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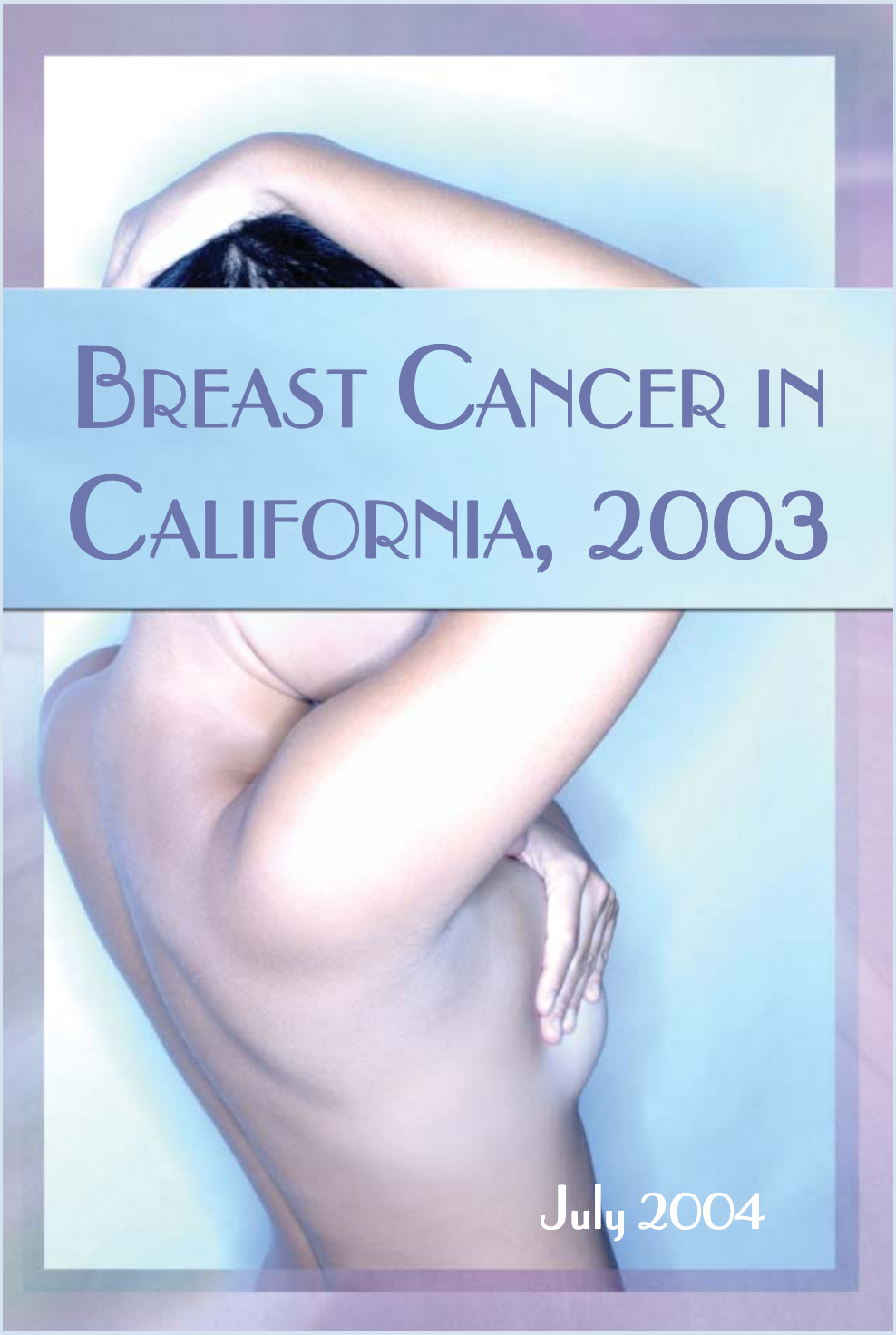
BREAST CANCER IN CALIFORNIA, 2003

State of California Department of Health Services



Breast Cancer in California, 2003

July 2004

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Suggested citation:

Morris CR, and Kwong SL (eds). Breast Cancer in California, 2003. Sacramento, CA; California Department of Health Services, Cancer Surveillance Section, July 2004.

Production and design by Maggie Burgos, California Cancer Registry

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Female Breast Cancer in California: An Overview

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Breast cancer is the most commonly diagnosed cancer and the second most common cause of cancer-related mortality (after lung cancer) among women in California and in the United States. During the period from 1988 through 1999, a total of 224,137 California women were diagnosed with new cases of invasive breast cancer, representing one of every three invasive cancers diagnosed among women in our state, and almost 35,000 were diagnosed with *in situ*, or noninvasive tumors. During this same 12 year period, 50,556 women died of breast cancer, representing nearly one-fifth of all cancer-related deaths occurring in California women.

Recognizing the importance of monitoring the occurrence of cancer, some hospitals in California began collecting cancer data as early as 1948. Over time, uniform cancer data collection was expanded to entire counties, such as Los Angeles and Alameda. In 1972, the five counties in the San Francisco Bay Area were included in the National Cancer Institute's Cancer Surveillance, Epidemiology, and End Results (SEER) program. As a response to public concerns over a perceived increase in the incidence of cancer, the California legislature approved a state law (Health and Safety Code Section 103885) in 1985 establishing the California Cancer Registry (CCR). Statewide, population-based data collection was implemented in 1988 and continues through the present time. The Ken Maddy California Cancer Registry is California's cancer surveillance system, built as a partnership between the California Department of Health Services, the Public Health Institute, and ten regional cancer registries. The regional registries are responsible for collecting cancer incidence reports from California health care providers. One of the main uses of CCR data is to monitor cancer trends and risk over time by geographic region and demographic characteristics such as age, sex, race/ethnicity, and socioeconomic status (SES). In addition to monitoring the incidence of cancer in California, data collected by CCR has served as a foundation for numerous scientific studies on causes, prevention, and treatment of cancer (1). CCR is recognized as one of the leading cancer registries in the world, and has consistently attained the North American Association of Central Cancer Registries' gold standard for data quality and completeness. Currently, the entire state of California participates in the SEER program.

Since 1991, CCR has published annual reports summarizing cancer incidence and mortality in California. Special reports have also been published providing detailed information on breast (2), prostate (3), colorectal (4), and childhood (5) cancers among Californians. The present monograph is devoted solely to female breast cancer. It updates and expands information presented in a previous report on breast cancer, which was published in 1996 by CCR (2). Breast cancer related topics discussed in this report include risk factors, demographic aspects and trends in incidence, and mortality, risk estimates, utilization of screening mammography, stage at diagnosis, detailed site, and histology, surgical treatment, and survival.

The biology of breast cancer remains elusive, although numerous studies have shed light on some of the risk factors for the disease. Chapter 2 presents a review of the genetic and environmental factors already established to play a role in the development of breast cancer. Ovarian hormones are known to play a crucial role in the development of the disease. Other factors that increase a woman's risk of breast cancer include age, race, reproductive antecedents, SES, genetics and family history, body size, alcohol consumption, previous breast cancer or benign breast disease, use of oral contraceptives or hormone replacement therapy, and exposure to radiation. The exact mechanism by which some of these factors increase the risk of breast cancer is unclear. However, it is likely that many of the known risk factors for breast cancer may be explained by their direct or indirect effect on a woman's hormones.

During the last five-year period for which complete data was available (1995-99), the annual age-adjusted incidence rate of invasive and *in situ* breast cancer was 130.5 and 25.5 new cases per 100,000 women, respectively. The overall mortality rate during the same period was 24.5 deaths per 100,000 women. Breast cancer incidence and mortality rates vary markedly by age and race/ethnicity (6, 7), and a detailed discussion of these patterns in California is presented in Chapter 3. Non-Hispanic white women had the highest incidence rate for both invasive and *in situ* cancers, followed by non-Hispanic black, Asian/Pacific Islander, and Hispanic women. Mortality rates, however, followed a very different pattern and continued to be highest among black women followed by whites, Hispanics, and Asian/Pacific Islanders. Although breast cancer does affect young women, incidence and mortality increase sharply with age; the majority of cases and deaths occur among older women.

The association between breast cancer and SES is well established, although certainly not causal. While women of high SES are at higher risk for breast cancer, the excess risk is most likely due to differences in diet, lifestyle, delayed or no childbearing, breastfeeding, and other factors not yet determined. Chapter 4 examines the relationship between breast cancer and SES in the four major ethnic groups in California. With SES defined as an index combining census-level information on occupation, education, income, and cost of living, the overall risk of breast cancer increased with SES in all four race/ethnic groups. The impact of SES on breast cancer risk was modest (and similar) among non-Hispanic white and black women, but was more marked among Asian and Hispanic women.

Monitoring cancer trends is one of the most important surveillance activities in CCR. Chapter 5 presents a detailed analysis of trends in breast cancer incidence and mortality in California from 1988 through 1999 and, for comparison, also in the San Francisco Bay Area and in SEER regions (from 1973 through 1999). Overall, the pattern of breast cancer incidence in these three populations was remarkably similar, albeit with minor changes in magnitude. Incidence trends were best described in three different time

periods. The first period, from 1973 to the early 1980s, was characterized by relatively stable rates. The second period, covering approximately five years, was characterized by a rapid increase in incidence rates of approximately 150 percent and 30 percent, respectively, for *in situ* and invasive tumors. The last time period, which started in the mid 1980s, has been marked by a continued increase in the incidence of *in situ* tumors and relatively stable incidence rates for invasive tumors. This incidence pattern has been generally accepted as resulting from the unprecedented and widespread use of screening mammography that began in the early 1980s. Also consistent with early detection and improvements in treatment, breast cancer mortality in California has significantly declined since 1988 in almost all age and race/ethnic groups. However, for reasons still unclear, Asian/Pacific Islander women in California have experienced an increase in breast cancer incidence and mortality in the last 11 years.

The risk of developing breast cancer increases sharply with age. Because breast cancer rates vary markedly by race/ethnicity (6, 7), it is important to take these two factors into account when estimating and informing women of their baseline risk of breast cancer. Chapter 6 provides two types of estimates, interval risk and cumulative risk, of being diagnosed with breast cancer for California women of four different race/ethnicities. Based on current CCR data, a newborn girl in California has a 13 percent (one in eight) probability of being diagnosed with breast cancer during her lifetime. The estimated lifetime risk was highest for white girls, followed by risks for black, Asian/Pacific Islander, and Hispanic girls. The lifetime risk of developing cancer is an appealing and frequently cited statistic that has, nonetheless, often been misinterpreted. One of the most common misconceptions is that lifetime risk applies to adult women, when in reality it represents the risk for a newborn girl. Risk projections based on current age, also presented in this report, may be more meaningful for most women. For example, current estimates of the risk for a 40-year-old woman are 1 in 189 within the next 5 years, 1 in 71 within 10 years, and 1 in 25 within 20 years.

Although a healthy lifestyle can reduce the risk of developing cancer, effective strategies for preventing breast cancer are still lacking. However, early detection of breast cancer can save lives, and regular screening mammography is an important tool to decrease a woman's risk of dying of breast cancer. Chapter 7 discusses the utilization of screening mammography in California, based on recent data from the California Behavioral Risk Factor Surveillance System (BRFSS). For the most part, California women have achieved the Healthy People 2010 (HP 2010) objective that calls for 70 percent of women aged 40 and over to have received a mammogram in the preceding two years (8). In 1987, less than one-half (46.9 percent) of California women aged 40 and older had ever had a mammogram. The percent of women who reported having had at least one mammogram increased to more than 90 percent in 2000. In addition, the period between 1994 and 2000 saw a promising reduction in the existing screening gap related to a woman's age, income, education, and race/ethnicity. Notwithstanding

these great achievements, much work remains if California women are to achieve the American Cancer Society goal that, by 2008, 90 percent of women aged 40 and over have a mammogram annually (9).

The stage at which breast cancer is diagnosed represents the strongest prognostic factor for the disease. Cancer-directed treatments are most effective when tumors are discovered early, and women diagnosed with early stage breast cancer experience much longer survival rate than those diagnosed with more advanced disease. Chapter 8 presents data on the stage at which breast cancers have been diagnosed in California. Such information is crucial for allocating screening resources to areas or subpopulations where the needs are greatest. During the period from 1995 through 1999 and regardless of age, white and Asian/Pacific Islander women were more likely than black or Hispanic women to be diagnosed at an early stage. Not surprisingly, SES was significantly related to stage at diagnosis. Women living in less affluent areas, particularly those of black or Hispanic race/ethnicity, were more likely to be diagnosed at a later stage. Rates of early disease were also highest in areas of the state characterized by urban centers and affluence, and lowest in rural and impoverished areas. Despite all these worrisome disparities, rates of *in situ* and local breast cancers have increased over time while rates of late stage disease have decreased. Such pattern is consistent with the broad use of screening mammography in our state. However, much work remains to be done to reduce the age, race/ethnic, and socioeconomic gaps in the opportunity for early detection of breast cancer.

Although stage at diagnosis remains one of the most significant prognostic factors for breast cancer, the location and histologic features of the tumor have also important treatment and prognostic implications. Chapter 9 presents detailed information on laterality, primary site, and histology of breast cancers diagnosed in California from 1988 through 1999. Consistent with information in a previous CCR report (2), breast cancer was somewhat more likely to occur in the left breast than in the right. Tumors were also more frequently diagnosed in the breast's upper-outer quadrant. The majority of breast cancers were histologically classified as infiltrating duct carcinoma (IDC), corresponding to about 70 percent of all invasive tumors, and ductal carcinoma *in situ* (DCIS), corresponding to 52 percent of *in situ* tumors. It is interesting to note that the proportion of DCIS among *in situ* breast cancers has increased over time, which may be due to the widespread use of screening mammography.

The last two decades have witnessed substantial changes in the paradigm of breast cancer treatment. No longer are women with breast cancer left with no choice but to undergo a radical mastectomy. Breast-conserving surgery (BCS) is now recommended for most women with early-stage breast cancer, and results in survival time comparable to those observed following a mastectomy. Chapter 10 examines patterns of breast cancer surgical treatment, with particular emphasis on factors associated with BCS

utilization in California. Substantial differences were detected in surgical treatment according to stage at diagnosis, race/ethnicity, age at diagnosis, and SES in the patient's neighborhood. Overall, women were more likely to be treated with BCS if they were of white or black race/ethnicity, were diagnosed with *in situ* or stage I disease, or lived in a more affluent area. Differences were also detected in the proportion of women receiving radiation following BCS. For example, while white and black women were just as likely to receive BCS, white women were more likely to receive radiation after BCS. Despite these disparities, a strong trend towards BCS was observed in all race/ethnicities, age groups, stages at diagnosis, and SES levels examined in that chapter. It should be emphasized that BCS may not be the patient's first choice, even when adequate information on the procedure is provided. However, it is important that women are offered the full range of treatment options, and the trends uncovered in the study show that BCS is steadily gaining acceptance in California.

In the U.S., the prognosis for breast cancer is usually favorable. Currently, 86.2 percent of women with breast cancer are still alive five years after the diagnosis, compared to 74.7 percent in 1976 (7). Evaluating cancer survival continues to be a high priority for CCR. Chapter 11 presents a detailed analysis of the survival experience of women diagnosed with breast cancer in the San Francisco Bay Area, the region with the longest and most complete cancer survival database in California. Survival following invasive breast cancer is largely determined by stage of disease at the time of diagnosis, although tumor characteristics such as grade, estrogen receptor status, and progesterone receptor status are all associated with survival. Breast cancer patients in the San Francisco Bay Area experienced excellent survival rates, mostly due to the high proportion of women who had their tumor diagnosed at an early stage. Disparities in survival were detected by SES in this population, but largely disappeared when stage at diagnosis was taken into account. Race/ethnic disparities were also detected, demonstrating a survival gradient where Asian/Pacific Islanders, Hispanics, and blacks had poorer survival than whites. As with SES, taking stage at diagnosis into account attenuated such survival gradient, but black women still experienced significantly shorter survival time. Research is even more crucial to uncover the reasons for survival disparities.

Data on breast cancer in California over the past decade provide reason for optimism. Mortality rates in California have significantly decreased during the last decade and survival has increased. Screening mammography has become widespread and the majority of breast cancers are now diagnosed at an early stage. Research continues to develop better treatments, and less disfiguring options are available to many women affected by the disease. Notwithstanding the progress achieved, much work remains to be done. Race/ethnic and socioeconomic disparities in breast cancer detection and mortality still exist. We must ensure that all women benefit from early detection and have equal access to standard treatment for breast cancer. Refined and more specific

drugs are needed to reduce morbidity and improve the patient's quality of life. Breast cancer remains an enormous challenge, but we are confident that research efforts will ultimately yield effective prevention strategies. CCR is strongly committed to the search for causes and cures for cancer, and will continue to serve both as a foundation for research and as an invaluable tool for monitoring the occurrence of cancer in California.

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Risk Factors for Female Breast Cancer

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Although the cause of breast cancer is unknown, several factors that increase a woman's chance of developing this disease are well established. Both genetic and environmental factors are believed to play a role in the development of breast cancer. There is overwhelming evidence that ovarian hormones play a crucial role at all stages of development of breast cancer (1, 2), and other risk factors are related in some way to this central fact. The following risk factors are well established.

Demographic Factors

Although men also develop breast cancer, women are at a much higher risk of this cancer. Risk of breast cancer for women increases with age, and the majority of cases occur in women over age 50. The risk is highest among black women under age 45, and highest among white women aged 45 and older (see Chapter 6). Women who never married, and Jewish women, have an elevated risk of breast cancer, probably attributable to lifestyle and reproductive patterns (3). Women of higher SES are at greater risk than those of lower SES, and this association also is likely a result of differences in reproductive and lifestyle factors (4, 5).

Reproductive Factors

The most consistent indicator of risk of breast cancer is a woman's age at first full-term pregnancy. Women who have no full-term pregnancy or a first full-time pregnancy after age 30 have a two- to three-times greater risk than women who have a full-term pregnancy before age 20 (6). Beginning menstruation before age 12 and entering menopause at age 55 or later also increase a woman's risk, while removal of both ovaries before age 40 reduces risk to about half (6). These reproductive factors are related to the length of time breast tissue is exposed to estrogen.

Estrogen Replacement Therapy and Oral Contraceptives

Some studies have shown a slight increase in risk of breast cancer with use of estrogen replacement therapy, especially the current formulation of combined estrogen and progestin, among those who use it for a long time and for high doses. However, the effect is reduced after women stop taking the drugs, and women who develop breast cancer subsequent to use of hormone replacement therapy are more likely to have tumors of favorable histology (7, 8). Similarly, a large collaborative study of over 50,000 women revealed a small increased risk in women currently taking oral contraceptives, with a small elevation in risk up to ten years after stopping. There was no evidence of increased risk ten or more years after ceasing oral contraceptives (9).

