

ABSTRACT

Objectives. This study examined times to diagnosis and treatment for medically underserved women screened for breast cancer.

Methods. Intervals from first positive screening test to diagnosis to initiation of treatment were determined for 1659 women 40 years and older diagnosed with breast cancer.

Results. Women with abnormal mammograms had shorter diagnostic intervals than women with abnormal clinical breast examinations and normal mammograms. Women with self-reported breast symptoms had shorter diagnostic intervals than asymptomatic women. Diagnostic intervals were less than 60 days in 78% of cases. Treatment intervals were generally 2 weeks or less.

Conclusions. Most women diagnosed with breast cancer were followed up in a timely manner after screening. Further investigation is needed to identify and then address factors associated with longer diagnostic and treatment intervals to maximize the benefits of early detection. (*Am J Public Health*. 2000;90:130-134)

Time to Diagnosis and Treatment of Breast Cancer: Results From the National Breast and Cervical Cancer Early Detection Program, 1991-1995

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Since early diagnosis and treatment are associated with decreased breast cancer mortality, it is important to minimize the times from detection to diagnosis to treatment. The interval between self-discovery of breast symptoms and medical evaluation, the "patient delay," has been studied extensively.¹⁻⁵ The interval between initial medical consultation or screening and diagnosis or initiation of therapy—the "system delay"—has been investigated less, especially among asymptomatic women. Many symptomatic breast cancer patients experience long delays in obtaining diagnosis and treatment,⁶⁻⁸ perhaps negatively affecting their prognosis.^{7,8} Only 1 study has included screen-detected cancers, but it provided no survival data.⁹

This study explored the time required to diagnose and begin treating breast cancers that are screen-detected through the National Breast and Cervical Cancer Early Detection Program (NBCCEDP), which is administered by the Centers for Disease Control and Prevention (CDC). NBCCEDP provides breast and cervical cancer screening and diagnostic services to medically underserved women.¹⁰ To realize the benefits of early detection, timely follow-up and treatment must occur.¹¹

Methods

NBCCEDP has been described elsewhere.^{10,12} Briefly, the CDC implemented cooperative agreements with state and territorial health agencies and American Indian/Alaskan Native tribal organizations to provide screening, referral, and follow-up services for underserved women. The program provides annual clinical breast examinations (CBEs) for all women and annual mammograms for women 40 years and older, along with diagnostic services. Programs contract with a broad range of providers, including health departments, community and migrant health centers, radiology facilities, private physicians, and community organizations, to coordinate and deliver services. Because the law prohibits federal payment for treatment, programs must find financial or in-kind support so that women diagnosed with cancer can receive timely and appropriate treatment.

The CDC estimates that programs that have been in existence for several years reach about 10% to 15% of eligible women.

The CDC and its state partners developed a set of standardized data items to monitor screening, diagnostic, and follow-up activities. Women self-report demographic characteristics, mammography history, and breast symptoms. Providers report the results of mammograms and CBEs, the performance of diagnostic procedures, diagnostic results, and when treatment is initiated. Programs report data electronically to the CDC biennially. Thirty-five states and 6 tribal programs reported data during our study period. Each woman's zip code or county of residence and a US census data file were used to categorize residence as urban (within a standard metropolitan statistical area) or rural.

Most of the mammography offered through the program is for screening, but diagnostic mammography is also provided: eligible women may self-refer on the basis of symptoms or concerns, and women whose customary providers detect a breast abnormality may be referred for diagnostic evaluation. Approximately 20% of program mammographies may be diagnostic (performed after an abnormal CBE or self-reported symptoms).¹² We considered 3 time intervals: the diagnostic interval—the time between the date of the first examination (CBE or mammogram) that found an abnormality and the date of the pathologic diagnosis of cancer; the treatment interval—the time between the date of diagno-

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TABLE 1—Distribution of Times to Breast Cancer Diagnosis and Initiation of Treatment According to Screening Test Outcome: National Breast and Cervical Cancer Early Detection Program, 1991–1995

