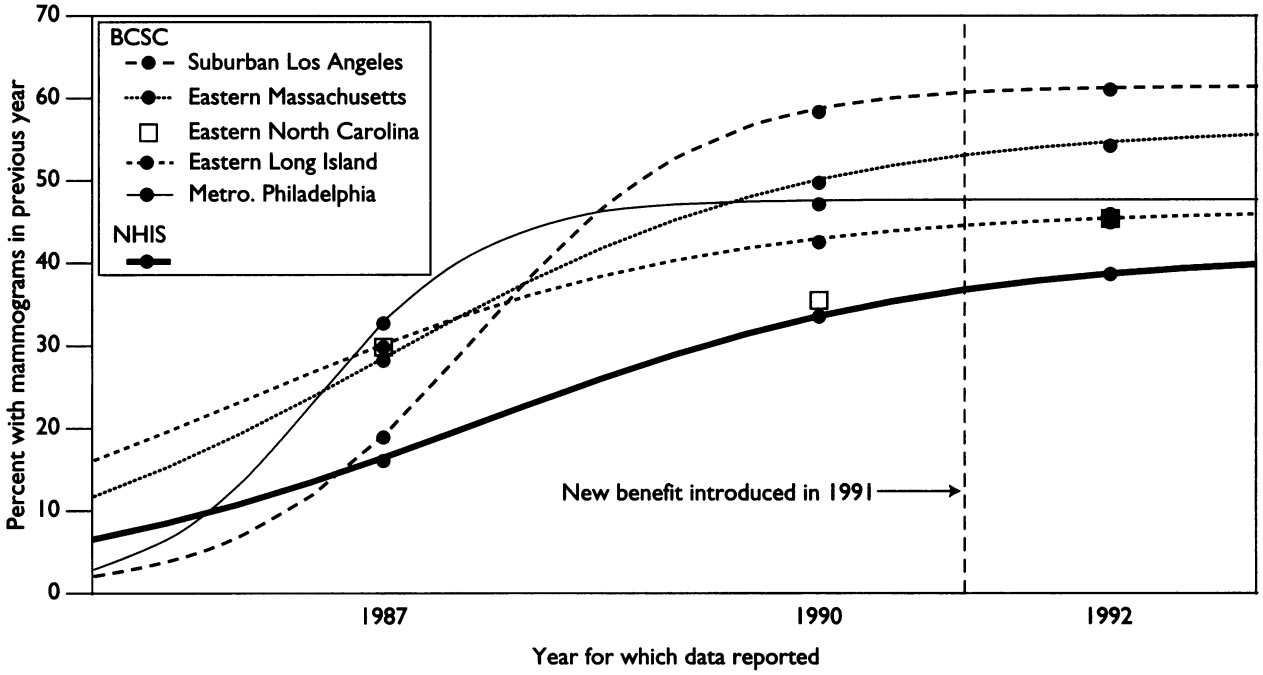
[b]Significant difference between 1991 and 1993 in reported rates of use ($P < 0.01$).

Figure 2. Percentages of women reporting methods of payment for mammograms in the two calendar years prior to each survey. The percent of women reporting that Medicare or Medicaid paid some and the 95% confidence interval are presented above each bar.



[a]Significant difference between 1991 and 1993 in percentages of women reporting full or partial Medicare or Medicaid payment ($P < 0.05$).
[b]Significant difference between 1991 and 1993 in percentages of women reporting full or partial Medicare or Medicaid payment ($P < 0.01$).

Figure 3. Percent of women reporting mammograms in the previous year, comparing National Cancer Institute Breast Cancer Screening Consortium data and National Health Interview Study data for non-Hispanic white women ages 65 to 74



Data for control subsites in eastern Long Island, metropolitan Philadelphia, Eastern Massachusetts, and suburban Los Angeles from the National Cancer Institute Breast Cancer Screening Consortium (BCSC) and data for the United States from the National Health Interview Survey[32–34] are fitted to logistic curves. Data points for eastern North Carolina are not fitted to a curve; they continue to rise instead of showing the flattening characteristic of a logistic curve. BCSC data are standardized by income and education using 1987 data as the standard.

mately 17% in 1987 to 33% in 1990,[10] and a negligible increase in 1992.[11] This pattern of an initially rapid increase in the use of a health service followed by a leveling off has been characterized as logistic diffusion. Logistic diffusion theory may help explain the modest impact of the Medicare benefit on mammography utilization.

Logistic diffusion theory posits that people in a social system adopt new ideas or techniques in an ordered time sequence. Five categories of adopters have been identified: innovators, early adopters, early majority, late majority, and laggards. The rate of adoption over time for a population can be displayed as a bell-shaped frequency curve or as an S-shaped cumulative curve.[12]

Figure 3 shows a comparison of the proportions of non-Hispanic white woman ages 65 to 74 obtaining mammograms in the previous year using data from the pre-intervention baseline surveys of BCSC control subsites,[5] our 1991[13] and 1993 surveys, and the 1987, 1990, and 1992 National Health Interview Surveys. If the data fit a logistic curve, this would indicate that the rate of increase in mammography use has leveled off. Logistic diffusion theory suggests that once the rate of increase levels off, subsequent increases in adoption will be more difficult to achieve.

