

Timing of Follow-up After Abnormal Screening and Diagnostic Mammograms

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Objective: To evaluate woman-level characteristics associated with timing of follow-up after abnormal mammograms in an integrated healthcare system with an active breast health program.

Study Design: Retrospective cohort study.

Methods: The study included women aged 40-84 years who had an abnormal mammogram (20,060 screening and 3184 diagnostic) recommended for follow-up. We compared characteristics of women who received any follow-up evaluation within ≤ 7 , 8 to 14, 15 to 21, and 22 to 180 days. We estimated odds ratios (ORs) and 95% confidence intervals (CIs) using multivariate ordinal logistic regression.

Results: The proportion of women seeking care within 7 days was 23% for screening and 69% for diagnostic mammograms. Characteristics associated with later follow-up (≥ 8 days vs ≤ 7 days) after an abnormal *screening mammogram* included being older (OR = 1.15; 95% CI, 1.04-1.26 [age 70-79 years]; OR = 1.31; 95% CI, 1.14-1.51 [age 80+ years]), Asian (OR = 1.18; 95% CI, 1.04-1.33), or having a college degree (OR = 1.10; 95% CI, 1.01-1.19). Characteristics associated with earlier follow-up included family history of breast cancer (OR = 0.93; 95% CI, 0.88-0.98), symptoms at time of mammogram (OR = 0.79; 95% CI, 0.70-0.88), or extremely dense breasts (OR = 0.82; 95% CI, 0.69-0.96). For *diagnostic mammograms*, symptoms at time of mammogram (OR = 0.47; 95% CI, 0.39-0.56) and being obese (OR = 0.79; 95% CI, 0.65-0.98) were associated with earlier follow-up.

Conclusions: Several woman-level characteristics were associated with timely follow-up after an abnormal screening exam, but only presence of symptoms and being obese was associated with timely follow-up after an abnormal diagnostic exam.

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For author information and disclosures,
see end of text.

Approximately 75% of US women report having at least 1 screening mammogram to detect breast cancer.¹ Abnormal mammograms, which require additional imaging or surgical follow-up, occur at a rate of almost 10% and 8% of screening and diagnostic exams, respectively.^{2,3} There are currently no published national data available for mammography facilities and practices benchmarks for the appropriate timing for receipt of follow-up evaluation after an abnormal mammogram.⁴⁻⁶

A delay in follow-up can be attributed to characteristics of the woman (ie, not making an appointment), the provider (ie, not communicating the importance of follow-up), or the healthcare system (ie, insufficient scheduling space for prompt return). Failure of 1 or all of these systems results in delayed follow-up by the patient, which may contribute to a delayed diagnosis of breast cancer, later stage disease,⁷ and poorer survival.^{8,9} Woman-level characteristics associated with a delay or lack of follow-up after an abnormal mammogram include being older,^{6,10} lacking health insurance,^{5,11-13} being African American or Hispanic,^{5,14} having a low income,^{5,11,12} having no breast symptoms,¹⁵ and having no previous mammograms.¹²

Evaluating the follow-up of breast health within an HMO setting provides opportunities to monitor women after an abnormal mammographic exam when access to appropriate follow-up care should be equitable. Two prior studies have evaluated follow-up after an abnormal mammogram within an HMO setting,^{6,12} but neither study had an active program for breast health, which would identify and schedule care for women with abnormal mammograms. In our study, we investigated woman-level characteristics associated with follow-up after an abnormal mammography examination in women enrolled in a health plan with an active breast health program.

MATERIALS AND METHODS

Study Subjects

Women aged 40 to 84 years who received a mammogram between 1996 and 2003 in Group Health, an integrated delivery system in the Puget Sound region of Washington State, and were enrolled for at least 12 months were eligible for this study. All women had access to free mammography

In this article
Take-Away Points / p163
www.ajmc.com
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through the health plan, including screening and diagnostic exams. This analysis is restricted to women with an abnormal result from mammography defined as a Breast Imaging Reporting and Data System (BI-RADS)¹⁶ assessment of 0 (incomplete), 4 (suspicious abnormality), or 5 (highly suspicious of malignancy). We specifically excluded women recommended for 6-month short-interval follow-up (BI-RADS 3) because we were interested in abnormal exams that required immediate attention. Further, we restricted the sample to women who were recommended to receive additional follow-up with 1 of 4 procedures: (1) biopsy, (2) fine needle aspiration, (3) surgical evaluation, or (4) ultrasound. Women had to be continuously enrolled for 12 months after the abnormal mammogram to ensure adequate information on follow-up. We identified 25,272 and 5074 abnormal screening or diagnostic mammograms, respectively.