Diet, Body Size, and Physical Activity

Some studies have shown a positive association between height and breast cancer risk, with taller women at a slightly higher risk (10). For postmenopausal women, breast cancer risk increases with weight and body mass, and distribution of weight also may play a role. For premenopausal women, the association is reversed and breast cancer risk decreases with weight (10). Despite this association with weight, and the higher risk of breast cancer in countries with a high fat diet, numerous studies have shown no association between a "Western" diet (high in meat, fat, and sweets) and risk (11, 12). Studies have shown a small but consistent increased risk for women who consume two alcoholic drinks or more a day (12-14). Physical activity during adolescence has been shown to decrease risk of breast cancer among premenopausal women (15), and regular exercise later in life also has been shown to reduce breast cancer risk (16).

Radiation

Exposure to high doses of radiation before age 40 increases a woman's risk of breast cancer later in life. Teenage girls exposed to high doses of ionizing radiation during World War II had a doubling risk of breast cancer. The low doses of radiation used in mammography are considered to be of minimal risk that is outweighed by the benefits of early diagnosis (17).

Genetics and Family History

Although a gene for breast cancer has been identified, only about five percent to ten percent of breast cancer cases are attributable to an inherited gene. If a woman has a sister or mother with breast cancer, her risk increases by two or three times, and if both a mother and a sister had breast cancer, her risk increases up to six times. However, eight out of nine women who develop breast cancer do not have an affected mother, sister, or daughter (18). Rates of breast cancer increase among migrants who move from low-incidence areas of the world to high-incidence areas, indicating that lifestyle and environmental factors play a greater role than genetics.

Previous Breast Cancer or Benign Breast Disease

A prior history of breast, ovarian, or endometrial cancer increases a woman's risk of developing subsequent breast cancer. Women with a history of biopsy-confirmed benign breast disease, particularly atypical hyperplasia, also have an increased risk of breast cancer (19), as do women with very dense breast tissue on mammography (20).

In conclusion, factors that increase a woman's risk of breast cancer include age, race, reproductive factors, SES, genetics and family history, body size, alcohol consumption, previous breast cancer or benign breast disease, use of oral contraceptives or hormone replacement therapy, and exposure to radiation. All of these factors probably influence breast cancer risk by directly or indirectly affecting a woman's hormones. However, only about half of breast cancer incidence can be explained by known risk factors. It is likely that other factors exist, and that multiple factors play a role in a woman's probability of developing this disease.

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Demographic Aspects of Breast Cancer Incidence and Mortality in California, 1988–1999

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Introduction

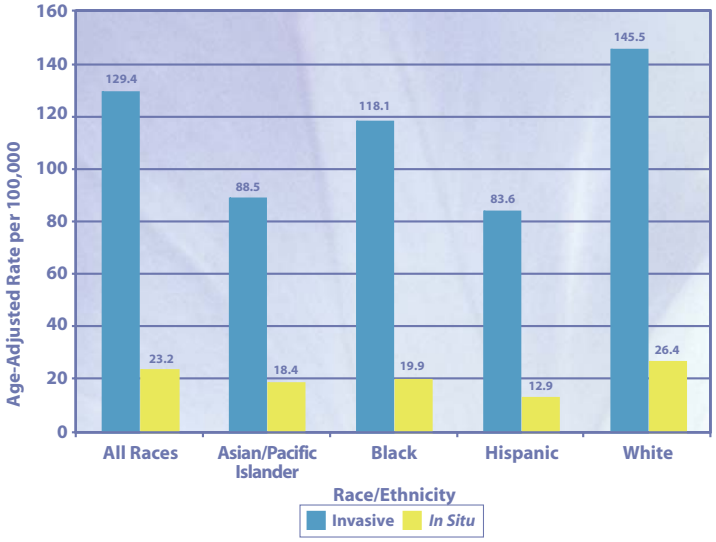
This chapter summarizes data on female breast cancer incidence and mortality in California from 1988 through 1999 by age and race/ethnicity including data on the incidence of *in situ* or noninvasive breast cancer. Later chapters will provide more detailed information on breast cancer and SES (Chapter 4), temporal trends (Chapter 5), and stage at diagnosis (Chapter 8).

From 1988 to 1999, breast cancer was the most common cancer diagnosed and the second most common cause of cancer-related mortality among California women regardless of race/ethnicity. Only malignancies of the lung and bronchus account for more cancer-related deaths. A total of 224,137 new cases of invasive and 34,712 cases of *in situ* breast cancer were diagnosed, representing one of every three (32.2 percent) invasive cancers diagnosed among women. During this same 12 year period, 50,556 women died of breast cancer, representing nearly one-fifth (17.2 percent) of all cancer-related deaths occurring in California women.

Invasive and *In Situ* Breast Cancer Incidence Patterns

Breast cancer remains the most commonly occurring invasive cancer diagnosed among all women in California regardless of race/ethnicity. In absolute terms, for the most recent five-year period (1995-1999) an average of 23,711 women were newly diagnosed with, and 4,152 died from, breast cancer annually in California. However, the risk of developing breast cancer, whether invasive or *in situ*, varied substantially by race/ethnicity. Figure 3.1 illustrates the average annual age-adjusted incidence of invasive and *in situ* breast cancer among women for this same five-year period by race/ethnicity (i.e., Asian/Pacific Islander, non-Hispanic black, Hispanic, and non-Hispanic white). Table 3.1 lists the corresponding number of cancer cases and age-adjusted incidence rates.

Figure 3.1
Average Annual Age-Adjusted (2000 U.S. Population) Invasive and *In Situ* Female Breast Cancer Incidence Rates by Race/Ethnicity,[1] California, 1995-1999



[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 3.1
Female Breast Cancer Incidence: Number of Cases and Age-Adjusted Rates (AAR) per 100,000 Population by Year and Race/Ethnicity,[1] California, 1988-1999

Invasive Tumors

Year of Diagnosis	All Races Combined		Asian/Pacific Islander		Black		Hispanic		White	
	New Cases	AAR	New Cases	AAR	New Cases	AAR	New Cases	AAR	New Cases	AAR
1988	17,063	134.2	712	76.9	964	128.1	1,529	89.5	13,701	147.3
1989	16,609	127.6	747	74.6	884	113.6	1,573	85.7	13,241	140.4
1990	17,417	129.3	896	81.4	961	119.9	1,606	82.7	13,791	142.8
1991	17,681	128.1	844	70.8	976	117.8	1,737	83.6	13,973	142.7
1992	18,386	129.8	1,015	82.8	1,022	120.3	1,847	84.5	14,316	144.2
1993	18,039	125.4	1,014	77.2	1,016	115.6	1,825	80.1	13,993	140.0
1994	18,247	124.8	1,064	76.6	1,058	119.2	1,921	80.3	14,000	139.8
1995	18,864	126.6	1,200	82.2	1,059	117.6	2,037	81.6	14,334	141.8
1996	19,611	129.4	1,335	87.1	1,116	120.3	2,149	82.4	14,738	145.3
1997	20,102	129.2	1,455	90.0	1,136	118.2	2,263	82.4	15,006	145.4
1998	20,864	130.9	1,541	89.7	1,112	113.0	2,470	86.1	15,461	147.9
1999	21,254	130.5	1,645	92.3	1,212	121.3	2,556	84.9	15,582	147.3
1995-1999	100,695	129.4	7,176	88.5	5,635	118.1	11,475	83.6	75,121	145.5

***In Situ* Tumors**

Year of Diagnosis	All Races Combined		Asian/Pacific Islander		Black		Hispanic		White	
	New Cases	AAR	New Cases	AAR	New Cases	AAR	New Cases	AAR	New Cases	AAR
1988	2,020	16.3	77	7.9	91	12.4	127	6.9	1,691	19.3
1989	1,962	15.4	92	9.4	92	12.0	136	7.2	1,617	18.1
1990	2,291	17.4	120	11.1	106	13.2	197	10.1	1,827	20.0
1991	2,562	19.0	144	12.0	129	15.9	199	9.6	2,039	21.8
1992	2,683	19.4	132	10.3	126	14.9	225	10.3	2,132	22.5
1993	2,556	18.1	152	11.6	130	15.3	222	9.9	1,979	20.5
1994	2,780	19.3	204	14.4	161	18.8	254	10.7	2,091	21.5
1995	3,020	20.6	222	15.4	168	18.9	238	9.6	2,308	23.6
1996	3,269	21.9	271	17.6	168	18.1	284	10.9	2,448	25.0
1997	3,561	23.2	294	17.9	203	21.1	330	12.4	2,644	26.4
1998	3,884	24.6	323	18.7	191	19.2	450	16.0	2,829	27.7
1999	4,124	25.5	390	21.7	216	22.1	438	14.7	2,993	29.0
1995-1999	17,858	23.2	1,500	18.4	946	19.9	1,740	12.9	13,222	26.4

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

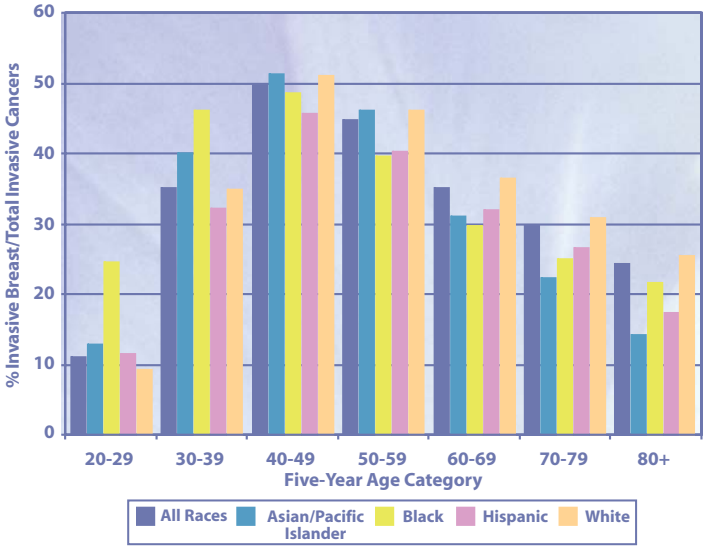
Between 1995 and 1999, Hispanics and Asian/Pacific Islanders had a substantially lower age-adjusted incidence (83.6 and 88.5 cases per 100,000) as compared to blacks and non-Hispanic whites (118.1 and 145.5 cases per 100,000, respectively). A similar pattern was observed for the age-adjusted incidence of *in situ* breast cancer, with non-Hispanic whites having the highest incidence (26.4 cases per 100,000) followed by rates among black (19.9 cases per 100,000), Asian/Pacific Islander (18.4 cases per 100,000), and Hispanic women (12.9 cases per 100,000).

Figure 3.2 presents the relative proportion of all invasive cancers occurring at the breast by race/ethnicity and age for the period 1995 to 1999 among women in California. The relative burden of invasive breast cancer by age varies with race/ethnicity. Breast cancer accounts for less than one-tenth (9.1 percent) of all new invasive cancers diagnosed in non-Hispanic whites, but nearly one-quarter (24.4 percent) in black women ages 20 to 29. In black women, the relative proportion increases to nearly

one-half of all malignancies by ages 30 to 39 (46.2 percent). Among all women prior to age 50, breast cancer accounts for the largest proportion of invasive tumors at over one-third (39.9 percent). Nonetheless, breast cancer continues to severely afflict older women, accounting for over one-fifth (24.2 percent) of all invasive cancers diagnosed in women after age 80 years.

Although breast cancer is the most common invasive cancer occurring in women ages 30 to 50, the vast majority of absolute cases continue to be diagnosed among older women. Average annual age-adjusted incidence rates (1995 to 1999) by race/ethnicity for California women under age 50 years and older than 50 are listed in Table 3.2. Breast cancer incidence, for both invasive and *in situ* tumors, varied markedly among women less than 50 years of age by race/ethnicity. In the case of invasive breast cancer incidence, non-Hispanic whites (43.5 cases per 100,000) and blacks (41.8 cases per 100,000) had higher rates compared to Asian/Pacific Islanders (38.1 cases per 100,000) and Hispanics (30.8 cases per 100,000). After age 50, non-Hispanic whites had the highest rate at 412.7 new cases per 100,000 women, followed by rates in blacks (317.9 cases per 100,000), Hispanics (221.9 cases per 100,000), and Asian/Pacific Islanders (220.3 cases per 100,000). A similar pattern was observed for *in situ* incidence rates again with non-Hispanic whites and blacks having higher rates, particularly among the oldest women. In women over age 50, average annual *in situ* rates were highest among non-Hispanic whites (9.2 cases

Figure 3.2
Proportion of Invasive Breast Cancers Relative to All Invasive Cancers Diagnosed Among Females by Age and Race/Ethnicity,[1] California, 1995-1999



[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 3.2
Female Breast Cancer Age-Adjusted Incidence Rates per 100,000 Population by Race/Ethnicity,[1] California, 1995-1999

	Age-Adjusted Rate Women <50 Years		Age-Adjusted Rate Women Age 50 Years and Older	
Race/Ethnicity	*In Situ*	Invasive	*In Situ*	Invasive
All Races Combined	7.9	40.1	63.2	363.0
White	9.2	43.5	71.4	412.7
Black	6.6	41.8	54.9	317.9
Hispanic	4.4	30.8	35.0	221.9
Asian/Pacific Islander	8.2	38.1	45.1	220.3

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

per 100,000), over twice the rate observed among Hispanic women (4.4 cases per 100,000). Regardless of race/ethnicity, breast cancer incidence was nearly ten times higher in women over 50.

Tables 3.3 and 3.4 present detailed annual age-specific incidence rates by five-year age category. Age-specific incidence rates are extremely low until age 20, at which point rates rise sharply. In the most recent five-year period (1995 to 1999) incidence of invasive breast cancer was highest in blacks until age 39. However, starting at ages 40 to 44, non-Hispanic whites had the highest average annual age-specific cancer incidence. Asian/Pacific Islanders and Hispanics had relatively lower age-specific incidence, but Asian/Pacific Islander rates were higher than comparable Hispanic rates through age 64. Overall, age-specific incidence for invasive cancer in California peaked in women ages 75 to 79 (495.6 cases per 100,000) and *in situ* incidence at ages 70 to 74 (76.2 cases per 100,000) (Figures 3.3 and 3.4).

Table 3.3
Invasive Female Breast Cancer Incidence: Number of Cases and Age-Specific Rates (ASR) per 100,000 Population by Race/Ethnicity,[1] California, 1995-1999

	All Races Combined		Asian/Pacific Islander		Black		Hispanic		White	
Age	New Cases	ASR	New Cases	ASR	New Cases	ASR	New Cases	ASR	New Cases	ASR
00-04	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
05-09	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
10-14	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0
15-19	5	0.1	0	0.0	0	0.0	4	0.2	1	0.0
20-24	75	1.5	8	1.3	11	2.7	29	1.7	26	1.1
25-29	451	7.8	48	6.9	60	13.6	141	7.2	196	7.3
30-34	1,575	23.7	170	22.6	169	34.3	404	19.8	810	24.4
35-39	3,777	53.6	440	53.7	317	61.5	800	42.9	2,177	57.2
40-44	7,181	110.6	875	112.2	515	111.8	1,341	87.6	4,337	118.0
45-49	10,337	185.5	1,119	165.3	678	175.2	1,540	133.6	6,871	207.1
50-54	11,012	249.1	999	207.3	663	231.5	1,332	160.6	7,879	282.3
55-59	10,417	302.8	867	236.8	643	279.6	1,248	199.4	7,542	343.9
60-64	10,190	354.0	730	236.2	605	321.0	1,188	235.0	7,563	407.2
65-69	11,219	413.2	658	233.3	553	354.3	1,111	252.6	8,766	481.0
70-74	11,899	453.3	557	228.8	477	344.0	978	277.7	9,758	519.7
75-79	10,439	495.6	389	227.9	448	424.4	727	303.7	8,733	552.1
80-84	6,783	461.2	197	193.8	286	408.2	352	224.5	5,842	514.3
85+	5,334	394.0	119	153.0	210	355.2	280	179.8	4,619	438.0

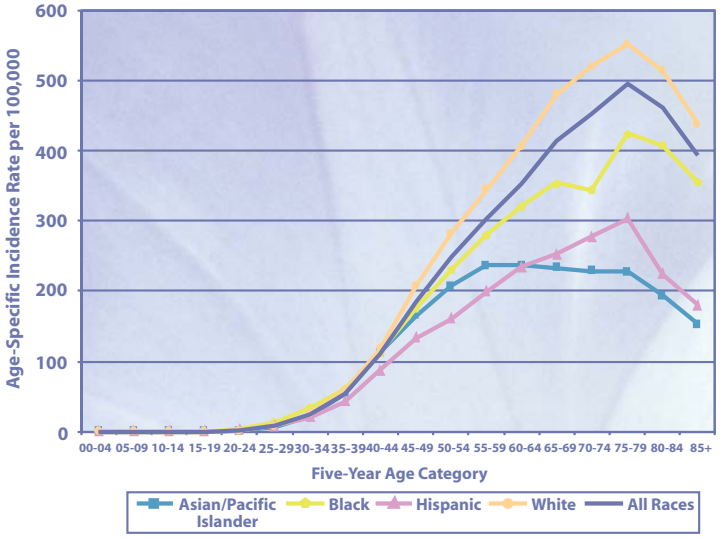
[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 3.4
***In Situ* Female Breast Cancer Incidence: Number of Cases and Age-Specific Rates (ASR) per 100,000 Population by Race/Ethnicity,[1] California, 1995-1999**

	All Races Combined		Asian/Pacific Islander		Black		Hispanic		White	
Age	New Cases	ASR	New Cases	ASR	New Cases	ASR	New Cases	ASR	New Cases	ASR
00-04	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
05-09	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
10-14	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
15-19	1	0.0	0	0.0	0	0.0	1	0.1	0	0.0
20-24	4	0.1	1	0.2	1	0.2	1	0.1	1	0.0
25-29	32	0.6	7	1.0	1	0.2	9	0.5	15	0.6
30-34	146	2.2	20	2.7	11	2.2	22	1.1	86	2.6
35-39	572	8.1	67	8.2	45	8.7	78	4.2	366	9.6
40-44	1,532	23.6	197	25.3	83	18.0	205	13.4	1,011	27.5
45-49	2,288	41.0	276	40.8	129	33.3	267	23.2	1,565	47.2
50-54	2,474	56.0	235	48.8	117	40.8	270	32.6	1,797	64.4
55-59	2,064	60.0	183	50.0	114	49.6	191	30.5	1,524	69.5
60-64	1,901	66.0	153	49.5	106	56.2	179	35.4	1,418	76.4
65-69	2,056	75.7	130	46.1	122	78.2	200	45.5	1,548	84.9
70-74	2,001	76.2	99	40.7	79	57.0	150	42.6	1,613	85.9
75-79	1,582	75.1	84	49.2	73	69.2	103	43.0	1,289	81.5
80-84	799	54.3	38	37.4	43	61.4	45	28.7	647	57.0
85+	406	30.0	10	12.9	22	37.2	19	12.2	342	32.4

