

# Low-Income Women With Breast Abnormalities: System Predictors of Timely Diagnostic Resolution

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**Background:** Incomplete or delayed diagnostic resolution of breast abnormalities suspicious for cancer may contribute to poor breast cancer outcomes. We examine system predictors of timely diagnostic resolution in low-income, mostly Latina women with breast abnormalities at two Los Angeles County public hospitals.

**Methods:** We collected medical record data on 1,671 women. The outcome — timely diagnostic resolution — was defined as receipt of definitive diagnosis (malignant or benign) within six months of the index referral. Predictors of the outcome were examined with bivariate and multivariate logistic regression models.

**Results:** Only 56% of women received timely diagnostic resolution; however, the proportion was higher at Hospital B (67%) compared to Hospital A (51%). The effect of predictors differed by hospital. At Hospital B, the odds of timely diagnostic resolution were lower for women with self-identified abnormalities ( $P < .033$ ) and higher for women referred to Radiology rather than Surgery for their first appointment ( $P < .005$ ). At Hospital A, the odds of timely diagnostic resolution were higher for women with self-identified abnormalities ( $P < .043$ ) and lower for women referred to Radiology rather than Surgery for their first appointment ( $P < .001$ ).

**Conclusions:** Rates and predictors of timely diagnostic resolution differed by hospital. System barriers may be a function of referral processes and patient tracking. Interventions may need to be tailored to a hospital's unique culture.

## Introduction

Despite substantial gains in rates of breast cancer screening in the past decade, ethnic minority women have lower screening rates than white women, and they are diagnosed with breast cancer at later stages of disease.<sup>1-5</sup> Therefore, efforts to prevent and control breast cancer among ethnic minority women must continue to focus on early detection. Although evidence linking breast cancer screening to reductions in breast cancer deaths

is strong,<sup>6-10</sup> for early detection to be truly effective, efforts must also focus on timely diagnostic resolution of abnormal test results. Studies show significant decreases in 5-year survival rates among women with delays of 3 to 6 months between identification of an abnormality and initiation of cancer treatment.<sup>11-14</sup> Yet, recent reviews of the literature have found that only about 75% of all patients<sup>15</sup> and 50% to 70% of minority women who test positive for any screening test receive appropriate follow-up care.<sup>16</sup>

Reasons for incomplete or delayed diagnostic resolution are not fully understood. Most studies on barriers to diagnostic follow-up have examined patient-level characteristics, such as income, education, health insurance, age, and cultural attitudes and beliefs.<sup>15</sup> Few studies have examined system-level characteristics.<sup>17</sup> Yet, specific features of the health care delivery system, such as organization of care, are critical to the follow-up process. Difficulty scheduling appointments, long wait periods in the waiting room, and long lengths of time between identification of the abnormality and further evaluation are all factors that can lead to inadequate follow-up care.<sup>18,19</sup>

To identify additional features of the health care delivery system that may affect timely diagnostic resolution of a breast abnormality, this study used medical record data to examine potential system-level predic-

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tors of follow-up in 1,671 low-income, mostly Hispanic/Latina women with breast abnormalities receiving care at two Los Angeles County public hospitals.

## Methods

### *Data Source and Study Sample*

Data were collected from June 1996 to December 1998 for a study testing the effectiveness of a telephone counseling intervention on diagnostic resolution among women identified with a breast abnormality at two public hospitals in the Los Angeles County Department of Health Services. The County health system, with five acute care hospitals, one rehabilitation hospital, and six comprehensive health centers, is the nation's second-largest public hospital system. The County provides direct patient care and public health services to 10 million residents and the majority of uncompensated care to about 3 million uninsured residents.<sup>20</sup> In the past 10 years, however, the County has not made significant changes to its delivery of health care services.<sup>20</sup> Hospital A is a large facility (with approximately 100,000 outpatient and 34,000 inpatient visits a year) located in a congested urban area. Hospital B is a smaller facility (with about 50,000 outpatient and 11,000 inpatient visits a year) located on the outskirts of Los Angeles.

A total of 1,708 subjects were enrolled in the study. Eligible women were 18 years and older identified with a breast abnormality (eg, lumps, calcifications, abnormal mammograms, abnormal nodes) and referred to Surgery or Radiology Departments offering consultation, diagnostic, and surgical services. Women with breast pain and tenderness, a history of breast cancer, or a breast cancer diagnosis at referral were excluded from the study. Following enrollment, women were randomized into an intervention ( $n = 859$ ) or usual-care control ( $n = 849$ ) group. Women in the intervention group received a telephone intervention delivered by a team of professional and peer counselors. Control group subjects received usual care. At 6 months, medical chart audits were conducted on all enrolled subjects.