Breast Cancer Screening Program at Group Health

Since 1985, the Breast Cancer Screening Program at Group Health has sent reminder letters to women to encourage participation in mammography screening.¹⁷ To date, the program has mailed more than 500,000 letters. Breast clinic nurses were responsible for much of the follow-up after a mammogram. For *screening mammograms*, the radiologist interpreted the image the next working day after the mammogram. The breast clinic nurses called the patient within 24 to 48 hours after the report was issued with the patient's result. If a patient had an abnormal result, the breast clinic nurse attempted to schedule the next available appointment for the patient. For *diagnostic mammograms*, the radiologist interpreted the image the same day and reported the result of the mammogram to the woman. A patient with an abnormal diagnostic mammogram would have scheduled the next available follow-up appointment recommended by the radiologist with the breast clinic nurse. Among nonresponders for either screening or diagnostic mammograms, the breast clinic nurse would call the patient to schedule the follow-up appointment.

Data Collection

At the time of the mammography visit, women completed a self-administered questionnaire,¹⁸ which collected information on age, reproductive risk factors, breast screening, medical history, and concerns regarding women's breasts at the time of the exam. Women completed the questionnaire before knowing the results of their mammogram. The ques-

Take-Away Points

Within an integrated healthcare system with an active breast health program to facilitate care after an abnormal mammogram, there remains woman-level characteristics associated with timely follow-up.

- Presence of symptoms was associated with timely follow-up after both abnormal screening and diagnostic mammogram.
- Women who were older, Asian, or more educated were less likely to return earlier after an abnormal screening mammogram. Efforts to understand and reduce barriers might be important in these groups of women.

tionnaire served as the data source for woman-level characteristics under evaluation.

Information about follow-up procedures was available through electronic administrative data including pathology, radiology, utilization, and claims databases. Time to follow-up care was calculated from the date of the mammogram until the first date of follow-up care with any of the 4 procedures. Women might have received a procedure that was different from the one recommended, but was still 1 of the 4 procedures of interest. We categorized women according to receipt of follow-up care within ≤ 7 , 8 to 14, 15 to 21, and 22 to 180 calendar days, based on ability to seek follow-up care within sequential weeks up to 4+ weeks.

This study was approved by the institutional review board at Group Health Research Institute.

Statistical Analysis

Woman-level characteristics of interest for this analysis included the following risk factors: age, race, body mass index (kg/m^2), education, family history of breast cancer in first- or second-degree relatives, self-reported symptoms at the time of mammography, biopsy history prior to the mammography examination, radiologists' interpretation of mammographic breast density,¹⁶ and use of postmenopausal hormone therapy. Women with missing data for any of the risk factors or without follow-up within 180 days were excluded from the analysis. The final sample size included 20,060 screening and 3184 diagnostic mammograms. Descriptive summary statistics were calculated for each variable by interval of follow-up time.

We used a multivariate ordinal logistic regression model (ologit) for ordered outcome variables to compare differences in the follow-up timing intervals.¹⁹ An ordinal logistic model is a model for multinomial data that generalizes the logistic regression model. The model allows the consideration of differences in "early" versus "later" follow-up at each of the 3 thresholds of the outcome. The interpretation of the odds ratio is the comparison of early versus late defined in our analysis as ≤ 7 days versus ≥ 8 days. All analyses included all potential risk factors and used robust methods to account for clustering for multiple records per woman. Tests for trends

were evaluated by entering the ordinal term representing the categorical variable into the ordinal model. We evaluated the contribution of each variable using a likelihood ratio test, comparing the full model with the reduced model. All hypothesis tests were 2-sided and assumed a type I error rate of $\alpha = .05$.

All analyses were conducted in Stata/MP 11.0 (Stata-Corp, College Station, TX).

RESULTS

For women who had an abnormal screening mammogram, the median time from receipt of the exam to follow-up was 13 days. The proportion of women receiving care within ≤ 7 , 8 to 14, 15 to 21, and 22 to 180 days was 23.3%, 36.3%, 22.0%, and 18.3%, respectively, among women with abnormal screening mammogram (Table 1). For women who had an abnormal diagnostic mammogram, the median time to further follow-up was 5 days. Further, the proportion of women receiving care within 7, 8 to 14, 15 to 21, and >22 days was 69.1%, 10.6%, 7.0%, and 13.2%, respectively (Table 2).