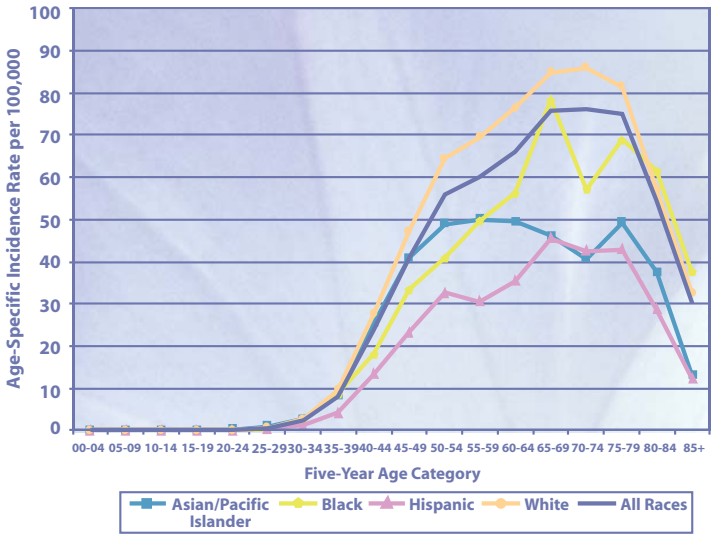
[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 3.3
Age-Specific Incidence Rates Invasive Female Breast Cancer by Race/Ethnicity,[1] California, 1995-1999



[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 3.4
Age-Specific Incidence Rates Female *In Situ* Breast Cancer by Race/Ethnicity,[1] California, 1995-1999

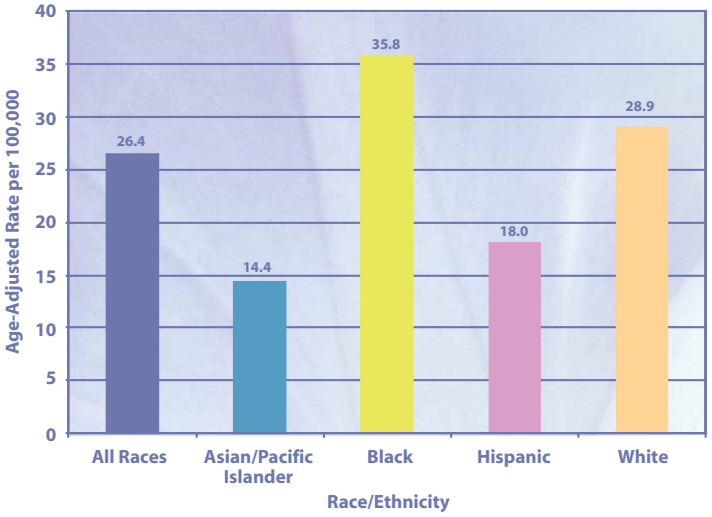


[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Breast Cancer Mortality Patterns

Breast cancer remains the second leading cause of cancer-related death among California women. For the most recent five-year period (1995 to 1999), although black women had a lower incidence of breast cancer as compared to non-Hispanic whites, their average annual age-adjusted mortality rate continued to be higher (35.8 versus 28.9 deaths per 100,000, respectively) (Figure 3.5). Mortality due to breast cancer was substantially lower for Asian/Pacific Islander (14.4 deaths per 100,000) and Hispanic women (18.0 deaths per 100,000). Table 3.5 lists the corresponding number

Figure 3.5
Average Annual Age-Adjusted Female Breast Cancer Mortality Rates by Race/Ethnicity,[1] California, 1995-1999



[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 3.5
Female Breast Cancer Mortality: Number of Deaths and Age-Adjusted Rates (AAR) per 100,000 Population by Year and Race/Ethnicity,[1] California, 1988-1999

	All Races Combined		Asian/Pacific Islander		Black		Hispanic		White	
Year of Death	Deaths	AAR	Deaths	AAR	Deaths	AAR	Deaths	AAR	Deaths	AAR
1988	4,121	32.4	125	14.0	304	39.9	318	18.8	3,364	35.5
1989	4,258	32.8	162	16.7	307	40.7	379	22.4	3,400	35.4
1990	4,292	31.8	162	15.7	328	42.4	393	21.0	3,405	34.4
1991	4,295	31.1	193	17.5	306	38.2	368	18.4	3,420	34.0
1992	4,116	29.1	144	12.1	318	38.9	408	19.9	3,234	31.7
1993	4,310	29.8	177	14.1	308	36.5	424	19.4	3,396	33.0
1994	4,404	29.9	209	16.6	335	38.9	446	19.7	3,403	32.7
1995	4,241	28.3	222	15.5	348	39.3	421	18.1	3,237	30.9
1996	4,295	28.1	199	13.8	351	37.5	488	19.6	3,248	30.8
1997	4,090	26.1	221	14.0	347	36.5	480	18.0	3,030	28.3
1998	4,095	25.5	255	15.2	336	34.4	496	17.8	3,000	27.6
1999	4,039	24.5	236	13.7	308	31.8	488	17.0	2,994	26.8
1995-1999	20,760	26.4	1,133	14.4	1,690	35.8	2,373	18.0	15,509	28.9

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

of breast cancer deaths and age-adjusted mortality rates.

Table 3.6
Female Breast Cancer Mortality Rates per 100,000 Population by Race/Ethnicity,[1] and Age, California, 1995-1999

	Age-Adjusted Rate	Age-Adjusted Rate
Race/Ethnicity	Women <50 Years	Women Age 50 Years and Older
All Races Combined	6.2	79.5
White	6.0	88.7
Black	11.9	98.5
Hispanic	5.3	51.3
Asian/Pacific Islander	5.0	39.1

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Average annual age-adjusted mortality rates by race/ethnicity for California women less than 50 years of age and older than 50 are listed in Table 3.6. Breast cancer mortality was similar among women less than 50 years of age by race/ethnicity, with the glaring exception of mortality among black women, at 11.9 deaths per 100,000 or nearly twice the comparable rate in non-Hispanic whites (6.0 deaths per 100,000), Hispanics (5.3 deaths per 100,000), and Asian/Pacific Islanders (5.0 deaths per 100,000). After age 50, black women continued to have the highest mortality rate at 98.5 deaths per 100,000 women, followed by rates in non-Hispanic whites (88.7 deaths per 100,000). Mortality rates were substantially lower among Hispanics (51.3 deaths per 100,000), and Asian/Pacific Islanders (39.1 deaths per 100,000). Regardless of race/ethnicity, breast cancer mortality in women over 50 was 16 times higher than rates in women under 50, reflecting the much higher incidence of breast cancer among older women.

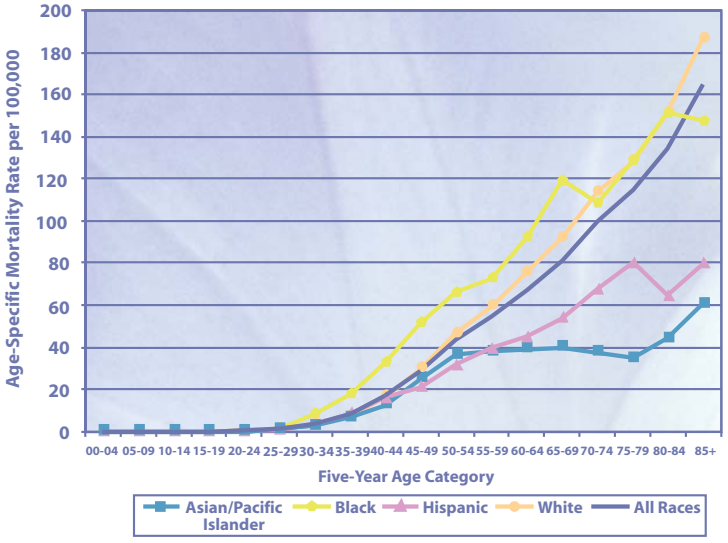
Table 3.7
Female Breast Cancer Mortality: Number of Deaths and Age-Specific Rates (ASR) per 100,000 Population, by Race/Ethnicity,[1] California, 1995-1999

	All Races Combined		Asian/Pacific Islander		Black		Hispanic		White	
Age	New Cases	ASR	New Cases	ASR	New Cases	ASR	New Cases	ASR	New Cases	ASR
00-04	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
05-09	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
10-14	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
15-19	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
20-24	8	0.2	0	0.0	3	0.7	5	0.3	0	0.0
25-29	59	1.0	8	1.2	7	1.6	18	0.9	26	1.0
30-34	244	3.7	21	2.8	42	8.5	73	3.6	107	3.2
35-39	582	8.3	53	6.5	93	18.0	159	8.5	276	7.2
40-44	1,097	16.9	96	12.3	150	32.6	247	16.1	602	16.4
45-49	1,601	28.7	168	24.8	200	51.7	243	21.1	987	29.7
50-54	1,923	43.5	174	36.1	189	66.0	260	31.4	1294	46.4
55-59	1,862	54.1	138	37.7	167	72.6	248	39.6	1299	59.2
60-64	1,930	67.0	121	39.2	174	92.3	228	45.1	1404	75.6
65-69	2,214	81.5	112	39.7	186	119.2	237	53.9	1671	91.7
70-74	2,618	99.7	91	37.4	150	108.2	238	67.6	2135	113.7
75-79	2,419	114.8	59	34.6	136	128.8	192	80.2	2027	128.2
80-84	1,974	134.2	45	44.3	106	151.3	101	64.4	1717	151.1
85+	2,229	164.6	47	60.4	87	147.2	124	79.6	1964	186.3

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 3.7 and Figure 3.6 present detailed annual age-specific mortality rates by five-year age category. In the most recent five-year period (1995 to 1999), age-specific mortality was highest among black and non-Hispanic white women after age 39. Asian/Pacific Islanders and Hispanics had similar, and relatively lower, age-specific mortality, but with Hispanic mortality rates increasing after age 64. Overall, five-year age-specific mortality rates increase sharply with age, quadrupling for women between ages 40 to 44 (16.9 deaths per 100,000) and 60 to 64 (67.0 deaths per 100,000), and continuing to climb with age (164.6 deaths per 100,000 women ages 85 years or older).

Figure 3.6
Age-Specific Female Breast Cancer Mortality Rate by Race/Ethnicity,[1] California, 1995-1999



[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Summary

Breast cancer remains the most commonly diagnosed cancer and the second most common cause of cancer-related mortality among California women regardless of race/ethnicity. From 1988 to 1999, a total of 224,137 new cases of invasive and 34,712 cases of *in situ* breast cancer were diagnosed. During this same 12 year period, 50,556 women died of breast cancer, representing more than one-sixth of all cancer-related deaths occurring in California women.

In 1999, 21,254 invasive and 4,124 *in situ* breast cancers were diagnosed among California women, representing an annual age-adjusted incidence of 130.5 and 25.5 new cases per 100,000 women, respectively. Non-Hispanic whites had the highest incidence rate for both invasive and *in situ* cancers, followed by rates among non-Hispanic black, Asian/Pacific Islander, and Hispanic women. Although breast cancer is the most commonly occurring cancer among young women, the majority of cases and highest age-specific incidence rates occur in older women. Additionally, over 4,000 women die of breast cancer each year in California. In 1999, 4,039 breast cancer-related deaths occurred, resulting in an annual mortality rate of 24.5 deaths per 100,000 women. Mortality rates continued to be highest among non-Hispanic black women, followed by mortality among non-Hispanic whites, Hispanics, and Asian/Pacific Islanders. As with incidence, breast cancer-related mortality increases sharply with age, with older women having substantially higher age-specific mortality rates.

Socioeconomic Status and Breast Cancer Incidence in California

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Introduction

Certain characteristics increase a woman's risk of developing breast cancer. These characteristics include a woman's age, race/ethnicity, reproductive history, and SES (1). Breast cancer incidence rates in California increase with age, and they differ by race/ethnicity with non-Hispanic white women having higher rates than non-Hispanic black, Asian/other, and Hispanic women (2, 3). Reproductive risk factors include age at first birth and total number of children. SES is generally considered to be a combination of occupation, education, and income (4) and is related to several health outcomes including cardiovascular disease, mortality from all causes, infant mortality, mental disorders, and some types of cancer (4, 5). This chapter focuses on the relationship between SES and breast cancer incidence in California for different race/ethnic groups.

Methods

CCR does not currently collect information on SES for individual cancer patients; therefore, aggregate-level SES data from the 1990 U.S. Census was used as a surrogate to approximate individual-level SES. SES information was aggregated at the census block group level. Each census block group represents approximately 1,000 individuals. Seven SES measures from the 1990 U.S. Census were combined into a single SES index using principal component analysis (SAS PRINCOMP procedure). The seven measures that comprised the SES index were:

- Two measures of occupation: "proportion with a blue-collar job" and "proportion older than 16 in the work force without a job."
- Two measures of income: "proportion below 200 percent of the federal poverty level" and "median household income."
- An education index developed by Liu et al. (6) that weights the proportion of people in a census block group with a given level of education by the number of years needed to attain that level of education.
- Two measures of cost of living: "median rent" and "median house value."

Therefore, SES was defined as an index combining three generally accepted domains (education, income, and occupation) plus measures of cost of living (i.e., median rent and median house value) to account for the diversity of living costs across California. Scores for the SES index for all census block groups in California were sorted in descending order and categorized into quintiles. For more information on this method for creating an SES index, see Yost et al., 2001 (7).

A total of 97,227 *in situ* and invasive incident breast cancer cases over 15 years of age who were diagnosed between 1988 and 1992 were evaluated in this chapter. Breast cancer cases were limited to diagnosis between 1988 and 1992 because the SES index and corresponding population estimates were based on information from the 1990

U.S. Census. It is reasonable to assume that SES and population size of a given census block group would not change markedly two years before or two years after the census year. Cases were separated into four mutually exclusive race/ethnicity categories: non-Hispanic white, non-Hispanic black, Hispanic, and Asian/other. The Asian/other race category includes Asian, Pacific Islander, American Indian, and women of unspecified race/ethnicity. Hispanic ethnicity was based on information in the medical record and on surname. Women with race coded as white, black, or unknown with a last name (or maiden name, when present) on the 1980 U.S. Census list of 12,497 Hispanic surnames were categorized as Hispanic. The use of surname was adopted to more accurately classify Hispanic ethnicity, which is usually underreported in medical records (8).

Cases and population estimates in a given census block group were assigned SES level of that census block group. That is, each census block group had a specific SES level. A case was assigned SES level of the census block where she resided at the time she was diagnosed with breast cancer. Of the 97,227 breast cancer cases included in the study, 80.2 percent were white, 5.5 percent were black, 9.3 percent were Hispanic, and 5 percent were Asian/other. Age was categorized into three groups (15-49, 50-64 and 65 or older). Population estimates and breast cancer cases were stratified by age, race/ethnicity, and SES index. Age-specific and age-adjusted incidence rates using five-year age categories were calculated by directly standardizing to the 1970 U.S. population. Rate ratios (RR) were calculated to measure the effect of SES on breast cancer incidence rates. A RR is estimated by dividing the incidence rate for one group by the incidence rate for a reference group. For example, if the incidence rate for white women in the highest SES category is 218 per 100,000 women, and the incidence rate for white women in the lowest SES category (e.g., the reference level) is 171 per 100,000, then the RR would be estimated as:

$$\frac{218/100{,}000}{171/100{,}000} = 1.27$$

The interpretation of this RR is that white women in the highest SES category are 27 percent more likely to be diagnosed with breast cancer than white women in the lowest SES category. A RR of 1.0 indicates that the two groups do not differ in their risk of developing breast cancer. A test for trend in incidence rates[1] across levels of SES was conducted to determine whether the increase in incidence rates over SES was statistically significant and whether the slopes of the trends differed by race/ethnicity. The slope measures how steep the trend is. The significance level for these tests was set at 0.05.

[1.] A chi-squared test for trend was conducted on the log incidence rates using PROC GENMOD (SAS System).

