Relationship Between Pap Smear Performance and Physician Ordering a Mammogram

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Background. Although Pap smear screening for cervical cancer in general has been successfully implemented, mammography screening for breast cancer remains relatively underused. Patients having one screening test are more likely to have other screening tests performed. The objective of this study was to determine whether visits by women for Pap smears serve as opportunities for physicians to order a screening mammogram.

Methods. A matched case-control design was used for this retrospective study. Eligible women included those over 50 years of age who had no history of breast cancer or mastectomy and who had made at least one visit to a family practice residency program during the 2-year study period. Cases were randomly selected from women who had mammograms performed. For each case, one control subject who did not have a mammogram was matched by age and number of visits. A chart audit was performed to collect data on the characteristics of these women and whether they completed their screening tests.

Results. The adjusted odds ratio (controlling for the patient's age and number of physician visits) for mammogram completion among women who had a Pap smear compared with those who did not was 6.67. This effect persisted after controlling for other confounding factors using logistic regression.

Conclusions. Performing a Pap smear appears to serve as a prompt for the physician to order a screening mammogram. That physicians appear to provide screening tests, particularly Pap smears and mammograms, as a package of services should be considered when future efforts to improve implementation are made.

Key words. Mammography; mass screening; preventive health services; clinical protocols. *J Fam Pract 1992; 35:644-648.*

Implementation of cervical cancer screening in the United States has generally been successful since the development of the Pap smear test in the 1940s. About 75% of women report having had a recent Pap smear.[1–4] Rates of breast cancer screening with mammograms, while improving, remain suboptimal. Despite the higher incidence and mortality rates for breast cancer compared with cervical cancer, greater percentages of women are screened with Pap smears than with mammograms.[5–7] Widespread breast cancer screening did not begin until after the early 1970s when the Health Insurance Plan (HIP) project first showed that breast cancer mortality could be reduced by early detection through regular breast physical examinations and screening mammograms.[8,9] However, a number of important barriers to breast cancer screening have been identified from both the patient and physician perspective. These barriers include concerns about the cost and inconvenience of having a mammogram performed,[10,11] and physicians neglecting to refer their patients for the procedure.[6,12,13]

In 1980, the American Cancer Society extended its recommended interval between Pap smears from annual to every 3 years after two negative smears.[14] Concerns were raised that the longer interval not only would result in missed cases of cervical cancers, but would also eliminate opportunities to screen for other conditions such as breast cancer.[15,16] Given that Pap smears are generally well accepted by patients, visits to physicians for this procedure may have helped reduce access barriers to screening for other conditions.

Studies have shown indirectly that the completion of one screening test, such as the Pap smear, is related to the completion of others. In general, populations screened for one condition are more likely to have been screened for other conditions.[2] Much of this difference is likely related to physician access. For example, one recent study has shown that women who have received gynecologic

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care or who have a regular source of gynecologic care were more likely to have received breast cancer screening.[17] Persons seen more often by physicians have more opportunities to be screened. In this study, we examined in greater detail the extent to which performance of one screening test predicted the performance of another. Assuming that women have equal opportunities to be screened, we determined the extent to which performing Pap smears is associated with the ordering of screening mammography.

Methods

The subjects for this study were retrospectively identified using computerized visit information from patients followed in a family practice residency training program. Care for these patients was provided by more than 24 faculty and resident family physicians and one internist. Eligible subjects included all female patients over 50 years of age seen at least once during a 2-year interval (June 1, 1986, to May 31, 1988). Among the identified eligible women, we defined case subjects as women for whom one or more mammograms had been ordered or performed during the study interval. The case subjects were then stratified by age (in 5-year intervals) and number of visits during the study period (1 to 3, 4 to 6, and 7 or more visits). Each case subject was then matched with a corresponding control subject by age and number of visit category. A random-number table was used to select the control group from the women not noted to have had a mammogram during the study period.

The medical records for both case and control subjects were abstracted to confirm that the classifications based on the computerized information were correct. Notations by the physician in progress notes or a health maintenance reminder sheet or the presence of a radiology report was used to determine whether a mammogram had been ordered or completed. We excluded women whose computerized information regarding mammogram completion was incorrect or whose medical record could not be located. We also excluded women with a history of breast cancer or mastectomy.