Among women with an abnormal screening mammogram, those more likely to receive follow-up care after 7 days were older (70-79 and ≥ 80 years) (P -trend $< .001$), Asian or Pacific Islander, and college graduates (P -trend = .006). The woman-level factors associated with being more likely to receive follow-up care within 7 days included reporting symptoms at the time of the exam, having a positive family history of breast cancer, and having extremely dense breasts (P -trend = .001) (Table 1).

Among women with an abnormal diagnostic mammogram, few woman-level characteristics were associated with earlier or later follow-up. Older women had later follow-up than younger women, though the results were not statistically significant at all levels. Women with higher body mass index (P -trend = .026) and symptoms at the time of the mammogram were more likely to have follow-up care earlier rather than later.

DISCUSSION

This is the largest study to date to investigate the timing of follow-up after an abnormal mammogram. Unique features of this analysis include the available data from an integrated healthcare system and active surveillance by nurses to encourage and assist patients in returning to evaluate the abnormality noted on the mammogram. Further, we had sufficient data to investigate follow-up for both screening and diagnostic mammograms.

We confirmed that women of older age were more likely to seek care later rather than earlier for both screening and diagnostic mammograms.^{6,10} We also detected that having symptoms at the time of the mammogram was associated with earlier follow-up for both screening and diagnostic exams. Our finding is supported by Caplan and colleagues, who determined that women with breast symptoms were diagnosed with breast cancer 6 days earlier than women without breast symptoms.¹⁵

In this study, we found that women of Asian/Pacific Islander descent were more likely than white women to delay follow-up care after an abnormal screening mammogram. Karliner and colleagues reported that Asian women did not fully understand their physicians' reports of their mammograms, particularly Chinese-speaking women.²⁰ It is unclear whether language barriers were responsible for the longer delay in seeking care among Asian/Pacific Islander women in our study, but language interpreters or written materials might help reduce delay in other programs.

Women with extremely dense breasts were more likely to seek follow-up care quickly compared with women with less dense breasts. Prior studies have not reported on breast density and delay in follow-up care. The sensitivity of mammography in women with extremely dense breasts is only 30% compared with 80% in women with fatty breasts.²¹ These women are also likely to have an increased risk of interval cancers,²¹ which likely results in their prompt follow-up.

In our study, fewer than 1% and 4% of women with abnormal screening and diagnostic mammograms, respectively, did not receive any follow-up within 180 days (data not shown). Other studies have reported lack of follow-up in women after abnormal exams at rates between 8% and 28%.^{5,10} The difference in rates of follow-up is likely due to the ability of women to receive additional medical services within our health system at no financial burden and with the assistance of specially trained nurses working in the breast program. The use of computer monitoring to follow up with women postmammography reduces the delays in seeking care.^{22,23} Group Health's Breast Cancer Screening Program implemented active follow-up of women with breast clinic nurses and now uses the electronic medical record to help track women.

This study was conducted in a well-characterized defined population of women who receive healthcare through an integrated delivery system. There was thorough assessment and follow-up of mammography screening because of the Breast Cancer Screening Program at Group Health. We might have missed some clinical care that occurred at outside facilities that was not submitted for a claim. However, this is unlikely for women with their primary insurance at

Follow-up After Abnormal Mammogram

Table 1. Multivariable Odds Ratios and 95% Confidence Intervals for Woman-Level Characteristics Associated With Later Follow-up (≥ 8 Days) Compared With Earlier Follow-up (≤ 7 Days) for 20,060 Screening Mammograms^a