### *Data Collection*

Data on new patient referrals made to the hospitals' Surgery and Radiology Departments were collected weekly. Patients referred to these specialty departments came from clinics, such as family practice and medical walk-in, located within the medical centers themselves or surrounding comprehensive health centers. A small number of women ( $n = 157$ ) who had been receiving care at Surgery or Radiology for another health problem and needed consultation for a newly identified breast problem were referred internally from the two specialty clinics.

Medical chart audits were completed for 98% ( $n = 1,671$ ) of enrolled women. Chart audits were considered complete upon confirming a date of discharge or recording the last known appointment date. Missing charts were requested at least twice from the hospital's medical records office.

### *Main Outcome Measure*

Timely diagnostic resolution was defined as receipt of definitive diagnosis (malignant or benign) within 6 months of the index referral. The variable is based on medical record data and coded as a binary variable (ie, diagnosed vs not diagnosed within 6 months). County physicians agreed that 6 months was a clinically appropriate timeframe for diagnostic resolution of a breast abnormality in the County health system.

### *Predictor Variables*

Predictor variables were obtained from medical record data and included system and individual characteristics. System factors included priority of referral (urgent or routine), location of referring clinic (within or outside hospital), location of first appointment (Surgery or Radiology), and method of abnormality identification (patient/self, clinical, radiographic).

Patient variables included age ( $<40$ ,  $40-49$ ,  $\geq 50$  years), ethnicity (Hispanic/Latina or non-Hispanic/Latina), and patient attendance at first appointment (yes or no). Age and ethnicity were the only patient characteristics available in medical charts. Ethnicity was constructed using data from medical records and the US Census Bureau's 1990 Heavily Hispanic Surname File. The surname file contains over 12,000 names highly correlated with Hispanic ethnicity.<sup>21</sup> However, patient ethnicity noted in medical records took priority over the surname file. We first recorded ethnicity from medical records when the information was available. We then matched patient last names against the surname file for the remainder of patients whose ethnicity was omitted in medical charts.

The variable indicating whether a subject was in the intervention or usual-care control group was not included in this analysis. This report does not assess differences in outcome by study group status, and earlier analysis revealed that the intervention is not a significant predictor of the outcome (data not shown).

### *Statistical Analyses*

Since the hospitals differed significantly on all variables (see Table 2), predictors of timely diagnostic resolution were identified by fitting bivariate and multivariate logistic regression models separately by hospital. The multivariate regression models included all predictor variables (except patient attendance at first appointment due to zero cells). Therefore, each stratified multivariate regression equation was specified as a func-

tion of the subject's demographic characteristics (age and ethnicity), type of breast abnormality, method of abnormality identification, priority of referral, location of referring clinic, and location of first appointment.

We also conducted multiple imputations to account for missing data in predictor variables. We used the imputation by chained equations (ICE) procedure in software package Stata Release 9 that uses switching regression to conduct five imputations. According to Rubin,<sup>22</sup> five imputations are sufficient when data have up to 20% missingness. Missing data frequencies were age (2.7%), type of abnormality (3.5%), method of abnormality identification (12%), location of referring clinic (3.9%), and location of first appointment (1.4%). Although individual variables did not have large amounts of missing data, 10% (n = 167) of the sample would have been dropped from the analyses had we not imputed the data. Each conditional regression model used the total set of predictor variables (except attendance at first ap-

pointment) in Table 1. Inference from multiply-imputed data sets was combined using the method of Barnard and Rubin.<sup>23</sup> The Hosmer-Lemeshow test was used to assess the various models for goodness-of-fit; an acceptable degree of fit was indicated in all cases.