The process observed appears to be one in which educational interventions successfully promoted mammography in the targeted subsites, which moved them forward on a diffusion curve and in which control subsites later "caught up." (See Figure 1 and Figure 3.) The secular trend showing fast dissemination of mammography between 1987 and 1990, after which there is a leveling off, is the context within which the data in this study must be analyzed. Figure 3 shows that fast dissemination had already occurred by the time the Medicare screening mammography benefit took effect and helps explain why there was little subsequent change in mammography use. Logistic dissemination theory suggests that once dissemination levels off, there is little opportunity for further increase. We found that instead of increasing use, the benefit's strongest effect was to increase use of Medicare to pay for screening mammography and that this effect was strongest in subsites where an education intervention had occurred. This explanation is especially supported by the case of the eastern North Carolina intervention subsite, where the largest increase (16%) in mammography use occurred. The diffusion of mammography in North Carolina began later than at the other sites, and because adoption was still rising there, the data did not fit an S-shaped logistic curve. Other analyses of the Massachusetts data also support this explanation: in Massachusetts, a rapid rise over time in mammogra-

phy adoption masked initial faster progress in intervention subsites.[14,15]

As noted, North Carolina mandated private insurance coverage for screening mammography the same year the Medicare benefit took effect, while all other states had mandated private insurance coverage of screening mammography prior to 1991. This may explain why eastern North Carolina lagged behind other BCSC areas in use of mammography (Figure 3).

Promoting the benefit. Our analyses suggest that educational interventions *in addition to* payment benefits are more effective in inducing the desired behaviors than the introduction of the payment benefit alone. Knowledge of the procedure, recommendation by a provider, access to the procedure, and the price of the procedure all interact to determine whether a woman gets screened.[1,2] Further, mammography interventions have successfully targeted women in different social classes, as measured by income or educational attainment.[16–19] These previous research findings are confirmed by our study.

Our analyses suggest that educational interventions combined with a payment benefit were more effective in increasing use of screening mammography than the introduction of the payment benefit alone.

One reason the Medicare benefit did not boost mammography rates substantially may be that the Health Care Financing Administration, the agency that administers Medicare, did not promote the benefit to providers. In 1991, HCFA mailed a pamphlet introducing the screening mammography benefit to women Medicare beneficiaries. The American Association of Retired Persons (AARP) set up a series of national public service announcements emphasizing that breast cancer risk increases with age and encouraging eligible women to use the Medicare benefit to cover part of the cost of biennial screening mammography (Personal communication, Lisa Rubenstein, Senior Program Specialist, AARP). Yet physicians—whose recommendations have been found to be critical in women's decisions to get mammograms—are more likely to refer younger than older women for screening.[20–26] A preliminary analysis of data from the Long Island intervention subsites, where physicians were targeted for education, suggests that unless physicians become more convinced of the utility of screening for older women,[27] the Medicare benefit will not increase mammogram use. This seems especially true for providers whose Medicare patients are black,[28,29] rural,[30] inner-city,[4] or Hispanic.[31]

Use of mammography increased in three of the five control subsites while remaining stable in the intervention subsites. Reliance on Medicare or Medicaid to at least partially reimburse mammography increased most in the subsites where the educational interventions had occurred. We suspect this indicates that any prevention intervention that includes both education and payment would more effectively increase use than would either of the interventions alone. Further, we recommend that providers as well as beneficiaries be targeted in publicity campaigns.

In addition to the authors, the National Cancer Institute Breast Cancer Screening Consortium includes Ann Coleman, RNP PhD, Mary E. Costanza, MD, Sarah A. Fox, EdD, Russell Harris, MD, Suzanne Haynes, PhD, Larry Kessler, ScD, Eunice King, PhD, Dorothy S. Lane, MD, and Barbara Rimer, DrPH. The authors would also like to acknowledge the National Institute on Aging for cosponsoring the survey, Ryan Cox for assistance with programming, and Mathematica Policy Research for collecting the data.

References

1. Urban N, Anderson GL, Peacock S. Mammography screening: how important is cost as a barrier to use? Am J Public Health 1994;84:50–5.
2. Smith RA, Haynes S. Barriers to screening for breast cancer. Cancer 1992;69:1968–78.
3. Breen N, Brown ML, The price of mammography in the United States: data from the National Survey of Mammography Facilities. Milbank Q 1994;72:431–50.
4. Kiefe CI, McKay SV, Halevy A, Brody BA. Is cost a barrier to screening mammography for low-income women receiving Medicare benefits? a randomized trial. Arch Intern Med 1994;154:1217–24.
5. National Cancer Institute Breast Cancer Screening Consortium. Screening mammography: a missed clinical opportunity? JAMA 1990;264:54–8.
6. Katz SJ, Hofer TP. Socioeconomic disparities in preventive care persist despite universal coverage: breast and cervical cancer screening in Ontario and the United States. JAMA 1994;272:530–4.
7. Haynes SG, Mara JR. The picture of health: how to increase breast cancer screening in your community. Bethesda (MD): National Institutes of Health (US); 1993.
8. Trock B, Rimer BK, King E, Balshem A, Cristinzio CS, Engstrom PF. Impact of an HMO-based intervention to increase mammography utilization. Cancer Epidemiol Biomarkers Prev 1993;2:151–6.
9. Rimer BK, Ross E, Balshem A, Engstrom PF. The effect of a comprehensive breast screening program on self-reported