Results

The distribution of incident breast cancer cases among females 15 years or older are presented in Table 4.1. There were more breast cancer cases in higher SES categories for non-Hispanic whites and Asian/others, whereas for blacks and Hispanics there were more cases in the lower SES categories. This distribution of cases across SES for each race/ethnic group is consistent with the underlying population distribution as shown in Table 4.1. Age-adjusted incidence rates by SES and race/ethnicity are presented in Table 4.2. Breast cancer incidence rates increased as SES increased, which is a finding

Table 4.1
Number of Incident Breast Cancer Cases and Population Estimates for Women Aged 15 Years or Older by SES and Race/Ethnicity, California, 1988-1992

Socioeconomic Status*	All Races Combined		Asian/Other		Black		Hispanic		White	
	Cases	Population	Cases	Population	Cases	Population	Cases	Population	Cases	Population
SES Low	11,580	10,266,545	562	857,455	2,123	1,513,770	2,587	5,016,740	6,308	2,878,580
SES2	17,267	11,399,720	748	1,014,815	1,172	978,175	2,110	3,111,955	13,237	6,294,775
SES3	19,992	11,996,540	969	1,229,960	970	733,130	1,791	2,136,120	16,262	7,897,330
SES4	22,212	12,312,745	1,214	1,322,255	679	512,945	1,483	1,493,590	18,836	8,983,955
SES High	26,176	12,053,350	1,348	1,302,655	384	248,540	1,092	894,210	23,352	9,607,945
Total	97,227	58,028,900	4,841	5,727,140	5,328	3,986,560	9,063	12,652,615	77,995	35,662,585

*Socioeconomic status (SES) is measured as a composite index combining seven indicator variables.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

that has been reported elsewhere (6, 9). Failing to adjust by SES led to an overestimation of incidence rates for women in the lower SES quintiles and an underestimation of incidence rates for women in the higher SES quintiles. However, adjusting rates by SES did not eliminate the differences in rates between race/ethnic groups. Figure 4.1 shows race/ethnicity-specific RR based on age-adjusted rates, where the lowest SES quintile is the reference group. The overall risk of developing breast cancer increased with SES in all four race/ethnic groups. The effect of increasing SES level on the RR was modest and similar for blacks and whites, but it was more striking for Asian/others and Hispanics. Figure 4.2 presents SES-specific RRs based on age-adjusted rates for each race/ethnic group, with

Table 4.2
Age-Adjusted (1970 U.S. Population) Breast Cancer Incidence Rates for Women Aged 15 Years or Older by SES and Race/Ethnicity, California, 1988-1992

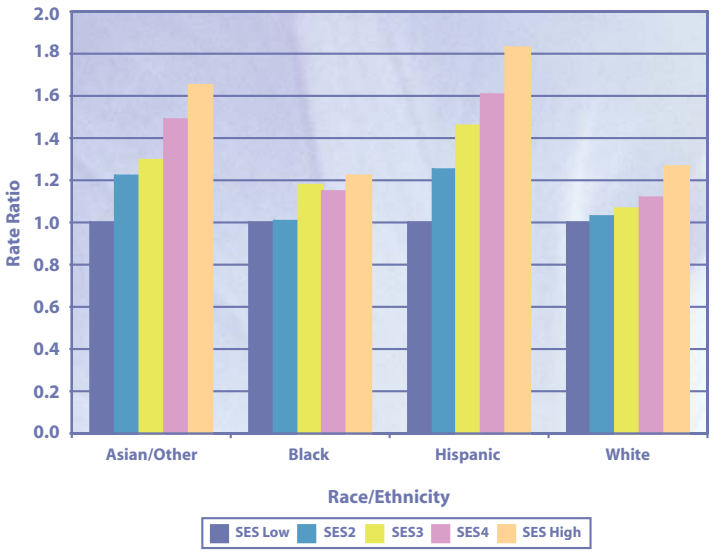
	Age-Adjusted Incidence Rates (per 100,000)			
Socioeconomic Status*	Asian/Other	Black	Hispanic	White
SES Low	70.9	145.7	84	171.3
SES2	86.4	146.4	104.9	175.6
SES3	92.2	171.6	122.5	182.5
SES4	105.8	167.7	135.8	191.7
SES High	117.2	177.8	153.9	218.3
Unadjusted by SES	96.4	155.4	108.5	192.7
Relative percent change from SES Low to SES High	-39.5%	-18.1%	-45.4%	-21.5%

*Socioeconomic status (SES) is measured as a composite index combining seven indicator variables.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Asian/other women serving as the reference category. At each level of SES, Asian/other women had the lowest rates, followed by Hispanic, black, and then white women. The disparity in RRs between race/ethnic groups was most pronounced in the lowest SES category.

A test for trend in incidence rates across levels of SES showed that the slopes were greatest (i.e., steepest) for Hispanics, followed by Asian/others, whites, and then blacks except for the 50 to 64 age group where the slope for blacks was greater than that for whites (data not shown). The slopes among the race/ethnic groups were not significantly different from one another in the 15 to 49 year age group (p=0.195), but they were significantly different in the 50 to 64 year age group (p=0.017) and the 65+ age group (p<0.0001) indicating that differences by race/ethnicity remained following adjustment for SES.

Figure 4.1
Race-Specific Breast Cancer Rate Ratio,[1] Women 15 Years of Age or Older, California, 1988-1992



[1] Reference category is the lowest socioeconomic quintile (SES low). Based on age-adjusted incidence rates.
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Figure 4.2
Socioeconomic Status Specific Breast Cancer Rate Ratios,[1] Women 15 Years of Age or Older, California, 1988-1992

[1] Reference category is Asian/Other women. Based on age-adjusted incidence rates.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Discussion

Breast cancer risk was different for each race/ethnic group and SES explained only some of these race/ethnic differences. While SES was positively related to breast cancer incidence in all race/ethnic groups, the magnitude of the relationship was not

the same for each group and race/ethnicity-specific incidence rates became more similar as SES increased. Furthermore, the relationship between SES and risk factors or screening behavior may be different for each race/ethnic group. These findings should be interpreted with caution. Aggregate-level SES is used to approximate individual-level SES, and previous research has suggested that aggregate-level SES can either overestimate (11) or underestimate (12) the impact of individual-level SES. However, aggregating SES over a small geographic area, such as the census block group, has been shown to approximate individual-level SES (13). SES itself, whether measured at the individual- or aggregate-level, is not a causal factor for breast cancer. Rather, it may be a surrogate for individual-level breast cancer risk factors such as diet, lifestyle, age at first birth, parity, and duration of lactation (1, 10). It may also be a surrogate for access to screening, which may account for some, but not all of the SES effects observed in this study. Additional research is needed to understand what risk factors for breast cancer are associated with SES and how exposure to those factors changes in different race/ethnic groups as SES changes.

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Trends in Female Breast Cancer Incidence and Mortality in California

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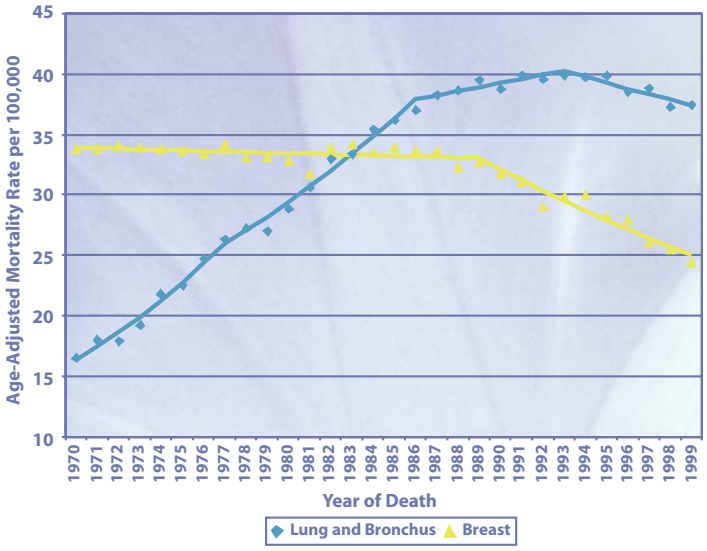
Introduction

Figure 5.1
Trends in Female Breast and Lung Cancer Age-Adjusted (2000 U.S. Population) Mortality Rates, All Races Combined, California, 1970-1999



Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Breast cancer is the most frequently diagnosed malignancy in women, although it is also diagnosed in men. Between 1988 and 1999, a total of 258,849 California women were diagnosed with breast cancer and 50,556 have died from this disease (1). It is estimated that 206,900 women survivors of breast cancer were living in California in 2002 (1). Breast cancer was the most frequently diagnosed cause of cancer death in California women until 1983, when it was surpassed by lung cancer (Figure 5.1). Presently, breast cancer accounts for 33 percent of all newly diagnosed cancers and 16 percent of all cancer deaths in California women. The five-year relative survival for women diagnosed with invasive breast cancer in the U.S. has consistently improved, from 75.4 percent for cases diagnosed in 1975 to 86.5 percent for cases diagnosed in 1994 (2).

The objective of this chapter is to examine secular trends in breast cancer incidence and mortality in California women. Monitoring long-term trends is a major component of cancer surveillance activities – it can be used to evaluate the effectiveness of cancer control measures and as an indicator of potential changes in risk factors. This is particularly true for female breast cancer, which in recent years has experienced significant progress in active screening and early detection, as well as improved treatments and case management.

The analysis of incidence trends presented in this chapter was based on data from two main sources: SEER program of the National Cancer Institute (2) and CCR. SEER data covered the time period between 1973 and 1999 and included information from nine population-based cancer registries. SEER database represents about 14 percent of the population in the U.S., and is generally accepted as a proxy for cancer trends in the U.S. data used for this analysis contained information on 406,885 cases of newly diagnosed female breast cancer, of which 11 percent were *in situ* cases. The San Francisco-Oakland Standard Metropolitan Statistical Area, also known as San Francisco Bay Area (SFBA),

is one of the nine original registries in the SEER program. SFBA data included 70,732 cases (of which 11.8 percent were *in situ*), and may be considered as a proxy of long-term trends of breast cancer in California. CCR has collected statewide data since 1988. Its database included 258,849 cases of newly diagnosed female breast cancer in California between 1988 and 1999, with detailed information on race/ethnicity. Race/ethnicity was grouped into four mutually exclusive groups: non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic Asian/Pacific Islander. Identification of women with Hispanic heritage was further enhanced through matching their last name (or maiden name, when present) with the 1980 U.S. Census list of 12,497 Hispanic surnames (3).

Incidence analyses are presented separately for *in situ* and invasive cases. By definition, *in situ* cases are small lesions that have not spread outside the point of origin and have favorable prognosis. *In situ* tumors are mostly diagnosed through screening mammography, and their incidence has dramatically increased pursuant to the widespread use of screening mammography since early 1980s. Epidemiological research, however, suggests that a portion of screening detected *in situ* tumors may be of low clinical importance (4).

Mortality data were extracted from the California Deaths Certificate Master files (California Department of Health Services, Office of Vital Records and Statistics). This file included 114,593 records of deaths for which breast cancer was identified as the underlying cause of death. Population estimates used for rate calculation were obtained from two sources: the U.S. Bureau of Census (SEER incidence data) and the California Department of Finance (CCR incidence data and California mortality data). Age groups selected for this analysis were based on intervals considered most relevant to health care services. Women ages 40-49 were of particular interest because of the controversy surrounding the routine use of screening mammography in this age group. A large number of incident breast cancers are diagnosed among women ages 50-64, but unlike women ages 65-79, they are not eligible to receive Medicare benefits. The last age group, women ages 80 and over, represent the elderly population and account for a rather small number of cases.

Incidence and mortality rates were calculated using SEER*Stat program (2) and were age-adjusted to the 2000 U.S. standard population. Trend analysis of the annual rates was based on segmented regression modeling using a Monte Carlo permutation method that was recently developed by SEER as the joinpoint analysis (5).

Results

Trends in Breast Cancer Incidence

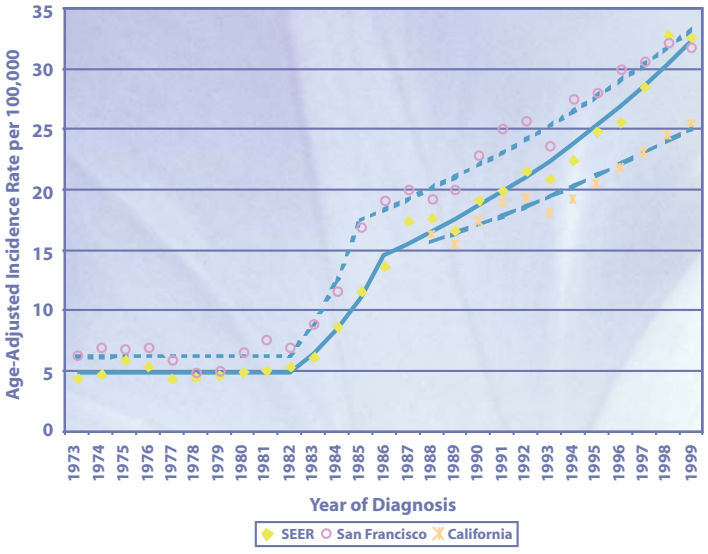
Table 5.1 presents the long-term changes in the incidence of female breast cancer in California, SEER, and SFBA by tumor behavior (invasive or *in situ*) in three time periods. Close examination of this table reveals that incidence of female breast cancer in each of these periods follows slightly different pattern by type and area under study. SEER and SFBA data included all the three time segments, while CCR data covered only the third segment. The first segment extends from 1973 to the early 1980s and reflects a period of relatively stable rates. Fluctuations in incidence rates during this period were not statistically significant. The second segment covers a short period of about five years, characterized by a rapid increase in incidence rates of approximately 150 percent and 30 percent, respectively, for *in situ* and invasive tumors. Except for invasive tumors in SFBA, the estimated annual changes during this period were all statistically significant. The third segment extends from the mid 1980s to 1999, and was marked by a continued increase in the incidence of *in situ* tumors (particularly among SEER cases), and a relatively stable incidence pattern for invasive tumors. CCR data, the main focus of the

Table 5.1
Secular Trends in Incidence of Female Breast Cancer by Tumor Behavior and Time Period: SEER Program, San Francisco Bay Area (SFBA), and California (CCR), 1973-1999

SEGMENT	INDICATOR	*IN SITU*			INVASIVE		
		SEER	SFBA	CCR	SEER	SFBA	CCR
I	Period	1973-82	1973-82	-	1973-80	1973-81	-
	Percent Change (%)[1]	22.97	9.62		3.61	-2.71	
	EAPC (%)[2]	0.23	0.09		-0.61	-1.13	
II	Period	1982-86	1982-85	-	1980-87	1981-85	-
	Percent Change (%)[1]	156.42	148.36		31.7	28.38	
	EAPC (%)[2]	31.33 *	41.02 *		3.66 *	6.12	
III	Period	1986-99	1985-99	1988-99	1987-99	1985-99	1988-99
	Percent Change (%)[1]	139.29	89.16	56.12	3.52	4.8	-2.8
	EAPC (%)[2]	6.27 *	4.68	4.36 *	0.46 *	0.19	-0.02

[1] Percent change is based on the first two and the last two years in study period.
[2] EAPC: Estimated annual percent change
* Statistically significant p<0.05
Prepared by the California Department of Health Services, Cancer Surveillance Section.

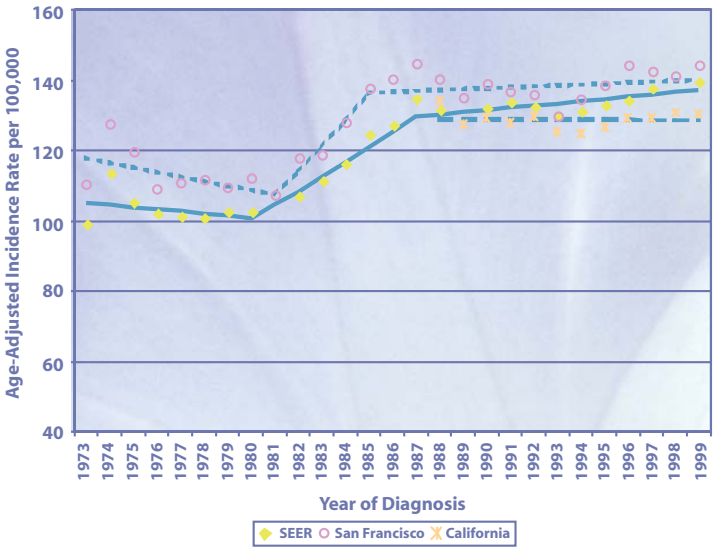
Figure 5.2
***In Situ* Female Breast Cancer Age-Adjusted (2000 U.S. Population) Incidence Rates, All Races Combined: California,[1] SEER Program , and San Francisco Bay Area, 1973-1999**



[1] Statewide incidence data not available prior to 1988.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

analysis presented in this chapter, correspond to the last segment of this time period only. The overall pattern of breast cancer incidence in California, SFBA, and SEER were remarkably similar, albeit with minor changes in magnitude. This incidence pattern has been generally accepted as resulting from the unprecedented and widespread use of screening mammography that began in the early 1980s (6, 7). Differences in incidence rates presented in Figure 5.2 (*in situ* cases) and Figure 5.3 (invasive cases) are most likely due to the coverage and intensity of the early detection activities, as well as to different racial and ethnic populations in these areas.

Figure 5.3
Invasive Female Breast Cancer Age-Adjusted (2000 U.S. Population) Incidence Rates, All Races Combined: California,[1] SEER Program, and San Francisco Bay Area, 1973-1999



[1] Statewide incidence data not available prior to 1988.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 5.2 shows the number of cases and age-adjusted incidence rates for breast cancer in California from 1988-1999, by tumor behavior, race/ethnicity, and year of diagnosis. Changes in breast cancer incidence during the same period by tumor behavior, race/ethnicity, and age group are shown in Table 5.3. The incidence of invasive and *in situ* cases among each race/ethnic group followed a distinctly different pattern. For *in situ* cases, the pattern was an increase in almost all age and race groups, except among women under 40 years of age. The estimated annual rate of change was between five percent and six percent for women 50 and over, which corresponds to 70 percent to 80 percent increase over the study period. The overall increase in the incidence of *in situ* cases varied from 134 percent among Asian/Pacific Islander to 52 percent among whites. Except for white women, changes in the incidence of *in situ* tumors were steeper among women between 50 and 64 years old.

Trends in the incidence of invasive tumors by age followed a mixed pattern during the 1988-1999 period – a monotonic decrease among women ages 40-49 and 80 and over, a monotonic increase among women 50-64 years old, and a change of direction in 1994 (from decreasing to increasing) among women 65-79 years old. Figure 5.4 shows trends in the incidence of invasive tumors by race/ethnicity. Incidence among white women followed a relatively stable pattern, although a significant decrease was

Table 5.2
In situ **and Invasive Female Breast Cancer Incidence Counts and Age-Adjusted (2000 U.S. Population) Rates per 100,000 Persons by Race/Ethnicity,[1] California, 1988-1999**

In situ

Year of Diagnosis	All Races Combined[2]		Asian/Pacific Islander		Black		Hispanic		White	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate
1988	2,020	16.3	77	7.9	91	12.4	127	6.9	1,691	19.3
1989	1,962	15.4	92	9.4	92	12.0	136	7.2	1,617	18.1
1990	2,291	17.4	120	11.1	106	13.2	197	10.1	1,827	20.0
1991	2,562	19.0	144	12.0	129	15.9	199	9.6	2,039	21.8
1992	2,683	19.4	132	10.3	126	14.9	225	10.3	2,132	22.5
1993	2,556	18.1	152	11.6	130	15.3	222	9.9	1,979	20.5
1994	2,780	19.3	204	14.4	161	18.8	254	10.7	2,091	21.5
1995	3,020	20.6	222	15.4	168	18.9	238	9.6	2,308	23.6
1996	3,269	21.9	271	17.6	168	18.1	284	10.9	2,448	25.0
1997	3,561	23.2	294	17.9	203	21.1	330	12.4	2,644	26.4
1998	3,884	24.6	323	18.7	191	19.2	450	16.0	2,829	27.7
1999	4,124	25.5	390	21.7	216	22.1	438	14.7	2,993	29.0
Total	34,712	--	2,421	--	1,781	--	3,100	--	26,598	--
Percent Change[3]	--	57.6	--	134.3	--	69.2	--	118.0	--	51.5

Invasive

Year of Diagnosis	All Races Combined[2]		Asian/Pacific Islander		Black		Hispanic		White	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate
1988	17,063	134.2	712	76.9	964	128.1	1,529	89.5	13,701	147.3
1989	16,609	127.6	747	74.6	884	113.6	1,573	85.7	13,241	140.4
1990	17,417	129.3	896	81.4	961	119.9	1,606	82.7	13,791	142.8
1991	17,681	128.1	844	70.8	976	117.8	1,737	83.6	13,973	142.7
1992	18,386	129.8	1,015	82.8	1,022	120.3	1,847	84.5	14,316	144.2
1993	18,039	125.4	1,014	77.2	1,016	115.6	1,825	80.1	13,993	140.0
1994	18,247	124.8	1,064	76.6	1,058	119.2	1,921	80.3	14,000	139.8
1995	18,864	126.6	1,200	82.2	1,059	117.6	2,037	81.6	14,334	141.8
1996	19,611	129.4	1,335	87.1	1,116	120.3	2,149	82.4	14,738	145.3
1997	20,102	129.2	1,455	90.0	1,136	118.2	2,263	82.4	15,006	145.4
1998	20,864	130.9	1,541	89.7	1,112	113.0	2,470	86.1	15,461	147.9
1999	21,254	130.5	1,645	92.3	1,212	121.3	2,556	84.9	15,582	147.3
Total	224,137	--	13,468	--	12,516	--	23,513	--	172,136	--
Percent Change[3]	--	-0.2	--	20.1	--	-3.1	--	-2.4	--	2.6

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
[2] All races includes persons of other and unknown race/ethnicity.
[3] Percent change is based on the first two and the last two years in study period.
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noticed in the 40-49 age group. The pattern among black women was monotonic with slight decline over time. Among Asian/Pacific Islander women, the incidence of invasive tumors increased monotonically by 20 percent between 1988 and 1999. Such increase was noticeable in all age groups except ages 80 and over. Among Hispanic women, a significant decline changed to an also significant increase in 1994.