## Results

### Sample Characteristics

Table 2 displays demographic and system-level data in the total sample, by hospital. The hospitals differed significantly on all variables. Hospital B had a slightly lower proportion of Hispanic/Latinas and a younger age distribution than Hospital A. Only 5% of the total sample was 65 years of age and older. Half the abnormalities were identified by the patient at Hospital B, and most were identified by radiographic examination at Hospital A. Most referrals to both hospitals came from clinics

Table 1. — Bivariate and Multivariate Logistic Regression of Timely Diagnostic Resolution (TDR)

	Hospital A (n = 1,217)					Hospital B (n = 454)				
	No. of Patients	% TDR	Odds Ratio BVA	Odds Ratio MVA	95% CI	No. of Patients	% TDR	Odds Ratio BVA	Odds Ratio MVA	95% CI
<b>Age (yrs)</b>										
<40	243	50	Ref			207	62	Ref		
40–49	394	54	1.17	1.20	(.93, 1.60)	131	65	1.12	.90	(.54, 1.50)
50+	580	50	.99	1.10	(.79, 1.14)	116	80	2.26*	1.80	(.92, 3.62)
<b>Ethnicity</b>										
Hispanic/Latina	953	52	Ref			321	66	Ref		
Non-Hispanic/Latina	264	50	.91	.91	(.69, 1.20)	133	68	1.06	.94	(.61, 1.50)
<b>Type of Abnormality</b>										
Mass	808	51	Ref			383	66	Ref		
Other	409	51	1.00	1.01	(.79, 1.30)	71	73	1.40	1.30	(.71, 2.37)
<b>Method of Abnormality ID</b>										
Patient/Self	201	59	1.46*	1.40*	(1.01, 1.94)	224	65	.58	.51*	(.27, .95)
Clinical	98	50	1.00	.96	(.63, 1.47)	150	65	.59	.54	(.28, 1.03)
Radiographic	918	50	Ref			80	76	Ref		
<b>Priority of Referral</b>										
Urgent	42	62	1.56	1.40	(.73, 2.7)	67	72	1.31	1.30	(.70, 2.30)
Routine	1175	51	Ref			387	66	Ref		
<b>Location of Referring Clinic</b>										
Inside Hospital	808	51	Ref			446	67	Ref		
Outside Hospital	409	52	1.09	1.11	(.86, 1.43)	8	38	.29	.19*	(.04, .92)
<b>Location of First Appointment</b>										
Surgery	729	56	Ref			304	62	Ref		
Radiology	488	44	.62*	.64*	(.51, .81)	150	76	2.32*	2.00*	(1.23, 3.18)
<b>Attendance at First Appointment</b>										
Kept Appointment	1000	63	<.001**			401	76	<.001**		
No Show	217	0				53	0			

Ref = referent group, BVA = bivariate analysis, MVA = multivariate analysis.  
 \* Significant at  $P < .05$ .  
 \*\* Fisher's exact test; area under ROC curve is .58 for Hospital A and .63 for Hospital B.

within the hospital. Women at both hospitals were more often referred to Surgery than Radiology for their first appointment. About 16% of women failed to keep their first appointment. Although 56% (n = 929) of women received timely diagnostic resolution, the proportion was higher at Hospital B (67%) compared with Hospital A (51%).

**Prediction of Outcome: Timely Diagnostic Resolution — Bivariate Analyses**

Results of the bivariate analyses by hospital are presented in Table 1. Age, method of abnormality identification, and location of first appointment were the main predictors of the outcome. However, effects differed by hospital.

**Method of Abnormality Identification:** At Hospital A, women with self-identified abnormalities had higher odds of timely diagnostic resolution than women with radiographically identified abnormalities. At Hospital B, women with radiographically identified abnormalities were more likely to receive timely diagnostic resolution.

**Location of First Appointment:** The effect of location of first appointment was opposite at the two

hospitals. At Hospital A, women scheduled to Radiology had lower odds of timely diagnostic resolution than women scheduled to Surgery. At Hospital B, women scheduled to Radiology had higher odds of timely diagnostic resolution than women scheduled to Surgery.

**Age:** At Hospital B, women ≥50 years of age compared with women <40 years had higher odds of timely diagnostic resolution. There was no age effect at Hospital A.