mammography use by primary care physicians and women in a health maintenance organization. J Am Board Fam Pract 1993;6:443–51.
10. Breen N, Kessler L. Changes in the use of screening mammography: evidence from the 1987 and 1990 National Health Interview Surveys. Am J Public Health 1994;84:62–7.
11. Breen N, Kessler L. Trends in cancer screening United States, 1987 and 1992. MMWR Morb Mortal Wkly Rep 1996;45:57–78.
12. Rogers EM, Shoemaker FF. Communication of innovations. 2nd ed. New York: Free Press; 1971. p. 1–476.
13. Coleman EA, Feuer E. National Breast Cancer Screening Consortium. Breast cancer screening among women from 65 to 74 years of age in 1987–88 and 1991. Ann Intern Med 1992;117:961–6.
14. Zapka JG, Costanza ME, Harris DR, Stoddard A. Impact of a breast cancer screening community intervention. Prev Med 1993;22:1:34–53.
15. Zapka JG, Hosmer D, Costanza ME, Harris DR, Stoddard A. Changes in mammography use: economic, need, and service factors. Am J Public Health 1992;82:1345–51.
16. Lane DS, Polednak AP, Burg MA. Breast cancer screening practices among users of county-funded health centers vs women in the entire community. Am J Public Health 1992;82:199–203.
17. Zapka JG, Harris DR, Hosmer D, Costanza ME, Mas E, Barth R. Effect of a community health center intervention on breast cancer screening among Hispanic American women. Health Serv Res 1993;28:223–35.
18. Price JH, Desmond SM, Slenker S, Smith D, Stewart PW. Urban black women's perceptions of breast cancer and mammography. J Community Health 1992;17:191–204.
19. Ansell DA, Dillard J, Rothenberg M, Bork J, Fizzotti GF, Alagaratnam D, et al. Breast cancer screening in an urban black population: a preliminary report. Cancer 1988;62: 425–8.
20. Fox SA, Murata PJ, Stein JA. The impact of physician compliance on screening mammography for older women. Arch Intern Med 1991;151:50–6.
21. Lane DS, Polednak AP, Burg MA. Effect of continuing medical education and cost reduction on physician compliance with mammography screening guidelines. J Fam Pract 1991;33:359–68.
22. Coll PP, O'Connor PJ, Crabtree BF, Besdine RW. Effects of age, education, and physician advice on utilization of screening mammography. J Am Geriatr Soc 1989;37:957–62.
23. Lane DS, Burg MA. Strategies to increase mammography utilization among community health center visitors: improving awareness, accessibility, and affordability. Med Care 1993;31:175–81.
24. Fox SA, Siu AL, Stein JA. The importance of physician communication on breast cancer screening of older women. Arch Intern Med 1994;154:2058–68.
25. Weinberger M, Saunders AF, Samsa GP, Bearon LB, Gold DT, Brown JT, et al. Breast cancer screening in older women: practices and barriers reported by primary care physicians. J Am Geriatr Soc 1991;39:22–9.
26. Rimer BK, Trock B, Balshem A, Engstrom PF, Rosan J, Lerman C. Breast screening practices among primary physicians: reality and potential. J Am Board Fam Pract 1990;3:26–34.
27. Burg MA, Lane DS. Mammography referrals for elderly women: is Medicare reimbursement likely to make a difference? Health Serv Res 1992;27:505–16.
28. Burns RB, McCarthy EP, Freund KM, Marwill SL, Shwartz M, Ash A, et al. Black women receive less mammography even with similar use of primary care. Ann Intern Med 1996;125:173–82.
29. Gornick ME, Eggers PW, Reilly TW, Mentnech RM, Fitterman LK, Kucken LE, et al. Effects of race and income on mortality and use of services among Medicare beneficiaries. N Engl J Med 1996;335:791–9.
30. Ives DG, Lave JR, Traven ND, Schulz R, Kuller LH. Mammography and Pap smear use by older rural women. Public Health Rep 1996;111:244–50.
31. Fox SA, Roetzheim RG. Screening mammography and older Hispanic women: current status and issues. Cancer 1994;74:2028–33.
32. National Center for Health Statistics (US). Current estimates from the National Health Interview Survey, 1987. Public use data tape; 1988.
33. National Center for Health Statistics (US). Current estimates from the National Health Interview Survey, 1990. Public use data tape; 1991.
34. National Center for Health Statistics (US). Current estimates from the National Health Interview Survey, 1992. Public use data tape; 1994.