Clinical Breast Examination	Mammogram ^a	n	Diagnostic Interval: Time From First Abnormal Screening ^b to Diagnosis (Days)		Treatment Interval: Time From Diagnosis to Treatment Initiation (Days)		Total Interval: Time From First Abnormal Screening ^b to Treatment Initiation (Days)	
			Median (Range)	% > 60, d	Median (Range)	% > 30, d	Median (Range)	% > 90, d
All	All	1659	32 (0–759)	21.7	10 (0–791)	21.8	48 (0–845)	22.9
Abnormal	Abnormal	714	29 (0–759)	17.0	10 (0–641)	21.6	43 (0–827)	19.5
Abnormal	Normal	70	46 (0–574)	40.0	2 (0–111)	17.1	65 (6–574)	37.1
Normal	Abnormal	648	34 (0–450)	24.7	9 (0–791)	21.1	51 (1–845)	25.3
Not done/unknown	Abnormal	227	29 (0–398)	22.5	13 (0–202)	25.6	50 (1–511)	22.5
<i>P</i>			<.0001	<.001	.05	.40	.0003	.002

Note. *P* values for differences between medians within each set are based on the Kruskal-Wallis test. *P* values for differences between percentages over specified number of days within each set are based on the χ^2 test.

^aStandard reporting categories from the Breast Imaging and Reporting Data System.¹³ Normal = negative, benign, or probably benign.

Abnormal = suspicious abnormality, highly suggestive of malignancy, or assessment is incomplete.

^bAbnormal finding in mammogram or clinical breast examination.

sis and the date the treatment plan was started; and the total interval—the time between the date of the first abnormal screening result and the date the treatment started.

Between July 1, 1991, and September 30, 1995, 325 035 examination cycles initiated by CBEs or mammograms were performed on 250 957 women 40 years or older. Of these cycles, 1907 resulted in a diagnosis of breast cancer. We excluded 61 women who refused treatment or were lost to follow-up and 58 others who had no record of an abnormal screening test. Also excluded were 118 women whose dates of diagnosis or initiation of treatment were not reported or predated the first abnormal examination. Finally, for 11 women with 2 breast cancers diagnosed through the program, we used the first. Thus, 1659 women with breast cancer diagnoses formed the basis for analysis.

The diagnostic, treatment, and total interval distributions were highly skewed because of a few extremely long intervals. Therefore, we compared medians rather than means to give a more accurate picture of the true distributions, using the Kruskal-Wallis test to assess statistical significance.¹⁴ We also determined the percentages of women with diagnostic intervals longer than 60 days, treatment intervals longer than 30 days, and total intervals longer than 90 days, using the χ^2 test for significance. Although there is no consensus on reasonable lengths for these intervals, total intervals of up to 90 days are unlikely to adversely affect survival.⁹

Results

Among women diagnosed with breast cancer after an abnormal mammogram, those

TABLE 2—Cumulative Distribution of Time Intervals to Diagnosis of Breast Cancer and Initiation of Treatment: National Breast and Cervical Cancer Early Detection Program, 1991–1995

Interval, d	Women Diagnosed With Breast Cancer ^a		
	Diagnosis After First Abnormal Screen Within Interval Shown, ^b %	Treatment Initiated After Diagnosis Within Interval Shown, %	Treatment Initiated After Abnormal Screen Within Interval Shown, ^b %
5	6.0	41.9	1.3
10	14.0	51.7	4.3
15	24.2	59.4	8.4
20	32.2	66.0	13.0
30	48.9	78.2	26.4
40	62.0	84.6	40.2
50	71.4	88.1	53.1
60	78.3	90.7	61.0
80	85.3	93.1	72.8
100	89.6	95.1	80.3
120	91.9	96.2	85.2
140	93.9	96.7	88.7
160	94.8	97.0	90.2
180	95.5	97.2	91.3
200	96.1	97.4	92.5

^an = 1659.

^bAbnormal finding in mammogram or clinical breast examination.

with normal CBEs had a median diagnostic interval 5 days longer than those with abnormal or unknown CBE results (Table 1). Women with normal mammograms and abnormal CBEs had a median diagnostic interval 12 to 17 days longer than those with abnormal mammograms. Median treatment intervals were within 2 weeks, regardless of mammogram or CBE result.

Among women diagnosed with breast cancer, the cancer was diagnosed within 15 days of the first abnormal test for nearly one fourth of the women, within 30 days for nearly half, and within 60 days for more than three fourths (Table 2). Treatment intervals

were substantially shorter than diagnostic intervals: nearly 80% of the women began treatment within 30 days after diagnosis.