Characteristic	Days to Follow-up								OR ^b	95% CI
	1-7 (n = 4685)		8-14 (n = 7277)		15-21 (n = 4422)		22-180 (n = 3676)			
	No.	%	No.	%	No.	%	No.	%		
Age at diagnosis, y										
40-49	1419	30.3	2166	29.8	1250	28.3	1092	29.7	1.00	Referent
50-59	1649	35.2	2464	33.9	1510	34.2	1223	33.3	0.97	0.90-1.04
60-69	909	19.4	1350	18.6	805	18.2	673	18.3	0.97	0.89-1.06
70-79	591	12.6	1019	14.0	680	15.4	541	14.7	1.15	1.04-1.26
≥ 80	117	2.5	278	3.8	177	4.0	147	4.0	1.31	1.14-1.51
P-trend										<.001
Race										
White	4173	89.1	6429	88.4	3930	88.9	3250	88.4	1.00	Referent
African American	125	2.7	232	3.2	107	2.4	95	2.6	0.92	0.80-1.07
Asian/Pacific Islander	189	4.0	332	4.6	220	5.0	195	5.3	1.18	1.04-1.33
Other	198	4.2	284	3.9	165	3.7	136	3.7	0.93	0.91-1.07
Body mass index, kg/m²										
<25	1855	39.6	2946	40.5	1776	40.2	1435	39.0	1.00	Referent
25-29.9	1459	31.1	2268	31.2	1386	31.3	1202	32.7	1.01	0.95-1.08
30+	1371	29.3	2063	28.4	1260	28.5	1039	28.3	0.97	0.90-1.03
P-trend										.369
Education										
High school graduate or less	1220	26.0	1701	23.4	1044	23.6	908	24.7	1.00	Referent
Some college	1689	36.0	2538	34.9	1554	35.1	1309	35.6	1.05	0.98-1.12
College graduate	767	16.4	1319	18.1	783	17.7	658	17.9	1.10	1.01-1.19
Postgraduate	1009	21.5	1719	23.6	1041	23.5	801	21.8	1.11	1.02-1.20
P-trend										.006
Family history of breast cancer										
No	2681	57.2	4231	58.1	2579	58.3	2287	62.2	1.00	Referent
Yes	2004	42.8	3046	41.9	1843	41.7	1,389	37.8	0.93	0.88-0.98
Breast symptoms at time of mammogram										
No	4325	92.3	6869	94.4	4190	94.8	3483	94.8	1.00	Referent
Yes	360	7.7	408	5.6	232	5.2	193	5.2	0.79	0.70-0.88
Prior breast biopsy										
None	3667	78.3	5802	79.7	3537	80.0	2921	79.5	1.00	Referent
1	758	16.2	1125	15.5	677	15.3	585	15.9	0.99	0.92-1.06
2+	260	5.6	350	4.8	208	4.7	170	4.6	0.91	0.80-1.02
P-trend										.198
Breast density assigned at mammogram										
Almost entirely fat	149	3.2	245	3.4	144	3.3	124	3.4	1.00	Referent
Scattered fibroglandular	1554	33.2	2446	33.6	1522	34.4	1270	34.6	0.98	0.85-1.13
Heterogeneously dense	2386	50.9	3686	50.6	2280	51.6	1928	52.4	0.95	0.82-1.10
Extremely dense	596	12.7	900	12.4	476	10.8	354	9.6	0.82	0.69-0.96
P-trend										.001
Postmenopausal hormone therapy										
No	2059	44.0	3278	45.1	1969	44.5	1645	44.8	1.00	Referent
Yes	2626	56.0	3999	54.9	2453	55.6	2031	55.2	0.97	0.92-1.03
Current	1875	41.7	2756	39.5	1693	39.9	1344	37.8	0.95	0.89-1.01
Former	563	12.5	945	13.6	581	13.7	570	16.0	1.03	0.94-1.12

CI indicates confidence interval; OR, odds ratio.

^aBoldfaced entries are statistically significant.

^bModels were adjusted for all other variables presented in the table, in addition to the year of the exam.

■ TRENDS FROM THE FIELD ■

■ **Table 2.** Multivariable Odds Ratios and 95% Confidence Intervals for Woman-Level Characteristics Associated With Later Follow-up (>8 Days) Compared With Earlier Follow-up (<7 Days) for 3184 Diagnostic Mammograms^a