The charts for women in the study were also audited to determine whether Pap smears and pelvic examinations were performed during the study period. Pap smear completion required the presence of a cytology report or a specific provider notation that one had been performed. Performance of a pelvic examination was based on reports in the progress notes or was presumed to have occurred if a Pap smear was completed. Additional patient data were collected including race or ethnicity, type of insurance coverage, other breast problems, family history of breast cancer in mother or sister, previous hysterectomy, and number of major medical problems.

Statistical Methods

Odds ratios and confidence intervals were calculated using McNemar's test for matched case-control studies using the Epistat program. A multivariate logistic regression analysis was performed using a BMDP computer program (BMDP Statistical Software, Inc) to evaluate the independent effect of Pap smear performance on predicting mammogram completion. This model controls for the effect of potential confounding factors influencing mammogram completion. Besides the main effect variables, an interaction between Pap smear performance and previous hysterectomy was tested in the logistic regression model because the effect of performing a Pap smear on the likelihood of ordering a mammogram might differ among women who have had vs those who have not had a hysterectomy.

Results

We identified 807 women in the practice who met the age and visit inclusion criteria. Of these, 229 women were noted to have had a mammogram during the study period. From 136 medical records randomly selected for auditing, a total of 121 case subjects were included in the study. Seven records could not be located for review, and six were excluded from the study because of previous breast cancer or mastectomy. The chart audit confirmed completion of mammograms for all but two of the case subjects audited, indicating good specificity of the computerized data in identifying women who had mammograms.

From the 578 women identified as potential control subjects, we selected 180 charts to obtain the 121 needed. The medical records for 18 women could not be located, and 8 other women had a history of breast cancer or mastectomy. There were greater problems with misclassification among the control subjects; 33 potential control subjects were excluded after the chart audit found a mammogram ordered or completed that had not been noted in the computerized data system.

The characteristics of the study subjects are summarized in Table 1. The distributions for age and number of visits in the two groups were identical because of matching. The groups did not differ significantly by race or ethnicity or marital status. There was a significant difference between the two groups in type of insurance coverage. Among the case subjects, 20% had prepaid health insurance compared with 11% of control subjects. The

Table 1. Characteristics of Case Subjects (n = 121) Who Underwent Screening Mammography and Control Subjects (n = 121) Who Did Not

Characteristic	Case Subjects No. (%)	Control Subjects No. (%)	*P* Value*
Age (y)			
50–54	22 (18.2)	22 (18.2)	NS
55–59	26 (12.5)	26 (12.5)	
60–64	19 (15.7)	19 (15.7)	
65–69	28 (23.1)	28 (23.1)	
70+	26 (21.5)	26 (21.5)	
Number of visits			
1–3	34 (28.1)	34 (28.1)	NS
4–6	39 (32.2)	39 (32.2)	
7+	48 (39.7)	48 (39.7)	
Race/ethnicity			
White	63 (53.4)	47 (43.9)	NS
Black	28 (23.7)	27 (25.2)	
Hispanic	13 (11.0)	16 (15.0)	
Other	14 (11.9)	17 (15.9)	
Marital status			
Single	7 (6.5)	6 (6.1)	NS
Married	66 (61.1)	51 (51.5)	
Separated	4 (3.7)	3 (3.0)	
Divorced	16 (14.8)	16 (16.2)	
Widowed	15 (13.9)	23 (23.2)	
Insurance coverage			
Prepaid	24 (19.8)	13 (10.7)	.016
Private	50 (41.3)	44 (36.4)	
Medicare	31 (25.6)	27 (22.3)	
Medi-Cal	6 (5.0)	14 (11.6)	
Self-pay	10 (8.3)	23 (19.0)	
Previous hysterectomy	44 (36.4)	30 (24.8)	.051
Family history of breast cancer	12 (9.9)	5 (4.1)	NS

**Chi-square test.*

percentages of control subjects with Medicaid and no health insurance were 12% and 19%, respectively, compared with 5% and 8%, respectively, for case subjects. Differences approaching statistical significance between the two groups were seen in the proportions of women with previous hysterectomies and family histories of breast cancer. A greater percentage of case subjects had previous hysterectomies (36%), compared with control subjects (25%). Nearly 10% of case subjects had a family history of breast cancer, compared with 4% of control subjects.