Women 70 years or older had shorter treatment intervals than younger women (Table 3). White women had shorter diagnostic and treatment intervals than women of other racial or ethnic groups. Black and Hispanic women had the longest diagnostic intervals, and other/unknown and Asian women had the longest treatment intervals. Total intervals were shorter for rural than for urban women. Diagnostic intervals were shorter for symptomatic than for asymptomatic women. Women with the most ominous

TABLE 3—Distribution of Times to Breast Cancer Diagnosis and Initiation of Treatment According to Demographics, Symptoms, and Mammography Results: National Breast and Cervical Cancer Early Detection Program, 1991–1995

	n	Diagnostic Interval: Time From First Abnormal Screening ^a to Diagnosis, d		Treatment Interval: Time From Diagnosis to Treatment Initiation, d		Total Interval: Time From First Abnormal Screening ^a to Treatment Initiation, d	
		Median	% > 60, d	Median	% > 30, d	Median	% > 90, d
Age, y							
40–49	442	30	20.1	10	22.2	48	23.3
50–69	979	32	22.9	11	22.6	48	24.0
70+	238	34	19.8	6	17.7	46	17.7
<i>P</i>		.47	.37	.035	.25	.25	.11
Race/ethnicity							
White	975	29	17.7	8	19.9	43	18.4
Black	255	36	25.9	15	29.0	60	30.6
Hispanic	270	38	28.2	8	20.4	52	28.2
Asian	45	35	24.4	18	24.4	57	26.7
American Indian/Alaskan Native	97	33	30.9	14	22.7	55	32.0
Other/Unknown	17	29	23.5	21	29.4	50	23.5
<i>P</i>		<.0001	<.001	.004	.050	<.0001	<.001
County of residence							
Rural	532	28	21.8	8	17.5	44	21.1
Urban	1072	34	21.9	10	23.9	50	23.7
Unknown	55	22	16.4	16	21.8	43	25.5
<i>P</i>		.0002	.62	.05	.014	.002	.45
Breast symptoms							
Yes	516	29	19.0	8	21.7	44	21.3
No	826	35	23.5	10	21.9	51	23.2
Unknown	317	29	21.5	11	21.5	44	24.6
<i>P</i>		.0002	.15	.64	.99	.013	.52
Mammography result^b							
Neg, Ben	34	47	41.2	3	17.7	63	32.4
PB	36	46	38.9	3	16.7	77	41.7
SA	687	34	22.3	10	22.4	50	23.4
HSM	594	21	8.8	9	20.5	37	13.5
AI	308	51	41.2	12	23.7	72	36.7
<i>P</i>		<.0001	<.001	.23	.69	<.0001	<.001

Note. *P* values for differences between medians within each set are based on the Kruskal-Wallis test, and *P* values for differences between percentages over specified number of days within each set are based on the χ^2 test.

^aAbnormal finding in mammogram or clinical breast examination.

^bStandard reporting categories from the Breast Imaging and Reporting Data System.²⁶ Neg = negative, Ben = benign, PB = probably benign, SA = suspicious abnormality, HSM = highly suggestive of malignancy, AI = assessment incomplete.

mammogram results (HSM, or “highly suggestive of malignancy”) had much shorter diagnostic and total intervals, but treatment intervals did not vary significantly by mammography result.

Discussion

Delays between breast cancer screening and initiation of therapy are of prognostic concern if they permit tumor burdens to increase. Estimates for tumor doubling times range widely, with a median time of 260 days for mammographically detected tumors.⁹ In this study, only 7.5% of the women had total intervals longer than 200 days. Unfortunately, no survival data are available to determine the significance of these prolonged intervals in our study popu-

lation. An additional concern is the worry and anxiety women may experience before diagnosis.¹⁵

While our median diagnostic intervals are slightly longer than others have reported,^{6,9} this is mainly because of the way dates are defined. NBCCEDP uses date of definitive pathologic diagnosis as the end of the diagnostic interval, whereas others use date of first diagnostic procedure.⁹ Also, most studies include primarily symptomatic women, whose symptoms are usually analyzed sooner⁶; this is confirmed by our finding of symptomatic women experiencing shorter diagnostic intervals than asymptomatic women. Completeness of diagnostic follow-up for women followed up in our program is comparable to that of other programs.⁹

Since NBCCEDP serves women who are poor and uninsured, and pays for only

some diagnostic and no treatment services, financial barriers may contribute to the longer diagnostic intervals. During a qualitative case study of 7 state-based programs, state program administrators and providers were concerned that this was a barrier to follow-up for some women. Since program participants were not questioned, we were unable to validate this concern.¹⁶

As expected, women with the most serious mammogram results received their breast cancer diagnoses promptly. Women with less definitive initial mammograms, such as those coded AI (“assessment incomplete”), might have experienced longer diagnostic intervals because additional mammographic views or ultrasound was needed to define the initial mammographic finding; only then would more definitive procedures be used to establish the diagnosis, if necessary.