As mentioned earlier, the overall pattern of breast cancer incidence is consistent with widespread activities for early detection. Immediately following the initiation of active screening, a significant rise is usually noticed in the incidence of both *in situ* and

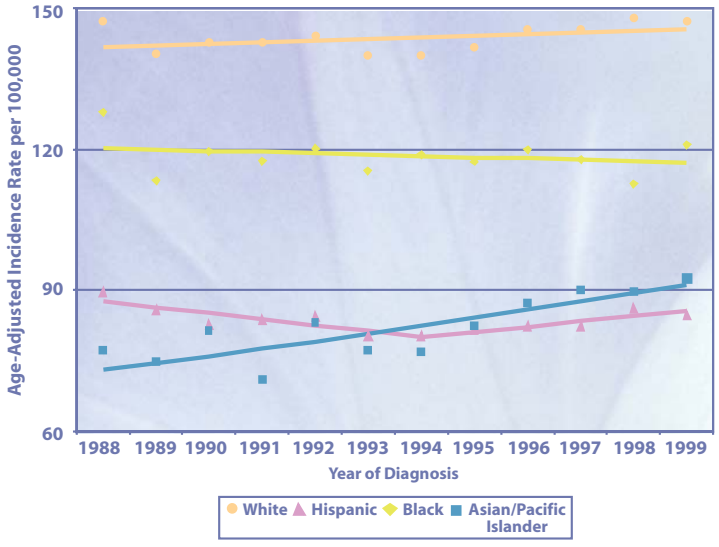
Table 5.3
Trends in Female Breast Cancer Incidence by Tumor Behavior, Race/Ethnicity,[1] and Age Group, California, 1988-1999

		In Situ					Invasive				
Age Group	Incidence	All Races [2]	Asian/Pacific Islander [3]	Black	Hispanic	White	All Races [2]	Asian/Pacific Islander [3]	Black	Hispanic	White
00-39	Count	1,675	178	110	247	1,098	14,200	1,469	1,382	3,092	8,093
	Percent Change [4]	9.76	22.61	73.13	6.37	10.39	-8.36	8.63	-15.13	-9.64	-6.94
	Estimated Annual Percent Change	0.31	3.94	3.52	-0.47	0.09	-1.07*	0.10	-1.77*	-1.35*	-0.86
40-49	Count	7,593	772	398	856	5,380	38,023	3,713	2,704	5,609	25,534
	Percent Change [4]	29.00	150.36	28.42	62.44	22.29	-4.48	17.33	-15.50	3.45	-4.86
	Estimated Annual Percent Change	1.97*	7.18*	3.17*	3.71*	1.53	-0.72*	1.20*	-1.83*	0.43*	-0.82*
50-64	Count	12,086	882	622	1,107	9,207	68,084	4,696	4,111	7,635	50,936
	Percent Change [4]	71.32	183.07	92.29	197.05	57.86	8.15	48.97	7.72	12.78	7.86
	Estimated Annual Percent Change	5.30*	11.98*	6.32*	7.89*	4.64*	0.89*	4.14*	0.82	1.16*	0.88*
65+	Count	13,358	589	651	890	10,913	103,830	3,590	4,319	7,177	87,573
	Percent Change [4]	72.13	100.45	76.85	119.27	75.62	-3.31	0.26	-2.84	-14.58	2.86
	Estimated Annual Percent Change	5.38*	6.24*	5.75*	7.46*	5.60*	-0.30	0.74	0.00	-1.31*	0.26
65-79	Count	11,137	526	541	781	9,031	77,350	3,035	3,310	5,807	64,397
	Percent Change [4]	70.55	102.82	88.54	116.16	73.24	-1.93	3.15	-1.90	-5.82	3.99
	Estimated Annual Percent Change	5.29*	5.42*	5.75*	7.57*	5.53*	-0.17	1.17	0.08	-0.30	0.35
80+	Count	2,221	63	110	109	1,882	26,480	555	1,009	1,370	23,176
	Percent Change [4]	80.01	88.37	41.58	143.28	88.02	-7.22	-9.46	-5.44	-37.21	-0.45
	Estimated Annual Percent Change	5.88*	8.87*	5.45*	6.53*	6.00*	-0.68*	-0.88	-0.25	-4.54*	-0.01
All	Count	34,712	2,421	1,781	3,100	26,598	224,137	13,468	12,516	23,513	172,136
	Percent Change [4]	57.61	134.27	69.21	117.95	51.55	-0.16	20.14	-3.08	-2.44	2.60
	Estimated Annual Percent Change	4.36*	8.71*	5.38*	6.44*	4.04*	-0.01	2.04*	-0.23	-0.15	0.24

1 Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
2 All races includes persons of other and unknown race/ethnicity.
3 Asian/Pacific Islanders
4 Percent change is based on the first two and the last two years in study period.
* Statistically significant at p<0.05.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

invasive tumors. Once a substantial number of women are screened and the pool of asymptomatic cases is almost exhausted, the incidence of *in situ* cases tends to level off, while the incidence of invasive cases begins to decline. Asian/Pacific Islander women, among whom the incidence of both *in situ* and invasive cases is rising, represent a population among which widespread use of screening mammography and early detection activities have started in recent years only. In fact, a 1993-1994 survey showed only 68.3 percent of Asian/Pacific Islander women over 50 years of age reporting ever having had a screening mammography (8), while the corresponding number among non-Hispanic white women was 87.4 percent. Incidence patterns for

Figure 5.4
Trends in Invasive Female Breast Cancer Age-Adjusted (2000 U.S. Population) Incidence Rates by Race/Ethnicity,[1] California, 1988-1999



1 Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

white women suggest that screening activities in this population are well established and have widespread coverage. The significant increase in the incidence of invasive cases among Hispanic women since 1994 may also be due to screening and early detection activities.

Trends in Breast Cancer Mortality

Trend analysis for female breast cancer mortality in California covers a period of three decades, from 1970 through 1999. As shown in Table 5.4, a total of 113,837 deaths due to breast cancer were recorded in California women during this period, of which about 82 percent were white, 6 percent black, 8 percent Hispanic, and about 2 percent

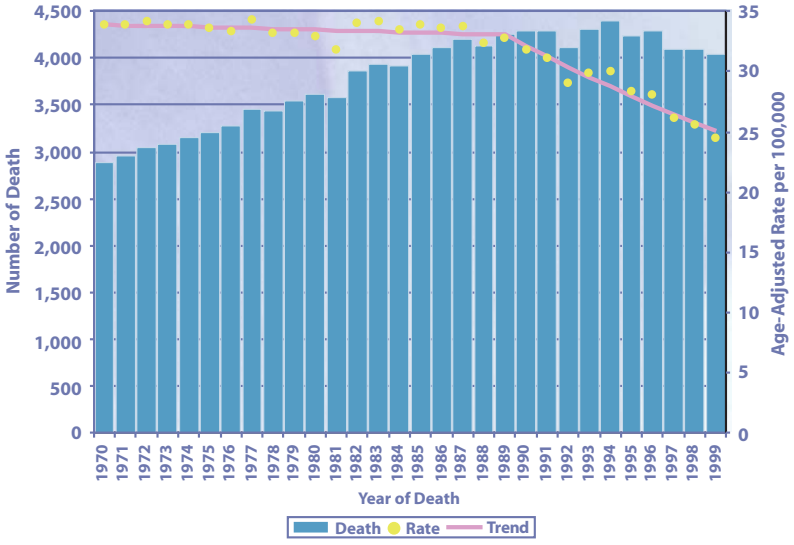
Table 5.4
Female Breast Cancer Mortality Counts and Age-Adjusted (2000 U.S. Population) Mortality Rates per 100,000 Persons by Race/Ethnicity,[1] California, 1970-1999

Year of Diagnosis	All Races[2]		Asian/Pacific Islander		Black		Hispanic		White	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate
1970	2,883	33.8	16	7.5	140	33.3	118	21.1	2,604	35.6
1971	2,949	33.8	18	7.6	148	33.6	108	17.6	2,672	35.8
1972	3,048	34.1	25	11.3	153	34.2	129	20.2	2,737	36.1
1973	3,085	33.9	28	9.0	148	32.0	123	16.5	2,783	36.2
1974	3,146	33.9	43	15.7	185	38.7	160	20.5	2,751	35.2
1975	3,201	33.6	25	7.8	155	30.6	139	17.5	2,874	36.4
1976	3,278	33.3	31	8.3	168	33.7	135	15.6	2,941	36.3
1977	3,447	34.2	35	8.7	205	37.5	168	19.0	3,034	36.9
1978	3,439	33.1	48	12.7	203	36.9	178	18.8	3,003	35.5
1979	3,536	33.2	40	8.7	192	32.1	221	20.9	3,077	35.8
1980	3,623	32.9	55	12.5	208	34.4	229	20.7	3,122	35.3
1981	3,575	31.8	65	13.5	204	32.6	250	20.8	3,047	34.1
1982	3,864	34.0	69	12.4	248	38.5	263	22.3	3,274	36.5
1983	3,944	34.2	64	11.6	268	41.0	305	24.0	3,284	36.3
1984	3,921	33.5	92	13.7	241	36.3	320	23.6	3,250	35.8
1985	4,043	33.9	98	14.5	284	41.5	325	22.5	3,332	36.4
1986	4,107	33.6	90	11.6	287	39.9	353	23.1	3,375	36.3
1987	4,198	33.7	109	13.3	284	39.7	408	25.8	3,388	36.1
1988	4,121	32.4	112	12.6	304	39.9	352	20.8	3,345	35.3
1989	4,258	32.8	138	14.3	307	40.7	418	24.3	3,383	35.2
1990	4,292	31.8	138	13.4	328	42.4	442	23.5	3,377	34.1
1991	4,295	31.1	167	15.3	305	38.1	408	20.5	3,405	33.9
1992	4,116	29.1	126	10.7	319	39.0	454	22.2	3,204	31.4
1993	4,310	29.8	158	12.6	306	36.2	493	22.5	3,348	32.5
1994	4,404	29.9	199	15.8	334	38.8	482	21.1	3,378	32.4
1995	4,241	28.3	196	13.7	345	39.0	479	20.5	3,206	30.7
1996	4,289	28.0	174	12.0	353	37.8	542	21.6	3,210	30.3
1997	4,090	26.1	187	11.9	345	36.2	551	21.0	2,992	28.0
1998	4,095	25.5	219	13.3	335	34.8	554	19.8	2,975	27.4
1999	4,039	24.5	236	13.7	308	31.8	488	17.0	2,994	26.8
Total	113,837	---	3,001	---	7,610	---	9,595	---	93,365	---
Percent Change[3]	---	-26.1	---	78.4	---	-0.4	---	-4.8	---	-24.0

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
[2] All races includes persons of other and unknown race/ethnicity.
[3] Percent change is based on the first two and the last two years in study period.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Asian/Pacific Islander. From 1970 through 1999, the overall decline (of 26 percent) in mortality from breast cancer in California was mostly due to reduced mortality among white women. There was a moderate reduction in the breast cancer mortality among Hispanic women, very little change among black women, and 78 percent increase among Asian/Pacific Islander women. Figure 5.5 shows the annual number of breast cancer deaths and the age-adjusted mortality rate for all races combined during the observation period.

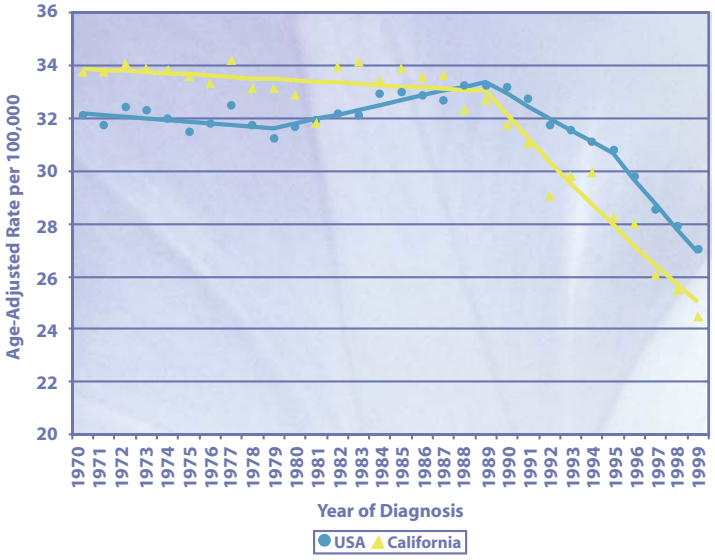
Figure 5.5
Trends in Age-Adjusted (2000 U.S. Population) Mortality Rates and Number of Deaths from Female Breast Cancer, All Races Combined, California, 1970-1999



Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Female breast cancer mortality began a statistically significant decline in 1989 that continued through 1999. In comparison with the U.S., mortality rates in California were slightly higher in the 1970s and 1980s, but began a significant and rapid decline in 1989 at an estimated annual rate of 2.8 percent. Mortality rates in the United States increased slightly beginning in 1979 (EAC=0.5 percent) until 1989 when breast cancer mortality rates began declining (EAC=-1.4 percent). This decline became even more dramatic beginning in 1995 (EAC=-3.2 percent).

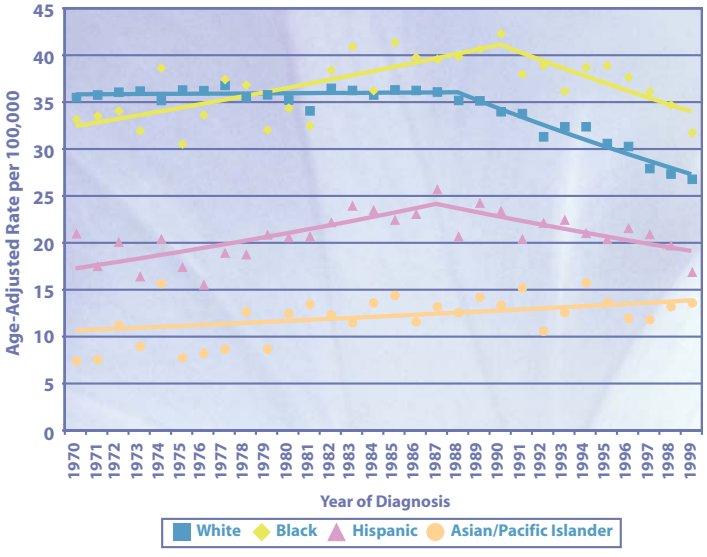
Figure 5.6
Trends in Female Breast Cancer Age-Adjusted (2000 U.S. Population) Mortality Rates, California and U.S., 1970-1999



Source: SEER (November 2001) and California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

The secular trends for breast cancer mortality by race/ethnicity are presented in Figure 5.7. The relatively stable mortality rates among white women began its rapid decline in 1988, at an estimated annual rate of 2.5 percent. Among black women, an increase of 1.2 percent per year in breast cancer mortality rates was followed by a period of significant decline of 2.1 percent since 1990. Among Hispanic women, the break in mortality rates occurred in 1987 when the estimated annual change of 1.9 percent during the increasing period was followed by a continuous decrease of 1.9 percent since 1987. Among Asian/Pacific Islander women, a monotonic increase has been observed at an estimated annual rate of 0.9 percent.

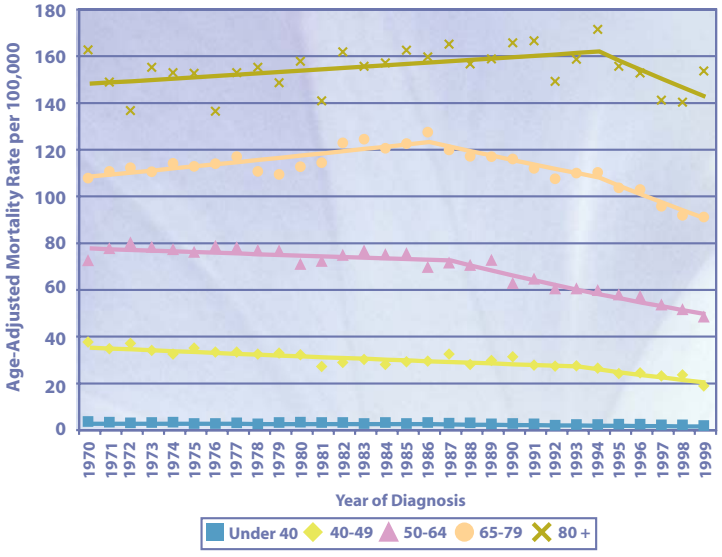
Figure 5.7
Trends in Female Breast Cancer Age-Adjusted (2000 U.S. Population) Mortality Rates by Race/Ethnicity,[1] California, 1970-1999



[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Female breast cancer mortality by age group, 1970-1999, is presented in Figure 5.8. Among women under 40 years of age, relatively stable mortality rates began to decline significantly in 1986 at an estimated annual rate of 3.5 percent. A total of 5,028 women in this age group died of breast cancer during the 30-year period. Among women ages 40-49, mortality rates, which had been declining since 1970 at an annual rate of negative 1.2 percent, began an

Figure 5.8
Trends in Female Breast Cancer Age-Adjusted (2000 U.S. Population) Mortality Rates by Age-Group, All Races Combined, California, 1970-1999



Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

accelerated decline in 1993, at a rate of 4.7 percent per year. The number of deaths in this age group was 13,823. A similar pattern was noticed among women ages 50-64, for whom moderately decreasing mortality rates began to rapidly decline in 1987, at an estimated rate of 3.4 percent per year. The total number of deaths in this age group was 37,285 during this period. Among women ages 65-79, mortality rates had increased at a rate of 0.8 percent per year up to 1986, when they began to decline at a rate of 1.6 percent. In 1994, the decline accelerated to 3.4 percent per year. The number of deaths in this age group was 39,350. Among women ages 80 and over, the mortality rate increased at an annual rate of 0.4 percent up to 1994. In the last five years, mortality rate in this age group has begun a slight decline that is statistically not significant. The total number of deaths in this age group was 18,212. Changes in breast cancer mortality from 1988-1999 by age group and race/ethnicity are shown in Table 5.5. Data presented in Table 5.5 emphasize that, except among Asian/Pacific Islanders and women ages 80 and over, breast cancer mortality in California has declined since 1988 in almost all age and race/ethnic groups.