We determined which factors predicted completion of a mammogram. We found that 76.9% of the case subjects but only 28.9% of control subjects had Pap smears during the study period. Thus, the odds ratio of mammogram completion adjusted for matching by age and number of visits for women who had a Pap smear

Table 2. Adjusted Odds Ratios and 95% Confidence Intervals of Mammogram Completion

	Adjusted Odds Ratio*	95% Confidence Interval
Pap smear Performed vs not performed	6.67	3.05–15.6
Pelvic examination Performed vs not performed	7.38	3.24–18.4
Stool occult blood Performed vs not performed	4.23	2.16–8.62
Race White vs nonwhite	1.50	0.93–2.94
Health insurance Medicaid/no insurance vs all others	0.30	0.12–0.67
Previous hysterectomy Yes vs no	1.82	0.94–3.61
Family history of breast cancer Positive vs negative	2.40	0.70–9.47

**Odds ratios are adjusted for the matching variables, age and number of visits.*

was 6.67 (95% confidence interval [CI] = 3.05 to 15.6) compared with those who had not (Table 2). Similarly, 79.3% of case subjects had pelvic examinations compared with only 33.1% of control subjects, with an adjusted odds ratio of mammogram completion of 7.38 (95% CI = 3.24 to 18.4). We examined another screening test, stool occult blood testing (three or more samples), to see if a similar relationship held true. The adjusted odds ratio ($\widehat{OR}$) of mammogram completion for women who had stool occult blood testing was 4.23 (95% CI = 2.16 to 8.62).

The type of health insurance coverage was also found to predict the ordering of mammograms. Women who had Medicaid or no health insurance were significantly less likely to have had a mammogram compared with women who had other types of insurance ($\widehat{OR}$ = 0.30, 95% CI = 0.12 to 0.67). Although race or ethnicity, family history of breast cancer, and previous hysterectomy were not significantly related to mammogram completion, there was a trend toward white women and women with a previous hysterectomy being more likely to have had a mammogram.

In the logistic regression analyses, potential confounding variables from Table 1 as well as an indicator of Pap smear completion were used to predict the ordering of mammography. No interaction terms were found to be significant. The final logistic model in Table 3 shows that Pap smear completion remained a strong independent predictor of mammogram completion ($\widehat{OR}$ = 8.79). In an alternative model not shown, adding the

Table 3. Logistic Regression Analysis of Mammogram Completion

	β	$\widehat{OR}$	95% CI
Pap smear completed	2.17	8.79	6.24–12.3
Age (y)			
55–59	0.206	1.23	.741–2.04
60–64	0.483	1.62	.904–2.91
65–69	0.323	1.38	.830–2.30
70+	0.660	1.93	1.15–3.26
Number of visits			
4–6	−0.114	0.892	.587–1.36
7+	0.156	1.17	.771–1.77
Nonwhite race	0.203	1.23	.880–1.71
Married	0.146	1.16	.820–1.63
Medicaid or no insurance	−1.15	0.318	.208–.481
Previous hysterectomy	0.841	2.32	1.62–3.32
Family history of breast cancer	0.878	2.41	1.04–5.57
Intercept	−1.70	—	—

NOTE: This logistic regression model predicts the likelihood of having had a mammogram as a function of the subject characteristics listed, while adjusting for the other characteristics. Adjusted odds ratios ($\widehat{OR}$) of mammogram completion and 95% confidence intervals (CI) are derived from the beta coefficients (and standard errors, not reported) in the logistic model.

completion of stool guaiac screening showed this variable to be an independent predictor of mammogram completion that did not qualitatively affect the results for Pap smear completion. No significant interaction was found between Pap smear and stool guaiac screening.