**Patient Attendance at First Appointment:** Patient attendance at the first appointment perfectly predicted the outcome. No woman who missed her first appointment received timely diagnostic resolution. Because of the significance of keeping the first appointment, we conducted bivariate analyses using attendance at first appointment as an outcome (results not shown). Data revealed that age (≥50 years), location of referring clinic (within hospital), and location of first appointment (Radiology at Hospital B) were significant predictors of keeping the first appointment (higher odds). We also conducted bivariate analyses of timely diagnostic resolution with the sample of women who kept their first appointment (n = 1,401). Analyses

Table 2. — Demographic Characteristics and System Variables by Hospital

	P Value*	Health Facility		Total N = 1,671 (%)
		Hospital A n = 1,217 (%)	Hospital B n = 454 (%)	
<b>Age (yrs)</b>	<.001			
<40		20	46	27
40–49		32	29	31
50+		48	25	42
<b>Ethnicity</b>	.001			
Hispanic/Latina		78	71	76
Non-Hispanic/Latina		22	29	24
<b>Type of Abnormality</b>	<.001			
Mass		66	84	71
Other		34	16	29
<b>Method of Abnormality Identification</b>	<.001			
Patient/Self		17	49	25
Clinical		8	33	15
Radiographic		75	18	60
<b>Priority of Referral</b>	<.001			
Urgent		3	15	7
Routine		97	85	93
<b>Location of Referring Clinic</b>	<.001			
Inside hospital (eg, medical walk-in)		66	98	75
Outside hospital (eg, comprehensive health center)		34	2	25
<b>Location of First Appointment</b>	.008			
Surgery		60	67	62
Radiology		40	33	38
<b>Attendance of First Appointment</b>	.002			
Kept appointment		82	88	84
No show		18	12	16
<b>Timely Diagnostic Resolution</b>	<.001	51	67	56

\* p values refer to comparisons between Hospitals A and B.

revealed that priority of referral (urgent), location of first appointment (Surgery at Hospital A), and method of abnormality identification (self-identified at Hospital A) were significant predictors of timely diagnostic resolution (higher odds).

### **Prediction of Outcome: Timely Diagnostic Resolution — Multivariate Analyses**

Results of the multivariate logistic regressions are presented in Table 1. As in the bivariate analyses, method of abnormality identification and location of first appointment, controlling for all other variables, significantly predicted the outcome. Location of referring clinic at Hospital B was also predictive of the outcome.

**Method of Abnormality Identification:** At Hospital B, women with self-identified abnormalities had lower odds of timely diagnostic resolution than women with radiographically identified abnormalities. At Hospital A, the odds of timely diagnostic resolution were higher among women with self-identified abnormalities.

**Location of First Scheduled Appointment:** At Hospital B, women scheduled to Radiology had higher odds of timely diagnostic resolution than women scheduled to Surgery. At Hospital A, the odds of timely diagnostic resolution were lower for women scheduled to Radiology.

**Location of Referring Clinic:** At Hospital B, women referred from clinics outside the hospital had lower odds of timely diagnostic resolution than women referred from clinics within the hospital. Because the “outside” hospital category had a small cell size, the multivariate model was also fit excluding location of referring clinic. Results (not shown) were virtually unchanged.

**Patient Attendance at First Appointment:** Results (not shown) of a multivariate logistic regression analysis using attendance at first appointment as an outcome revealed that the odds of keeping the first appointment are greater when the appointment is to Radiology rather than Surgery (at Hospital B) and when the patient is  $\geq 50$  years of age. Results of a multivariate regression among women who kept their first appointment ( $n = 1,401$ ) paralleled the main analysis. Priority of referral (urgent) also predicted higher odds of timely diagnostic resolution.

## **Discussion**

Consistent with findings of other studies,<sup>16</sup> our data indicate relatively low rates of diagnostic follow-up among low-income, mostly Hispanic/Latina women. Only 56% ( $n = 920$ ) of women received timely diagnostic resolution of their breast abnormality. However, the rate of resolution differed by 17 percentage points between hospitals; patient volume and structure might

account for the difference. The smaller patient volume at Hospital B might enable women to more easily schedule appointments and have shorter lengths of time between identification of the abnormality and further evaluation, both of which affect follow-up care.<sup>18,19</sup> Women might also have an easier time navigating Hospital B. Diagnostic clinics are in close proximity to one another, waiting areas are comfortable, and parking is accessible.

Factors associated with timely diagnostic resolution include method of abnormality identification and location of first appointment. Attendance at first appointment also predicted the outcome.

**Method of Abnormality Identification:** Results at Hospital B parallel the findings of Schootman and colleagues.<sup>24</sup> Women with self-identified abnormalities were less likely than women with mammographically identified problems to receive timely diagnostic resolution ( $P < .033$ ). Study authors did not investigate reasons but speculated that cultural factors might have played a role. Although we could find no other studies linking method of abnormality identification to diagnostic resolution, we found many studies linking method of abnormality identification to stage of disease, treatment, and survival among women with breast cancer. Studies have found that women with late-stage breast cancer and lower rates of survival are more likely to have had a self-identified breast abnormality.<sup>25-28</sup> Thus, women with self-identified abnormalities are at risk of being diagnosed with advanced breast cancer if they have the disease. Delays in timely diagnostic resolution will further contribute to poor breast cancer outcomes.