Table 5.5
Trends in Female Breast Cancer Mortality by Race/Ethnicity[1] and Age Group, California, 1988-1999

Age Group	Mortality	All Races [2]	Asian/PI [3]	Black	Hispanic	White
00-39	Count	2,274	174	354	509	1,229
	Percent Change [4]	-32.1	-1.1	-42.0	16.8	-44.0
	Estimated Annual Percent Change	-3.5*	0.3	-4.4	2.1*	-5.8*
40-49	Count	6,446	523	757	1,055	4,095
	Percent Change [4]	-27.1	1.8	-24.0	-20.9	-30.9
	Estimated Annual Percent Change	-3.4*	-1.3	-1.4	-2.6*	-3.9*
50-64	Count	14,180	884	1,263	1,734	10,261
	Percent Change [4]	-30.5	4.7	-24.8	-21.0	-33.0
	Estimated Annual Percent Change	-3.2*	0.1	-2.7*	-2.5*	-3.3*
65+	Count	27,656	724	1,522	1,811	23,546
	Percent Change [4]	-16.9	-20.4	-4.3	-12.5	-13.0
	Estimated Annual Percent Change	-1.9*	-1.9	-0.9	-0.9	-1.4*
65-79	Count	18,219	563	1,084	1,343	15,190
	Percent Change [4]	-21.8	-33.4	-13.9	-7.0	-18.4
	Estimated Annual Percent Change	-2.3*	-3.6*	-0.9	-0.1	-2.0*
80+	Count	9,437	161	438	468	8,356
	Percent Change [4]	-6.6	22.7	21.6	-24.2	-1.5
	Estimated Annual Percent Change	-0.9	1.6	-1.1	-2.8*	-0.3
All	Count	50,556	2,305	3,896	5,109	39,131
	Percent Change [4]	-23.3	-6.1	-17.9	-15.6	-23.2
	Estimated Annual Percent Change	-2.5*	-1.0	-1.8*	-1.6*	-2.5*

1 Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
2 All races includes persons of other and unknown race/ethnicity.
3 Asian/Pacific Islanders
4 Percent change is based on the first two and the last two years in study period.
* Statistically significant at p<0.05.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Discussion

The overall pattern of female breast cancer incidence and mortality examined in this chapter is consistent with the introduction of a new and effective screening method such as mammography, which has affected diverse age and race/ethnic groups in distinct ways. Usually, when a new cancer screening methodology begins to be widely used, the incidence of cases in early stages of development increases due to the detection of asymptomatic cases. This will change the detection pattern of cases and will result in reduction of the clinically detected cases. Moreover, if early detection is able to change the outcome of the disease, a measurable impact on its natural history can be expected. Such impact includes a decline in the incidence of advanced cases and, eventually, lower mortality rates. On the other hand, if early detection cannot influence the outcome of the disease, then mortality rates remain the same, while survival may increase because of lead-time bias (8). In the early years of the widespread use of screening mammography, the incidence of early stage cases, i.e., *in situ*, as well as the small and localized invasive tumors, began a rapid increase. Once the existing pool of preclinical asymptomatic cases is diagnosed, the incidence of advanced cases begins to decline. The time difference between the rapid increase in detection of early cases and decline in incidence of advanced cases is known as detection lead time that positively influences the survival time. Improvements in the management and treatment of female breast cancer, such as adjuvant therapy and more frequent combination of radiation with surgery, particularly for early detected cases, are possibly the main reasons for the observed decline in mortality rates (9). Differences among different racial and ethnic populations may be explained by the acceptance and coverage of screening mammography and early detection activities. However, screening mammography is not regularly performed in women under 40 years; therefore, it does not explain trends detected in this age group. It has been suggested that changes in breast cancer incidence and mortality among younger women are mostly due to a cohort effect, i.e., that women born after 1926 are at lower risk of developing breast cancer when compared to women born between 1900 and 1916 (10).

Conclusions

The increasing trends in the incidence of *in situ* female breast cancer presented in this chapter are consistent with the widespread use of screening mammography. Increased coverage of early detection activities and improved therapies are also the most likely reasons for the decline in the incidence of invasive tumors and breast cancer mortality in California.

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Risk of Developing Invasive Female Breast Cancer in California

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Introduction

Since its inception in 1988, the CCR has collected information on all cancers diagnosed among Californians. Breast cancer is the most frequently diagnosed cancer among California women, and the second leading cause of cancer mortality (1). It is well established that the risk of breast cancer increases sharply with age. Because breast cancer rates also vary markedly by race/ethnicity (1, 2), it is important to take these two factors into account when informing women of their projected baseline risk of breast cancer. This chapter presents two types of estimates, interval risk and cumulative risk, of being diagnosed with breast cancer for California women of four different race/ethnicities: non-Hispanic black, non-Hispanic white , Hispanic, and non-Hispanic Asian/Pacific Islander. Cumulative risk represents the probability that a newborn female will be diagnosed with breast cancer by a certain age. The lifetime risk, also a cumulative risk estimate, represents a newborn female's probability of eventually being diagnosed with breast cancer. Interval risk, conditioned on current age, represents the probability that a breast cancer-free woman of a certain age will develop breast cancer within a specified number of years.

Methods

In this report, risk of developing cancer is taken to mean the risk of being diagnosed with cancer. Two types of risk estimates are presented: interval and cumulative (including lifetime) risk. Interval risk is conditioned on a woman's current age, and represents the probability that a breast cancer-free woman of a certain age will develop breast cancer within a specified number of years. Cumulative risk represents the probability that a newborn female will be diagnosed with breast cancer by a certain age. Lifetime risk, also a cumulative risk, represents a newborn female's probability of eventually being diagnosed with breast cancer.

The risk of developing cancer was calculated as a function of statewide breast cancer incidence rates and noncancer-related mortality rates from 1995-1999. Age-specific incidence rates (five-year intervals) and noncancer-related mortality rates were calculated for each race/ethnicity. Incidence rates were based on the number of first invasive primary breast cancers diagnosed in California from 1995-1999 and reported to CCR as of August 2001. Mortality data were obtained from the Center for Health Statistics, California Department of Health Services. Age- and race-specific population estimates were obtained from the Demographic Research Unit, California Department of Finance. Risk estimates were based on the life table methodology proposed by Feuer et al.(3, 4). During each five-year age interval, women in a hypothetical cohort were considered to be at risk for two mutually exclusive events: developing breast cancer or dying of other causes, and breast cancer-free. Incidence and mortality rates were used to derive probabilities of developing breast cancer or dying of other causes

during each interval. These probabilities were then applied to the hypothetical cohort to obtain the expected number of women developing breast cancer or dying of other causes during each age interval. All women surviving the interval cancer-free became the population at risk at the beginning of the next age interval.

The risk of developing breast cancer within a particular age interval was estimated as the number of expected new cancers developing during that interval divided by the population at risk (cancer-free) at the beginning of that period. The cumulative risk was estimated as the sum of all cancers up to a specified age divided by the initial population, and the lifetime risk was the sum of all cancers in the life table divided by the birth cohort.

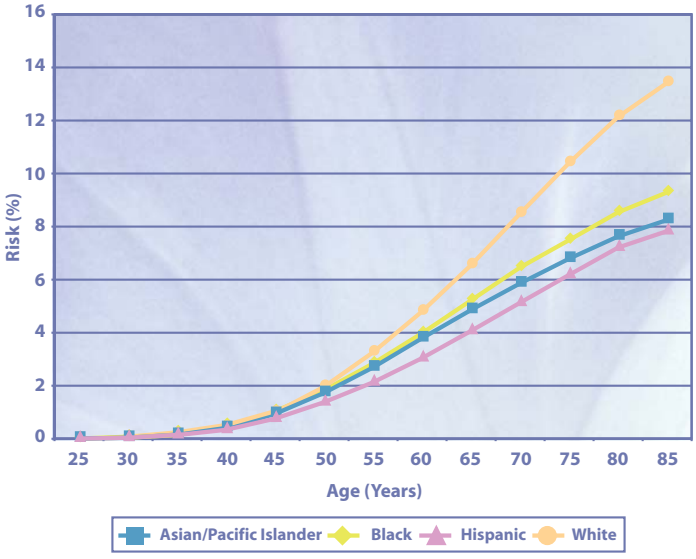
Hispanic ethnicity was based on information in the medical record or death certificate and on surnames. Women with race coded as white, black, or unknown with a last name (or maiden name, when present) on the 1980 U.S. Census list of 12,497 Hispanic surnames were categorized as Hispanic. The use of surname was adopted to more accurately classify Hispanic ethnicity, which is usually underreported in medical records and death certificates (5).

Results

Cumulative Risk

Table 6.1 and Figure 6.1 show the estimated risk of developing breast cancer from birth to a specified age by race/ethnicity. Only 1 in every 2,227 newborn girls would be expected to develop breast cancer by age 30, but the risk increases sharply with age. By age 60, 1 in every 24 women may have been diagnosed with breast cancer. Variations in cumulative risk by race/ethnicity were evident in all age groups (Figure 6.1). The risk accumulated from birth until age 45 was highest among blacks. However, the risk accumulated by ages 50 and over among white women was substantially higher than the

Figure 6.1
Cumulative Risk of Developing Breast Cancer by Race/Ethnicity,[1] California, 1995-1999



[1] Race/ethnicity categories are mutually exclusive. Women of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 6.1
Cumulative Risk of Being Diagnosed with Invasive Breast Cancer, by Age and Race/Ethnicity,[1] California, 1995-1999

Birth to Age	All Races	Asian/Pacific Islander	Black	Hispanic	White
	One in:	One in:	One in:	One in:	One in:
30	2,227	2,513	1,267	2,262	2,410
35	639	684	416	717	632
40	244	247	191	290	232
45	108	106	96	132	101
50	56	58	55	72	51
55	34	37	35	47	31
60	24	26	25	33	21
65	17	21	19	25	15
70	13	17	15	20	12
75	11	15	13	16	10
80	9	13	12	14	8
85	8	12	11	13	7
Lifetime risk	8	11	10	11	7

[1] Race/ethnicity categories are mutually exclusive. Women of Hispanic ethnicity may be of any race.
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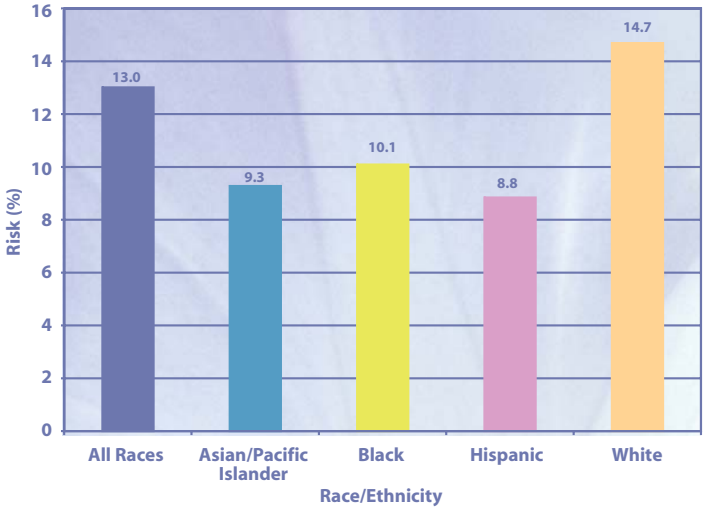
risk for women of any other race/ethnicity. For example, 1 in every 21 white females is expected to have been diagnosed with breast cancer by age 60. In contrast, the projected risks accumulated by 60 years of age among women of other race/ethnic groups were 1 in 25 for blacks, 1 in 26 for Asian/Pacific Islanders, and 1 in 33 for Hispanics. After age 35, Hispanic women had the lowest cumulative risk of developing breast cancer.

Lifetime Risk

Based on current data, a newborn female in California will have a 13 percent (1 in 8) probability of being diagnosed with breast cancer during her lifetime (Table 6.1 and Figure 6.2). The estimated lifetime risk was highest for white females (14.7 percent) followed by risks for blacks (10.1 percent), Asians/Pacific Islanders, (9.3 percent), and Hispanics (8.8 percent). These

Figure 6.2
Lifetime Risk of Developing Invasive Female Breast Cancer by Race/Ethnicity,[1] California, 1995-1999



[1] Race/ethnicity categories are mutually exclusive. Women of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

percentages correspond to 1 in 7 white women, 1 in 10 black women, and 1 in 11 Asian/Pacific Islander or Hispanic women developing breast cancer over a lifetime.

Compared to California, lifetime risk estimates from the SEER program (2) for all races combined were similar: 13.2 percent versus 13.0 percent, and almost identical for black women (10.1 percent). SEER estimates were lower for white women: 13.8 percent versus 14.7 percent in California. Some of the difference may be attributed to different time periods: CCR estimates are based on 1995-1999 rates, while SEER estimates are based on 1997-1999 rates. In addition, SEER includes persons of Hispanic ethnicity within the white race category. Because the incidence of breast cancer is lower among Hispanic women, SEER risk estimates for white plus Hispanic women are likely to be lower than CCR estimates for non-Hispanic white women.

Table 6.2
Risk of Being Diagnosed with Invasive Breast Cancer Within the Next 5, 10 or 20 Years, by Race/Ethnicity,[1] Assuming no Breast Cancer at Current Age: California, 1995-1999

Current	+ 5 Years		+ 10 Years		+ 20 Years [2]	
Age	Risk (%)	One in:	Risk (%)	One in:	Risk (%)	One in:
All Races						
30	0.11	883	0.37	271	1.76	57
40	0.53	189	1.41	71	3.94	25
50	1.20	84	2.62	38	5.96	17
60	1.71	59	3.57	28	7.21	14
70	2.16	46	4.2	24		
Asian/Pacific Islander						
30	0.11	929	0.37	270	1.70	59
40	0.55	182	1.34	74	3.45	29
50	1.01	99	2.16	46	4.32	23
60	1.17	86	2.27	44	4.20	24
70	1.12	89	2.13	47		
Black						
30	0.17	604	0.46	219	1.80	56
40	0.54	184	1.37	73	3.63	28
50	1.12	89	2.39	42	5.13	20
60	1.53	66	3.05	33	5.61	18
70	1.58	63	3.18	31		
Hispanic						
30	0.10	1035	0.30	328	1.36	74
40	0.43	235	1.07	94	2.76	36
50	0.78	128	1.74	58	3.93	25
60	1.15	87	2.31	43	4.62	22
70	1.32	76	2.61	38		
White						
30	0.12	845	0.40	253	1.94	51
40	0.57	175	1.57	64	4.47	22
50	1.37	73	3.00	33	6.91	14
60	1.99	50	4.19	24	8.33	12
70	2.53	40	4.84	21		

[1] Race/ethnicity categories are mutually exclusive. Women of Hispanic ethnicity may be of any race.
[2] Estimates were truncated at age 85 and are, therefore, not available for age 70 plus 20 years.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Interval Risk (Conditioned on Current Age)

Estimates of a woman's risk of being diagnosed with invasive breast cancer within the next 5, 10, or 20 years (assuming she is free of breast cancer at her current age) are shown in Table 6.2. Based on 1995-1999 rates, the estimated risk of developing invasive breast cancer for a 50-year-old woman of Hispanic ethnicity was 0.8 percent

(1 in 128) within the next five years, 1.7 percent (1 in 58) within the next ten years, and 3.9 percent (1 in 25) within the next 20 years. For a white woman of the same age, the risk of invasive breast cancer during the same period was substantially higher: 1.4 percent (1 in 73) within five years, 3.0 percent (1 in 33) within 10 years, and 6.9 percent (1 in 14) within 20 years. A 50-year-old black woman had a 1.1 percent (1 in 89) risk of developing invasive breast cancer by age 55, a 2.4 percent (1 in 42) risk by age 60, and a 5.1 percent (1 in 20) risk by age 70. Similarly, the estimated risks for 50-year-old Asian/Pacific Islander women were 1.0 percent (1 in 99), 2.2 percent (1 in 46), and 4.3 percent (1 in 23) within the next 5, 10, and 20 years, respectively. These estimates reflect the variation in the incidence of breast cancer by race/ethnicity in California, where rates have been highest among non-Hispanic white women and lowest among Hispanic women.

The older the woman, the higher the risk of developing breast cancer in the next 5 to 20 years of her life, reflecting the fact that incidence rates increase with age. However, the risk in the next 20 years for a woman at any age was always higher than the risk in the next ten years for a woman ten years older. For example, the estimated risk of developing breast cancer by age 70 for a 50-year-old woman was higher than the risk by age 70 for a 60-year-old woman. This is because, unlike an older woman who has already survived and reached her current age free of breast cancer, a woman ten years younger is still at risk of developing breast cancer in the next decade of her life.

Comments

The population-based estimates of risk presented in this report represent the average risk of breast cancer and do not take into account risk factors other than age and race/ethnicity. Clearly, these two factors alone cannot accurately predict the risk of developing breast cancer for an individual woman. More complex models have been developed that project the risk of breast cancer with consideration of individual risk factors (6-8). Such models can be very useful to counsel individual women, but have limited use for communicating risk to a broader population. The unique diversity of California population allowed for stable estimates of risk for the four major race/ethnic groups included in this report. Reflecting the already recognized race/ethnic differences in breast cancer rates in California and in the U.S., the estimated risk of developing breast cancer varied markedly by race/ethnicity.