Diagnostic intervals for women with normal mammograms and abnormal CBEs were longer than those for women with abnormal mammograms. When a mammogram is read as normal, health care providers and women may have a false sense of security and delay biopsy, as shown in reports of normal mammograms of palpable breast masses.¹⁷⁻¹⁹ In one study where the median diagnostic interval was 17 days, symptomatic women with nonsuspicious mammograms had diagnostic intervals of 90 days or more.¹⁹ In another study, 22% of women with palpable lesions eventually diagnosed as breast cancer had false-negative mammograms.²⁰ Therefore, biopsy of a suspicious breast mass should be done promptly, regardless of mammographic finding.²¹

Diagnostic and treatment intervals were shorter for Whites than for other racial and ethnic groups. To our knowledge, our results are the first to be based on differences among several racial and ethnic groups: earlier studies were limited to Whites vs Blacks or Whites vs other races.²²⁻²⁴ The results seen here, however, may be confounded by programmatic differences in data collection, since the racial distributions are quite variable among programs.

Diagnostic and treatment intervals were shorter for rural women than urban women. Access to care or convenience of services may differ between the 2 groups. We had postulated that women living in rural areas who traveled great distances for breast screening and received abnormal results might well be referred for a surgical consult and a biopsy on that same day to minimize travel, while urban women with better geographic access to care might be brought back later for a surgical consult. Informants in the case study of 7 states corroborated this assumption.²⁵ However, our data suggested that rural women were no more likely than urban women to receive their entire diagnostic workup on the day of the screening.

Our results for treatment intervals, with a median of 10 days and approximately 80% of women initiating treatment within 30 days of diagnosis, are impressive, especially since treatment services are not reimbursed with federal funds. In a binational study of insured women, Katz and colleagues reported median intervals from diagnosis to initial surgical treatment of 6 days for women diagnosed in Canada and 10 days for women diagnosed in Washington State.¹⁹ Another study found that one third of the women had treatment intervals greater than 6 weeks, while almost one quarter had treatment intervals of at least 12 weeks,²⁶ much longer than those seen here.

NBCCEDP provides one of the largest mammography series to date in the United States. The program targets a population that is often medically underserved, and the data collected reflect services actually delivered in a variety of community settings, including university- and community-based facilities, community health centers, health department clinics, and mobile mammography vans. The data are not collected for scientific investigation, but rather for program evaluation and assessment of service delivery. A limitation is that data collection may vary by screening program, even though detailed instructions for uniform, standardized data collection are distributed to programs. In addition, minimal information is collected by NBCCEDP on each woman, making it impossible to identify many of the factors (such as missed appointments or scheduling difficulties) that may be associated with longer intervals. Finally, our results could have been biased if some women lost to follow-up received breast cancer diagnoses outside the program. However, a comparison of women with incomplete follow-up and those with complete follow-up showed no differences in age, race/ethnicity, urban vs rural location, symptom status, or mammography results; thus, it is unlikely we introduced a major systematic bias by excluding the women lacking a final diagnosis.

The information provided here, although not generalizable to other programs, can be used by the CDC to evaluate and improve NBCCEDP. The program itself is the only federally funded program providing breast and cervical cancer screening for medically underserved women. The CDC implements many checks to ensure that program women are served appropriately, and it requires programs to establish proactive surveillance systems for timely and appropriate referral and follow-up of women with abnormal test results. In addition, new policies now allow state and tribal programs to reimburse for breast biopsies.¹⁶ Furthermore, some states use multispecialty clinics, where women with abnormal screening results are seen by a radiologist and a surgeon on the same day, thereby reducing the need to return for follow-up.²⁵ Further investigation is warranted to evaluate these strategies and to better identify factors associated with long intervals, to shorten them, and thus to maximize the benefits of early detection. □

Contributors

L. S. Caplan planned the study, analyzed the data, and wrote the paper. D. S. May and L. C. Richards contributed significantly to both the analysis of the data and the writing of the paper.

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