Although we cannot definitively explain why women with self-identified abnormalities at Hospital B have lower odds of timely diagnostic resolution, we believe that the hospital’s referral process might play a role. We observed that at Hospital B, all referrals, regardless of how the abnormality was identified, are reviewed in a central location and assigned to Surgery or Radiology within 2 weeks. Only women with suspicious masses can receive a same day or next day appointment to Radiology. At Hospital A, referrals for women with self-identified abnormalities (who come from the hospital’s breast clinic) bypass review at the central location and are fast-tracked through the referral process. Regardless of severity, these women receive a next day appointment to Radiology and if needed, a same week appointment to Surgery. (Most women with self-identified abnormalities referred to Radiology come from the hospital’s breast clinic.) Thus, women who are fast-tracked through the referral process are more likely to receive timely diagnostic resolution. Fast-tracking women through the referral process might confer a sense of urgency and encourage women to keep their first appointment. Keeping the first appointment is crucial to the outcome. A woman who misses her first appoint-

ment has no opportunity for timely diagnostic resolution. Also, once women keep their first appointment, clinic staff might be more vigilant and aggressive, ensuring women understand the follow-up process and keep subsequent appointments.

#### **Location of First Scheduled Appointment:**

Since Radiology has strict protocols designed to streamline the follow-up process, we expected women scheduled to Radiology rather than Surgery to have higher odds of timely diagnostic resolution. However, such was the case only at Hospital B ( $P < .005$ ). At Hospital A, women scheduled to Radiology had lower odds of timely diagnostic resolution ( $P < .001$ ). Although we could find no studies examining the relationship between Radiology, Surgery, and the outcome, we observed the department's informal patient tracking policies and believe that the aggressiveness of patient tracking might play a role.

Radiology at Hospital B and Surgery at Hospital A have aggressive patient tracking systems. Radiology staff send letters and Surgery staff call all women who miss appointments. Both departments can also schedule their own appointments for new and returning patients without going through the hospital's main appointment desk. Radiology at Hospital A and Surgery at Hospital B, however, do not have aggressive patient tracking systems. Neither department has the resources to contact women who miss appointments. Radiology staff only track women with lesions suspicious for breast cancer. Although Radiology staff can schedule their own appointments for new and returning patients, Surgery staff must go through the hospital's main appointment desk. Thus, the odds of timely diagnostic resolution are higher at departments with aggressive patient tracking systems: Radiology at Hospital B and Surgery at Hospital A. Studies have found that tracking systems for patients who miss appointments decrease the number of women with inadequate follow-up care.<sup>19</sup> Patient tracking systems might foster improved staff-patient communication. The more contact women have with staff, the more comfortable women are in asking questions and keeping their appointments. Women who know about their abnormality and understand the follow-up process are more likely to receive timely diagnostic resolution.<sup>14,19</sup>

## Conclusions

There are limitations to consider in this study. First, the lack of significant findings between other predictor variables and the outcome might be due to biases from omitted variables. For example, mammogram severity was not included in the analysis, yet may drive the intensity of patient tracking, at least in the Radiology Department at Hospital A. In Radiology, only women

with suspicious lesions are tracked aggressively. Also, studies have found that women with suspicious mammograms are more likely to receive adequate care.<sup>14,18</sup> However, severity of the mammogram was not readily available during data collection. Second, we could not control for the possibility that some women may have had their abnormality resolved at a facility outside the County health system. Third, only age and ethnicity were available in medical records. We attempted to collect additional socioeconomic patient information from administrative databases, but such efforts produced large amounts of missing data.

Despite these limitations, future research must focus on testing patient tracking systems that fast-track women through the referral process and monitor them throughout the follow-up period. Patient tracking systems must be feasible, cost effective, and tailored to a hospital's unique culture. It is equally important to ensure that women keep their first scheduled appointment since women who miss this are at a disadvantage. Consulting with a woman rather than sending a postcard with the appointment time and date (as the County does) may increase the chances of her keeping the first appointment. Ensuring that women receive timely diagnostic resolution after an abnormal screening test must become a public health priority.

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