The lifetime risk of developing cancer is a powerful and appealing statistic, but it has been frequently misinterpreted. For example, one common misconception is that lifetime risk applies to women of all ages. In fact, the commonly cited 1 in 8 lifetime risk is the risk of a newborn girl, not the risk of an adult woman. Another frequent misconception is that risk estimates are valid only if all women live to a specific age, when in reality the calculations take into account the likelihood of dying of other causes at any age (4). It is important to realize that risk estimates are projections of

current rates into the future and are, therefore, valid only if these rates remain stable over time. Such an assumption is probably not realistic over a long period of time. On one hand, improvements in screening technology may inflate incidence rates, since more tumors are detected at an earlier stage of development. On the other hand, breast cancer research may lead to more effective prevention strategies and, therefore, to an actual decrease in risk. Mortality rates may also substantially impact risk estimates. Because breast cancer is much more common among older women, a longer life span increases the likelihood of being diagnosed with the disease. For all these reasons, risk projections based on current age give women a horizon over the next few years that may be more relevant or meaningful. Ultimately, awareness about the disease should not bring unnecessary fear, but motivate women to take action and undergo a screening program.

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Utilization of Screening Mammography in California, 1987–2000

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Introduction

Screening mammography has been shown to lead to earlier diagnosis and to reduce mortality from breast cancer. National health objectives for the year 2010 were established in HP2010 (1). The goal of HP2010 is to significantly reduce preventable death and disability, enhance quality of life, and reduce health status disparities in various population groups. To reduce breast cancer mortality in the U.S., the HP2010 objectives call for 70 percent of women aged 40 and over to have received a mammogram in the preceding two years. While this objective is laudable, the American Cancer Society (ACS) has established an even higher goal that, by 2008, 90 percent of women aged 40 and over have a mammogram annually (2). This chapter uses data from the California BRFSS to examine the prevalence and frequency of mammography utilization in California.

BRFSS is an ongoing effort by the California Department of Health Services in conjunction with the U.S. Centers for Disease Control and Prevention to assess the prevalence of and trends in health-related behaviors in the California population aged 18 years and older. Using a computer assisted telephone interview system, data are collected monthly from a random sample of California adults living in households with telephones. During 2000, BRFSS data were collected in all states and territories. Slightly more than 96 percent of Californians reside in households with telephones compared to 94.5 percent nationwide (3).

In California, BRFSS has been the cornerstone of health surveillance activities since 1984. During the ensuing years, both the instrument and the sample size have evolved. The monthly BRFSS sample size has increased from 99 in 1984 to 336 in 2000. The questionnaire has been revised annually and has asked about a variety of behaviors such as exercise, weight control, diet, tobacco and alcohol use, utilization of cancer screening procedures, and other preventive health measures. Basic demographic data are also collected so that we can examine mammogram screening differences among different segments of California's population.

A representative sample is required so that findings are generalizable to the California population. Representative sampling is assured by interviewing a randomly selected adult in a randomly selected household. Furthermore, standardized procedures are followed for calling back numbers that ring with no answer or give a busy signal, or for encouraging selected respondents who may be reluctant to participate. Rigorous quality control procedures are followed so that the highest quality data possible are collected.[1]

1 More information about the telephone interviewing process is available by visiting the Survey Research Group Web site at www.surveyresearchgroup.org.

Screening Questions

Mammography screening questions became part of the BRFSS questionnaire in 1987. Following an explanation, "A mammogram is an x-ray of the breast to check for cancer and involves pressing the breast between two plastic plates," respondents are asked, "Have you ever had a mammogram?" Women who reported having had a mammogram were then asked, "How long has it been since your last mammogram?" and, "Was your last mammogram done as part of a routine checkup, because of a breast problem, or because you've already had breast cancer?" This question sequence was asked annually from 1987 through 2000. Beginning in 2001, breast cancer screening questions are no longer included on the annual questionnaire.

Statistical Analysis

The BRFSS sample does not completely match the age, race, and sex distribution of the California population, therefore, BRFSS data must be weighted to obtain meaningful population estimates. In addition to differences between the sample and the population, the probability of being selected to participate differs for different households and individuals. The probability of selection adjustment takes into account the number of adults in the household, number of unique telephone numbers in the household, and for 1987-1993, the number of interviews completed within a primary sampling unit.

In this analysis, different weighting schemes were used. Data in Tables 7.1 through 7.4 were weighted to reflect the age and race distribution of the 1990 California population (at the time this chapter was written, data from the 2000 census were not available for use in the analysis). Data in Tables 7.5 and 7.6 were age-adjusted. Age-adjusting allows for comparisons across race groups by eliminating the possible imbalance that may result from differences in the age distribution of each race and gender specific group.[2] Sample size and 95 percent confidence intervals for each point estimate are presented on the tables and on some figures. Differences between two point estimates are considered to be statistically significant when the confidence intervals do not overlap.

Screening Utilization

The following data examine screening behavior of asymptomatic women only. Women who reported they had their last mammogram because of a breast problem or because they had already had breast cancer were excluded from the analysis.

2 More information about weighting of BRFSS data is available in the BRFSS dataset documentation available at the Survey Research Group Web site, www.surveyresearchgroup.org.

More California women aged 40 and older reported receiving at least one mammogram in 2000 than in any prior year. While fewer than one-half (46.9 percent) of California women aged 40 and older in 1987 had ever had a mammogram, more than 90 percent of women in 2000 reported having had at least one mammogram (Table 7.1 and Figure 7.1). As shown, women aged 40 and over, 50 and over, and 70 and over, met HP2010 objectives that 70 percent receive a mammogram in the preceding two years. However, women in these same age groups fell short of ACS goal of 90 percent receiving a mammogram in the preceding year.

Table 7.1
Percent of Women Ages 40 and Over, 50 and Over, and 70 and Over Who Reported Having a Mammogram, California 1987 - 2000

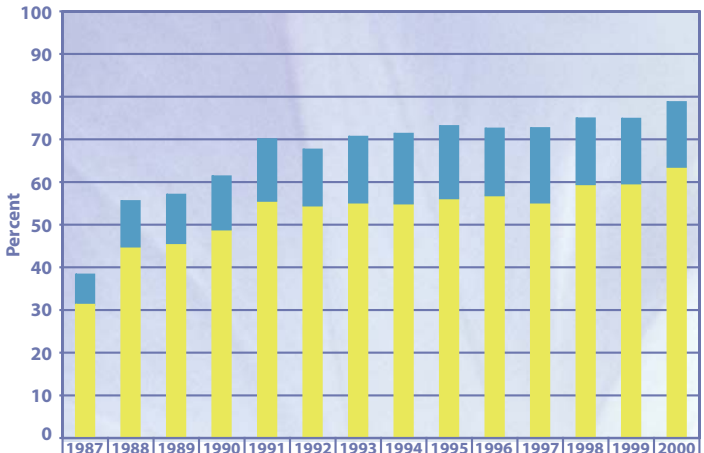
Year	N	Ever Had (%)			Had Within Last Two Years (%)			Had Within Last Year (5)		
		%	95% CI*		%	95% CI*		%	95% CI*	
			Lower	Upper		Lower	Upper		Lower	Upper
Age 40 and Over										
1987	451	46.9	41.5	52.3	38.3	33.1	43.5	31.2	26.2	36.1
1988	617	62.7	58.2	67.3	55.5	50.8	60.2	44.9	40.3	49.6
1989	574	65.4	60.9	70.0	57.0	52.3	61.7	45.7	41.0	50.4
1990	663	70.7	66.8	74.6	61.3	57.2	65.5	48.9	44.6	53.1
1991	732	78.2	74.7	81.7	70.0	65.8	73.4	55.6	51.5	59.7
1992	1,020	77.9	75.0	80.7	67.6	64.4	70.8	54.5	51.1	57.9
1993	1,049	82.5	79.9	85.2	70.6	67.5	73.7	55.2	51.9	58.6
1994	1,115	82.8	80.3	85.4	71.3	68.3	74.2	55.0	51.7	58.3
1995	1,129	85.0	82.6	87.4	73.1	70.2	76.1	56.2	52.9	59.4
1996	1,189	86.6	84.4	88.7	72.5	69.7	75.3	56.9	53.8	60.0
1997	1,248	87.2	85.1	89.4	72.6	69.8	75.4	55.2	52.1	58.3
1998	1,170	87.2	85.0	89.3	74.9	72.1	77.7	59.5	56.3	62.7
1999	1,292	86.7	84.5	88.9	74.8	72.1	77.5	59.7	56.7	62.7
2000	1,223	90.2	88.3	92.2	78.7	76.0	81.3	63.6	60.5	66.6
Age 50 and Over										
1987	324	46.6	40.3	53.0	35.8	29.7	41.9	29.7	23.9	35.5
1988	398	63.9	58.2	69.7	55.5	49.6	61.3	43.9	38.1	49.7
1989	386	70.4	65.0	75.8	60.2	54.5	65.9	48.8	43.0	54.5
1990	422	71.4	66.6	76.2	61.5	56.4	66.7	52.6	47.4	57.9
1991	507	78.1	73.7	82.4	68.9	64.1	73.6	56.2	51.3	61.1
1992	667	70.2	76.8	83.6	71.0	67.2	74.8	58.6	54.5	62.8
1993	670	86.1	83.1	89.1	73.3	69.6	77.1	59.5	55.3	63.6
1994	714	84.8	81.8	87.8	73.8	70.3	77.4	58.3	54.3	62.3
1995	720	88.9	86.1	91.6	79.1	75.7	82.4	64.2	60.3	68.1
1996	793	89.4	87.0	91.8	77.7	74.5	80.9	63.8	60.0	67.5
1997	826	91.5	89.3	93.6	77.9	74.7	81.1	63.2	59.5	66.9
1998	753	91.0	88.7	93.4	81.0	77.9	84.2	66.0	62.2	69.9
1999	782	90.0	87.4	92.6	80.5	77.3	83.7	65.6	61.9	69.4
2000	785	94.3	92.3	96.3	83.7	80.7	86.8	68.3	64.5	72.1
Age 70 and Over										
1987	114	38.2	28.2	48.2	30.1	20.6	39.5	26.0	17.0	35.1
1988	143	55.1	45.6	64.6	47.9	38.7	57.2	38.7	29.3	47.5
1989	136	65.5	56.8	74.2	53.1	43.6	62.7	41.5	31.9	51.1
1990	151	69.0	60.8	77.1	55.1	46.4	63.8	48.0	39.2	56.8
1991	179	75.5	68.5	82.5	64.2	56.2	72.1	52.1	44.0	60.2
1992	230	78.1	72.1	84.1	69.4	62.8	76.0	54.5	47.3	61.6
1993	247	83.9	78.8	89.1	70.6	64.2	76.9	55.6	48.8	62.4
1994	254	85.5	80.7	90.3	71.7	65.7	77.7	57.3	50.1	63.8
1995	274	87.0	82.4	91.6	75.7	70.2	81.2	57.8	51.5	64.2
1996	287	90.1	86.5	93.7	78.0	73.0	83.1	62.3	56.2	68.4
1997	311	89.2	85.4	93.1	72.0	66.5	77.5	56.6	50.4	62.7
1998	246	91.7	87.8	95.7	82.1	76.9	87.4	65.0	58.5	71.6
1999	264	86.8	81.5	92.2	76.5	70.4	82.6	63.3	56.7	69.9
2000	243	95.7	93.1	98.3	83.9	79.2	88.7	68.3	61.9	74.6

Excludes women whose most recent mammogram was done for a breast problem or cancer.
*Confidence Interval.
Source: California Behavioral Risk Factor Surveillance System. Weighted to the 1990 California population.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Since 1987, the proportion of women reporting ever having had a mammogram increased in each age group with the most dramatic improvement seen among women aged 70 to 79 (Table 7.2; Figure 7.2). A dramatic

increase in women reporting having received a mammogram during the preceding two years also is shown (Table 7.2; Figure 7.3). A review of Table 7.2 shows that women in the 50 to 59, 60 to 69, and 70 to 79 age groups met the HP2010 objective, whereas those in the 40 to 49, and 80 and older groups require continued improvement. It should be noted that the proportion of women aged 80 and over who reported receiving a mammogram in the prior two years increased from 29.9 percent in 1987 to 69.9 percent in 2000. Nevertheless, screening frequency improvements are needed among women in all age groups if California is to achieve the ACS goal that 90 percent of all women aged 40 and older receive a mammogram annually.

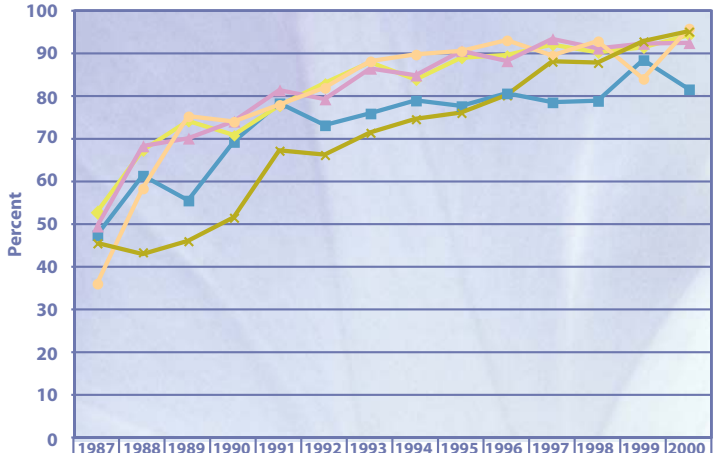
Figure 7.1
Women Aged 40 and Over Who Reported Having a Mammogram, California, 1987 - 2000



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Within Last 2 Years	7.1	10.6	11.3	12.4	14.4	13.1	15.4	16.3	16.9	15.6	17.4	15.4	15.1	15.1
Within Last 1 Year	31.2	44.9	45.7	48.9	55.6	54.5	55.2	55.0	56.2	56.9	55.2	59.5	59.7	63.6

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 7.2
Women Who Reported Ever Having a Screening Mammogram by Age, California, 1987-2000



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
40-49	47.5	61.4	55.6	69.3	78.4	73.2	76.0	79.0	77.7	80.7	78.6	78.9	88.5	81.7
50-59	52.9	67.3	74.2	70.9	77.8	83.1	88.0	83.9	89.0	89.7	92.1	90.3	91.4	94.3
60-69	49.5	68.3	70.1	74.1	81.4	79.3	86.5	84.9	90.6	88.3	93.4	91.2	92.3	92.5
70-79	36.1	58.4	75.3	74.1	78.0	82.0	88.2	89.8	90.6	93.1	89.6	92.9	84.1	95.9
80+	45.6	43.0	46.1	51.6	67.3	66.3	71.5	74.7	76.1	80.3	88.2	87.9	92.9	95.2

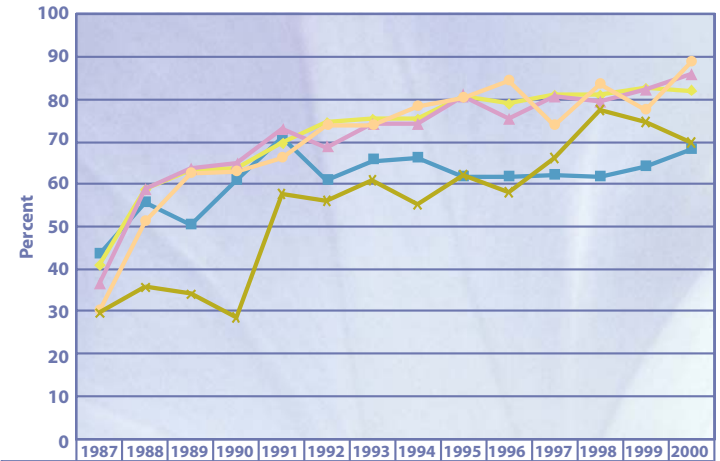
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Education

Although impressive improvements have been seen in the proportion of women aged 40 and over reporting at least one mammogram, women who are not high school graduates continue to be screened at a lower rate than do high school graduates. However, unlike in 1987, the 2000 gap in screening rates between the two groups is not statistically significant. In 1987, only 35.3 percent of less educated women aged 40 and over reported ever

receiving a screening mammogram compared to 50.2 percent of high school graduates (Table 7.3 and Figure 7.4). By 2000, the screening gap had narrowed with 86.7 percent of women aged 40 and older who were not high school graduates reporting a screening mammogram compared to 90.8 percent of high school graduates. However, other disparities are evident when comparing the screening frequency among those with and without a high school education. Although women who were high school graduates have consistently achieved the HP2010 objective for screening during the previous two years, this was a rare occurrence among women who were not high school graduates. Non-high school graduates achieved the HP2010 objective in 2000 and in 1996 only, compared with high school graduates who achieved this objective consistently since 1991. Neither group achieved the ACS screening goal (Table 7.3 and Figure 7.5). Among women aged 50 and older, both high school graduates and nongraduates achieved the HP2010 objective during 2000, but fell far short of the ACS goal.