Characteristic	Days to Follow-up								OR ^b	95% CI
	1-7 (n = 2201)		8-14 (n = 340)		15-21 (n = 223)		22-180 (n = 420)			
	No.	%	No.	%	No.	%	No.	%		
Age at diagnosis, y										
40-49	714	32.4	120	35.3	60	26.9	107	25.5	1.00	Referent
50-59	701	31.9	105	30.9	63	28.2	130	31.0	1.08	0.87-1.35
60-69	392	17.8	64	18.8	42	18.8	82	19.5	1.16	0.89-1.50
70-79	298	13.5	42	12.3	47	21.1	77	18.3	1.40	1.07-1.83
≥80	96	4.4	9	2.7	11	4.9	24	5.7	1.13	0.75-1.83
<i>P</i> -trend										.039
Race										
White	1906	86.6	306	90.0	197	88.3	365	86.9	1.00	Referent
African American	78	3.5	14	4.1	5	2.2	15	3.6	1.09	0.71-1.68
Asian/Pacific Islander	110	5.0	10	2.9	10	4.5	28	6.7	1.17	0.80-1.72
Other	107	4.9	10	2.9	11	4.9	12	2.9	0.78	0.52-1.18
Body mass index, kg/m²										
<25	902	41.0	156	45.9	100	44.8	184	43.8	1.00	Referent
25-29.9	661	30.0	110	32.3	59	26.5	128	30.5	0.88	0.73-1.06
30+	638	29.0	74	21.8	64	28.7	108	25.7	0.79	0.65-0.98
<i>P</i> -trend										.026
Education										
High school graduate or less	529	24.0	73	21.5	57	25.6	125	29.8	1.00	Referent
Some college	818	37.2	102	30.0	75	33.6	141	33.6	0.89	0.73-1.10
College graduate	369	16.8	74	21.8	51	22.9	60	14.3	1.12	0.89-1.43
Postgraduate	485	22.0	91	26.8	40	17.9	94	22.4	1.02	0.81-1.29
<i>P</i> -trend										.407
Family history of breast cancer										
No	1274	57.9	197	57.9	130	58.3	239	56.9	1.00	Referent
Yes	927	42.1	143	42.1	93	41.7	181	43.1	0.97	0.83-1.14
Breast symptoms at time of mammogram										
No	1334	60.6	234	68.8	166	74.4	340	81.0	1.00	Referent
Yes	867	39.4	106	31.2	57	25.6	80	19.0	0.47	0.39-0.56
Biopsy history										
None	1652	75.1	255	75.0	160	71.8	325	77.4	1.00	Referent
1	394	17.9	59	17.3	46	20.6	73	17.4	0.99	0.81-1.21
2+	155	7.0	26	7.6	17	7.6	22	5.2	0.94	0.69-1.27
<i>P</i> -trend										.717
Breast density assigned at mammogram										
Almost entirely fat	74	3.4	5	1.5	6	2.7	19	4.5	1.00	Referent
Scattered fibroglandular	630	28.6	101	29.7	80	35.9	133	31.7	1.10	0.67-1.79
Heterogeneously dense	1154	52.4	185	54.4	109	48.9	210	50.0	1.05	0.64-1.72
Extremely dense	343	15.6	49	14.4	28	12.6	58	13.8	0.97	0.57-1.64
<i>P</i> -trend										.502
Hormone therapy										
No	1011	45.9	169	49.7	82	36.8	190	45.2	1.00	Referent
Yes	1190	54.1	171	50.3	141	63.2	230	54.8	0.96	0.80-1.15
Current	816	38.9	110	34.8	89	42.8	163	41.8	0.92	0.75-1.12
Former	273	13.0	37	11.7	37	17.8	39	10.0	1.00	0.77-1.31

CI indicates confidence interval; OR, odds ratio.

^aBoldfaced entries are statistically significant.

^bModels were adjusted for all other variables presented in the table, in addition to the year of the exam.

Follow-up After Abnormal Mammogram

the health plan, because filing a claim would enable payment for outside services and women would be motivated to do so.

Clinical guidelines for promptness in obtaining an evaluation after an abnormality is noted on mammography examination are not well established. An assessment of the National Initiative on Cancer Care Quality in the United States suggests that 90% of patients should be seen within 3 weeks of an abnormal screening mammogram for a diagnostic mammogram, within 14 days from needing an open biopsy to cancer diagnosis, and within 5 working days from breast cancer diagnosis to an appointment with the treating physician.²⁴ While we cannot make a direct comparison to the National Initiative for Cancer Care Quality, we can report that 82% of women received the recommended follow-up care within 3 weeks of their abnormal screening mammogram. Further, 69% of women with abnormal diagnostic mammograms received recommended follow-up care within 7 days. In 2004, the National Quality Measures for Breast Centers identified 2 measures of timely follow-up: imaging timeliness of care (ie, time between screening mammogram, diagnostic mammogram, needle biopsy, surgery) and surgical timeliness (ie, time between diagnostic mammogram, open surgical biopsy/excision, initial breast cancer surgery).²⁵ There are characteristics that influence women's timeliness to follow-up that future interventions may address to reduce delays in breast cancer diagnosis.

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