Discussion

In this study, we found that performing a Pap smear very strongly predicted the ordering of a mammogram. This association cannot be explained by differences in the frequency of visits to the physician because the two groups of women were matched by the number of physician visits. Matching also removed patient age as a potential confounding factor. Furthermore, logistic regression analyses showed that a variety of potential confounding factors, such as the patient's type of insurance coverage and a family history of breast cancer, did not explain the association between these two tests. Thus, it appears that office visits by women for Pap smears provide opportunities to screen for another very important women's health problem, breast cancer.

Potential limitations to this study should be considered in interpreting these results. First, during the chart audit we found that a significant proportion of the patients identified as control subjects in our computerized records had been misclassified. If they had been correctly identified, these misclassified control subjects would have been included in the group of patients from which the study case subjects were obtained. Thus, if our study had shown that misclassified control subjects were less likely to have had a Pap smear than case subjects, our results would have been biased toward overestimating the association between Pap smear and mammogram completion. We found, however, that approximately equal proportions of the misclassified control subjects and actual case subjects (81.8% and 83.5%, respectively) had Pap smears, which indicates that the misclassification did not bias our results. Furthermore, our final classifications into case subjects and control subjects were almost certainly correct given that most Pap smears and mammograms were documented by printed laboratory or radiology reports.

A second consideration is that even though matching and the logistic regression analysis controlled for many potential confounding variables, the relationship between these Pap smears and mammograms could be explained by confounding variables known to influence completion of breast cancer screening that we did not measure.[6,7,10–12,17–21] For example, we could not determine from auditing the charts the patients' education levels, or the patients' or physicians' attitudes toward health screening. Another important unmeasured variable was the context and content of the visits. Studies have shown that women making visits for complete physical examinations and preventive health care are more likely to receive breast cancer screening.[17–19] In this study, even though women having and not having mammograms were seen for similar numbers of visits, what occurred during the visits might have been different for the two groups. Women who did not have mammograms may have had more numerous or more serious coexisting medical problems that required the time the physician normally would have used for health maintenance activities. Also, these women might have been perceived by their physician or themselves to be in worse health and therefore less likely to benefit from screening. Conversely, women who had Pap smears might have made appointments specifically for a complete physical examination or for preventive health care, thus providing an opportunity both for performing Pap smears and ordering mammograms. We used stool occult blood testing as an indicator of women receiving other preventive care. The strong independent effect of Pap smear performance and lack of interaction with stool occult blood testing in predicting mammogram ordering suggests a "bundling" of the two cancer screening procedures that are specifically designated for women.

Another limitation is that a case-control design cannot easily define temporal relationships, eg, whether the Pap smear and mammogram were performed on the same day. We could not define the exposure as "having a Pap smear within some interval around the time of the mammogram" because by definition the control group

did not have mammograms. However, we also did not expect the two tests necessarily to have been performed or ordered on the same day. Most mammograms were ordered at the time of the Pap smear and performed at some later date. Other mammograms were ordered before the Pap smear visit so that the results would be available for discussion. In fact, most of the mammograms and Pap smears were performed within 1 to 2 months of each other. One final consideration is that this study was conducted in a single family practice residency program. Although the program provides care to a typical primary care population, caution must be taken in generalizing these results to other populations.

These results serve to highlight that screening recommendations for one specific condition may adversely affect compliance with screening for other conditions. The American College of Obstetricians and Gynecologists may have been correct in arguing in 1980 that a longer recommended interval for Pap smear screening would cause some women to miss being screened for other problems.[15,16] This study provides indirect evidence that a longer interval between Pap smears may have an adverse impact on breast cancer screening.

These results also suggest an explanation for reported differences in breast cancer screening rates by specialty.[6,20] In the 1989 American Cancer Society survey of primary care physicians, obstetrician-gynecologists reported higher rates of breast cancer screening with mammography than internists and family physicians.[6] Obstetrician-gynecologists similarly reported higher rates of performing Pap smears to screen for cervical cancer. Part of the differences in breast cancer screening rates may reflect the context of the visit to obstetrician-gynecologists as compared with a visit to internists and family physicians. More visits to the obstetrician-gynecologists may be specifically for a Pap smear, which these results suggest provides an opportunity to order a mammogram. Family physicians, given the same context of performing a Pap smear, are very likely to order a mammogram. These findings need to be substantiated in a multispecialty study.

In conclusion, access to mammography is a bit more complex than simply having physical access to a physician to order the test and the financial means to pay for it.[21] We need to consider more carefully the context of the physician-patient interaction during office visits. It appears that physicians providing one preventive service may take the opportunity to provide others. This suggests that perhaps we can better implement breast cancer screening by encouraging this tendency to package mammography screening with the already well-disseminated practice of performing regular Pap smears. Greater emphasis may also need to be placed on women seeing their physician specifically for comprehensive preventive health care.[18]

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References

1. Makuc DM, Freid VM, Kleinman JC. National trends in the use of preventive health care by women. Am J Public Health 1989; 79:21–6.
2. Hayward RA, Shapiro MF, Freeman HE, Corey CR. Who gets screened for cervical and breast cancer? Results from a new national survey. Arch Intern Med 1988; 148:1177–81.
3. BRFSS Coordinators. Pap smear screening—Behavioral Risk Factor Surveillance System, 1988. MMWR 1989; 38:772–9.
4. Harlan LC, Bernstein AB, Kessler LG. Cervical cancer screening: who is not screened and why? Am J Public Health 1991; 81:885–91.
5. McPhee SJ, Richard RJ, Solkowitz SN. Performance of cancer screening in a university general internal medicine practice. J Gen Intern Med 1986; 1:275–81.
6. American Cancer Society. 1989 Survey of physicians' attitudes and practices in early cancer detection. CA 1990; 40:77–101.
7. Schwartz JS, Lewis CE, Clancy C, Kinosian MS, Radany MH, Koplan JP. Internists' practices in health promotion and disease prevention: a survey. Ann Intern Med 1991; 114:46–53.
8. Shapiro S. Evidence on screening for breast cancer from a randomized trial. Cancer 1977; 39:2772–82.
9. Shapiro S, Venet W, Strax P, Venet L, Roeser R. Ten- to fourteen-year effect of screening on breast cancer mortality. J Natl Cancer Inst 1982; 69:349–55.
10. Rutledge DN, Hartmann WH, Kinman PO, Winfield AC. Exploration of factors affecting mammography behavior. Prev Med 1988; 17:412–22.
11. Howard J. Using mammography for cancer control: an unrealized potential. CA 1987; 37:33–48.
12. Fox SA, Murata PJ, Stein JA. The impact of physician compliance on screening mammography for older women. Arch Intern Med 1991; 66:154–8.
13. Wolosin RJ. The experience of screening mammography. J Fam Pract 1989; 29:499–502.
14. American Cancer Society. Guidelines for the cancer-related checkup: recommendations and rationale. CA 1980; 30:224–9.
15. American College of Obstetricians and Gynecologists Task Force on Periodic Cancer Screening for Women. ACOG statement of policy: periodic cancer screening for women. Washington, DC: American College of Obstetricians and Gynecologists, 1980.
16. Oncology Committee, Georgia State Obstetrical and Gynecological Society. The Pap smear, how often? The gynecologist perspective. J Med Assoc Ga 1981; 70:557–9.
17. Fulton JP, Buechner JS, Scott HD, et al. A study guided by the Health Belief Model of the predictors of breast cancer screening of women ages 40 and older. Public Health Rep 1991; 106:410–20.
18. Dietrich AJ, Goldberg H. Preventive content of adult primary care: do generalists and subspecialists differ? Am J Public Health 1984; 74:223–7.
19. Battista RN. Adult cancer screening prevention in primary care: patterns of practice in Quebec. Am J Public Health 1983; 73: 1036–9.
20. Albanes D, Weinberg GB, Boss L, Taylor PR. A survey of physicians' breast cancer early detection practices. Prev Med 1988; 17:643–52.
21. Salkever DS. Accessibility and the demand for preventive care. Soc Sci Med 1976; 10:469–75.