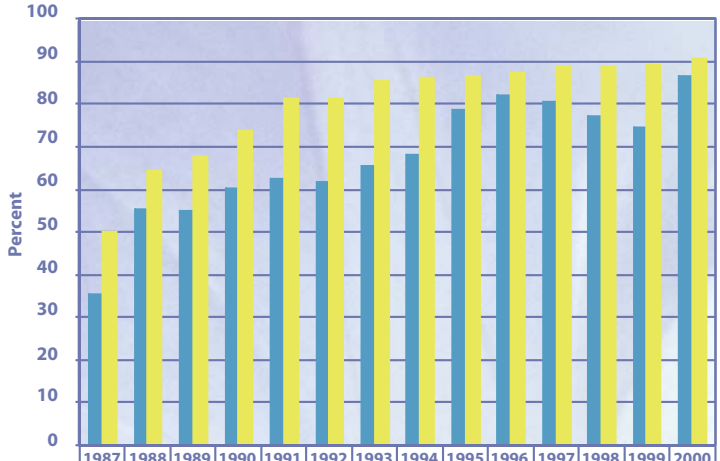
Figure 7.3
Women Who Reported Having a Mammogram in the Last Two Years by Age, California, 1987-2000



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
40-49	43.5	55.6	50.4	61.0	71.1	60.8	65.5	66.3	61.9	61.8	61.9	61.9	64.3	68.1
50-59	41.2	59.0	63.3	63.9	69.8	74.7	75.4	75.5	80.9	79.1	81.2	81.2	82.8	82.1
60-69	36.6	58.7	63.9	64.9	72.9	68.8	74.2	74.3	80.8	75.6	80.7	79.6	82.5	85.9
70-79	30.1	51.2	62.7	62.9	66.1	73.9	73.8	78.3	80.2	84.3	73.9	83.5	77.3	88.7
80+	29.9	35.8	34.2	28.5	57.8	56.1	61.1	55.1	62.2	58.1	66.1	77.4	74.7	69.9

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 7.4
Women Age 40+ Who Reported Ever Having a Mammogram by Educational Attainment, California, 1987-2000



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
< HS grad	35.3	55.3	55.1	60.2	62.5	61.6	65.4	68.1	78.6	82.0	80.7	77.1	74.3	86.7
HS grad +	50.2	64.5	67.9	73.6	81.1	81.2	85.6	86.1	86.5	87.4	88.7	88.9	89.2	90.8

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 7.2 Women Who Reported Having a Screening Mammogram by Age, California, 1987-2000

Age	18 - 29			30 - 39			40 - 49			50 - 59			60 - 69			70 - 79			80+		
Year	%	95% CI* Lower	Upper	%	95% CI* Lower	Upper	%	95% CI* Lower	Upper	%	95% CI* Lower	Upper	%	95% CI* Lower	Upper	%	95% CI* Lower	Upper	%	95% CI* Lower	Upper
Ever Had a Mammogram (%)																					
1987	5.9	2.9	8.8	20.6	14.6	26.6	47.5	37.4	57.6	52.9	41.8	64.1	49.5	37.9	61.0	36.1	24.6	47.6	45.6	26.4	64.8
1988	8.1	4.4	11.8	22.3	17.4	27.2	61.4	52.9	67.9	67.3	56.3	78.3	68.3	59.3	77.3	58.4	47.2	69.6	43.0	25.7	60.2
1989	11.0	7.0	15.1	25.2	20.0	30.5	55.6	47.4	63.7	74.2	65.1	83.4	70.1	60.6	81.3	75.3	65.7	85.0	46.1	30.8	61.3
1990	11.3	7.1	15.5	31.9	26.4	37.4	69.3	62.6	76.1	70.9	62.5	79.3	74.1	65.8	82.5	74.1	65.1	83.1	51.6	34.3	68.9
1991	13.4	9.4	17.4	34.0	28.8	39.3	78.4	72.5	84.2	77.8	70.4	85.2	81.4	73.3	89.5	78.0	70.0	85.9	67.3	52.8	81.8
1992	9.5	6.6	12.4	26.1	22.1	30.0	73.2	68.1	78.4	83.1	77.6	88.6	79.3	73.2	85.3	82.0	75.2	88.9	66.3	54.5	78.2
1993	12.4	9.0	15.9	32.6	27.9	37.3	76.0	71.1	80.9	88.0	83.0	93.0	86.5	81.0	92.0	88.2	82.7	93.7	71.5	60.0	83.1
1994	9.7	6.8	12.7	27.6	23.3	31.9	79.0	74.3	83.8	83.9	78.7	89.2	84.9	79.5	90.3	89.8	85.2	94.5	74.7	63.2	86.2
1995	11.8	8.6	14.9	23.2	19.2	27.1	77.7	73.1	82.3	89.0	83.3	94.7	90.6	86.6	94.7	90.6	85.6	95.6	76.1	65.8	86.5
1996	8.2	5.3	11.0	23.5	19.5	27.4	80.7	76.4	85.1	89.7	85.4	93.9	88.3	83.7	92.8	93.1	89.8	96.5	80.3	70.2	90.3
1997	7.9	5.0	10.8	22.0	18.1	25.8	78.6	74.1	83.2	92.1	88.2	95.9	93.4	90.2	96.7	89.6	84.9	94.2	88.2	82.0	94.4
1998	6.7	4.0	9.4	19.7	16.1	23.3	78.9	74.5	83.3	90.3	86.3	94.3	91.2	87.1	95.4	92.9	88.6	97.2	87.9	78.7	96.8
1999	11.6	8.1	15.1	20.7	17.0	24.4	88.5	76.5	84.6	91.4	87.8	95.1	92.3	88.2	96.4	84.1	77.2	91.1	92.9	85.9	100.0
2000	6.0	3.5	8.5	19.9	16.2	23.7	81.7	77.6	85.7	94.3	90.9	97.6	92.5	87.8	97.2	95.9	92.7	99.0	95.2	90.6	99.8
Had a Mammogram Within the Last Two Years (%)																					
1987	4.2	1.7	6.7	14.7	9.3	20.2	43.5	33.6	53.4	41.2	30.4	52.2	36.6	25.5	47.7	30.1	19.1	41.2	29.9	12.2	47.6
1988	6.1	2.8	9.5	19.9	15.2	24.6	55.6	48.0	63.1	59.0	48.0	70.1	58.7	49.0	68.4	51.2	40.3	62.2	35.8	18.9	52.7
1989	11.0	6.9	15.0	19.9	15.2	24.7	50.4	42.3	58.6	63.3	53.6	73.0	63.9	53.5	74.4	62.7	51.2	74.2	34.2	19.6	48.8
1990	9.1	57.1	12.5	26.5	21.3	31.8	61.0	53.9	68.1	63.9	55.0	72.9	64.9	55.9	73.8	62.9	53.1	72.8	28.5	12.3	44.6
1991	11.6	7.9	15.3	30.4	25.3	35.6	71.1	64.6	77.6	69.8	62.0	77.6	72.9	64.2	81.5	66.1	56.9	75.4	57.8	42.4	73.1
1992	6.2	3.9	8.6	21.7	18.0	25.5	60.8	55.0	66.5	74.7	68.4	81.1	68.8	61.9	75.7	73.9	66.2	81.6	56.1	43.9	68.3
1993	9.4	6.3	12.5	24.0	19.7	28.3	65.5	60.2	70.9	75.4	69.1	81.8	74.2	67.3	81.2	73.8	66.5	81.2	61.1	49.1	73.1
1994	7.6	4.9	10.2	20.5	16.6	24.4	66.3	60.9	71.6	75.5	69.3	81.6	74.3	67.9	80.7	78.3	72.1	84.6	55.1	42.7	67.4
1995	8.6	5.9	11.3	15.2	11.9	18.4	61.9	56.5	67.2	80.9	74.5	87.2	80.8	75.3	86.4	80.2	74.0	86.5	62.2	50.9	73.5
1996	4.9	2.8	7.0	16.2	12.8	19.5	61.8	56.5	67.1	79.1	73.8	84.4	75.6	69.2	82.0	84.3	79.2	89.4	58.1	46.0	70.1
1997	5.0	2.6	7.3	14.7	11.3	18.1	61.9	56.7	67.1	81.2	76.1	86.4	80.7	74.8	86.7	73.9	67.4	80.4	66.1	55.8	76.3
1998	5.7	3.1	8.3	11.0	8.2	13.7	61.9	56.7	67.1	81.2	76.3	86.2	79.6	73.2	86.0	83.5	77.5	89.6	77.4	66.7	88.1
1999	8.2	5.3	11.1	13.4	10.4	16.4	64.3	59.6	69.0	82.8	78.2	87.4	82.5	76.8	88.2	77.3	69.8	84.8	74.7	64.3	85.2
2000	4.8	2.5	7.1	13.3	10.2	16.5	68.1	63.2	73.0	82.1	76.9	87.3	85.9	80.0	91.8	88.7	83.8	93.6	69.9	58.8	81.0
Had a Mammogram Within the Last Year (%)																					
1987	2.5	0.6	4.4	12.6	7.5	17.7	34.1	24.9	43.3	36.8	25.9	47.6	27.0	16.8	37.2	26.4	15.7	37.0	24.7	8.4	41.0
1988	5.6	2.3	8.9	15.4	11.1	19.7	47.2	39.5	54.8	45.9	35.1	56.6	46.4	36.4	56.4	40.8	30.5	51.1	31.0	14.5	47.6
1989	8.9	5.2	12.5	13.7	9.8	17.7	39.7	31.7	47.7	51.8	41.9	61.8	52.6	42.2	63.1	47.4	35.0	59.7	29.8	15.7	43.9
1990	6.9	4.0	9.7	23.0	17.9	28.1	41.9	34.8	49.0	53.6	44.5	62.8	55.9	46.5	65.2	54.3	44.2	64.4	26.4	10.4	42.3
1991	9.0	5.6	12.4	22.4	17.6	27.1	54.3	46.9	61.7	57.8	49.6	66.0	58.5	49.3	67.8	52.8	43.3	62.3	49.8	34.1	65.4
1992	4.6	2.6	6.6	15.1	11.9	18.2	46.1	40.3	51.9	62.1	55.0	69.2	59.3	52.0	66.6	59.7	51.1	68.3	38.8	26.7	50.9
1993	8.7	5.7	11.8	17.0	13.2	20.8	47.4	41.9	53.0	59.1	52.0	66.3	64.3	56.8	71.8	60.0	52.0	68.0	42.8	30.8	54.8
1994	5.6	3.3	7.9	11.5	8.4	14.5	48.8	43.2	54.3	58.8	51.8	65.7	58.8	51.6	66.0	61.2	53.7	68.8	47.2	35.0	59.4
1995	5.0	2.8	7.1	10.9	8.1	13.8	40.8	35.5	46.1	65.5	58.1	72.8	69.6	63.1	76.0	61.3	53.8	68.8	47.5	35.8	59.3
1996	4.4	2.3	6.4	10.1	7.4	12.9	42.8	37.4	48.1	64.8	58.5	71.0	64.3	57.1	71.4	70.8	64.2	77.3	35.2	23.5	46.9
1997	4.2	1.9	6.4	9.7	6.9	12.6	39.0	33.8	44.2	68.2	62.2	74.1	64.9	57.8	72.1	58.0	50.7	65.2	52.1	40.9	63.4
1998	4.4	2.0	6.8	7.1	4.8	9.5	45.6	40.2	50.9	65.0	58.8	71.3	68.3	61.2	75.4	67.9	60.3	75.5	55.6	42.7	68.5
1999	7.0	4.2	9.7	10.1	7.5	12.7	49.0	44.1	53.8	67.9	62.2	73.6	65.6	58.4	72.8	65.3	57.2	73.4	59.0	47.6	70.4
2000	4.1	2.0	6.3	9.7	6.9	12.6	53.6	48.3	58.8	63.6	57.5	69.7	75.5	68.6	82.5	72.2	64.9	79.5	56.7	44.5	68.8
No. Women																					
1987	256			229			127			104			106			84			30		
1988	310			349			219			115			140			108			35		
1989	324			306			188			131			119			87			49		
1990	331			350			241			137			134			113			38		
1991	371			374			225			186			142			133			46		
1992	476			525			353			229			208			161			69		
1993	415			432			379			235			188			173			74		
1994	481			488			401			247			213			178			76		
1995	446			493			409			221			225			195			79		
1996	431			499			396			292			214			210			77		
1997	395			491			422			297			218			223			88		
1998	419			530			417			308			199			182			64		
1999	395			527			510			320			198			176			88		
2000	428			510			438			351			191			172			71		

Excludes women whose most recent mammogram was done for a breast problem or cancer.
*Confidence Interval.
Source: California Behavioral Risk Factor Surveillance System. Weighted to the 1990 California population.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 7.3 Women Who Reported Having a Mammogram by Educational Attainment, California, 1987–2000

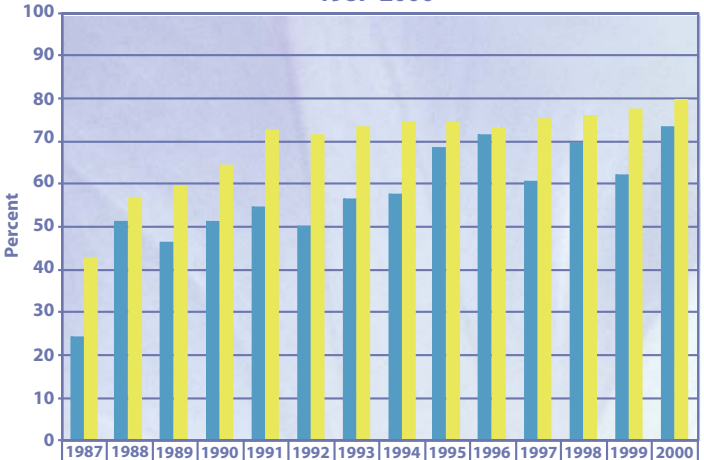
	Not High School Graduates										High School Graduates									
		Ever Had (%)			Had Within Last Two Years (%)			Had Within Last Year (%)				Ever Had (%)			Had Within Last Two Years (%)			Had Within Last Year (%)		
Year	N	%	95% CI* Lower	95% CI* Upper	%	95% CI* Lower	95% CI* Upper	%	95% CI* Lower	95% CI* Upper	N	%	95% CI* Lower	95% CI* Upper	%	95% CI* Lower	95% CI* Upper	%	95% CI* Lower	95% CI* Upper
Age 40 and Over																				
1987	75	35.3	22.7	47.9	24.0	13.0	35.0	19.7	10.0	29.3	375	50.2	44.4	56.0	42.3	36.6	48.0	34.4	28.8	39.9
1988	91	55.3	41.8	68.8	51.0	37.5	64.6	38.0	25.2	50.8	525	64.5	59.8	69.2	56.6	51.7	61.4	46.6	41.7	51.4
1989	85	55.1	42.5	67.7	46.4	33.8	58.9	38.7	26.5	50.9	488	67.9	63.2	72.6	59.4	54.5	64.4	47.3	42.3	52.3
1990	122	60.2	50.2	70.2	51.1	41.0	61.2	38.4	28.6	48.1	540	73.6	69.5	77.7	64.2	59.7	68.7	51.8	47.1	56.5
1991	104	62.5	51.4	73.5	54.6	43.5	65.8	45.3	34.3	56.4	625	81.1	77.6	84.6	72.3	68.3	76.3	57.4	53.0	61.8
1992	147	61.6	52.6	70.5	49.8	40.6	59.1	40.4	31.3	49.4	872	81.2	78.4	84.0	71.3	68.0	74.6	57.4	53.8	60.9
1993	136	65.4	56.4	74.4	56.5	47.1	65.8	49.6	40.2	59.1	911	85.6	82.9	88.2	73.2	70.0	76.4	56.4	52.8	59.9
1994	180	68.1	61.1	75.9	57.3	49.1	65.6	42.7	34.4	51.0	933	86.1	83.5	88.6	74.3	71.2	77.4	57.7	54.2	61.2
1995	172	78.6	71.2	86.0	68.4	60.4	76.4	50.7	42.1	59.2	953	86.5	84.0	89.0	74.2	71.1	77.3	57.4	53.9	60.9
1996	153	82.0	75.0	88.9	71.3	63.3	79.3	55.0	46.0	64.0	1,031	87.4	85.1	89.6	72.7	69.7	75.7	57.1	53.8	60.4
1997	167	80.7	74.0	87.4	60.4	52.0	68.7	43.6	35.1	52.0	1,077	88.7	86.5	90.8	75.2	72.3	78.0	57.6	54.4	60.9
1998	143	77.1	69.2	85.0	69.3	60.6	78.0	55.5	46.0	65.0	1,026	88.9	86.8	91.0	75.8	72.9	78.7	60.0	56.7	63.3
1999	176	74.3	66.7	82.0	62.1	53.9	70.4	50.1	41.7	58.5	1,113	89.2	87.1	91.3	77.5	74.8	80.2	61.8	58.7	65.0
2000	132	86.7	79.8	93.5	73.4	64.5	82.2	56.8	47.1	66.4	1,090	90.8	88.9	92.7	79.5	76.8	82.2	64.7	61.4	67.9
Age 50 and Over																				
1987	64	39.2	25.3	53.1	24.6	12.4	36.8	19.0	8.8	29.3	259	49.3	42.3	56.3	39.6	32.7	46.5	33.3	26.5	40.1
1988	73	55.8	40.1	71.5	51.9	36.1	67.6	35.3	21.1	49.5	324	66.3	60.4	72.1	56.6	50.5	62.7	46.3	40.2	52.4
1989	70	64.4	50.3	78.5	54.7	40.4	68.9	44.9	30.9	58.9	316	72.2	66.7	77.7	61.9	56.0	67.9	49.9	43.7	56.1
1990	95	60.2	49.0	71.4	50.0	38.7	61.3	43.1	31.9	54.3	326	75.1	70.0	80.2	65.2	59.6	70.9	55.7	49.8	61.5
1991	89	63.0	50.9	75.2	55.2	43.0	67.3	43.9	32.1	55.7	415	81.6	77.2	86.0	72.0	67.0	76.9	59.0	53.7	64.3
1992	120	62.6	52.6	72.6	54.1	43.8	64.4	43.6	33.4	53.8	546	84.7	81.5	88.0	75.4	71.5	79.3	62.5	58.1	66.9
1993	100	73.0	62.9	83.0	63.5	52.9	74.1	57.5	46.6	68.4	568	88.8	85.9	91.8	75.6	71.6	79.6	60.2	55.7	64.6
1994	127	74.4	65.9	82.8	63.6	54.3	72.9	50.2	40.4	59.9	585	87.2	84.1	90.3	76.1	72.3	79.9	60.1	55.7	64.4
1995	125	85.3	77.3	93.2	73.9	64.9	82.9	54.4	44.4	64.4	592	89.8	86.9	92.6	80.3	76.8	83.9	66.7	62.5	70.8
1996	115	85.6	78.4	92.9	74.0	65.2	82.8	57.4	47.1	67.7	674	90.2	87.7	92.6	78.4	75.0	81.8	64.8	60.9	68.8
1997	118	91.3	86.2	96.5	69.1	59.6	78.5	52.6	42.5	62.8	705	91.8	89.6	94.1	79.9	76.7	83.2	65.6	61.7	69.5
1998	96	84.5	76.0	93.0	79.1	69.8	88.4	65.2	54.3	76.0	656	92.2	89.9	94.4	81.2	77.9	84.6	65.9	61.8	70.0
1999	118	76.2	66.8	85.6	67.6	57.8	77.4	53.5	43.3	63.7	661	93.2	91.0	95.4	83.7	80.6	86.8	68.6	64.7	72.5
2000	91	88.0	79.8	96.2	73.8	63.1	84.5	55.9	44.2	67.6	693	95.4	93.5	97.3	85.4	82.3	88.4	70.5	66.6	74.4

Excludes women whose most recent mammogram was done for a breast problem or cancer.
*Confidence Interval.
Source: California Behavioral Risk Factor Surveillance System. Weighted to the 1990 California population.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Income

Screening rates have improved significantly since 1987 regardless of income. More lower income women reported having had a screening mammogram than ever before (with low income defined as a reported household income of less than $15,000 annually). Although only 32.5 percent of lower income women aged 40 and older reported having ever received a

Figure 7.5
Women Age 40+ Who Reported Having a Mammogram in the Last Two Years by Educational Attainment, California, 1987-2000



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
< HS grad	24.0	51.0	46.4	51.1	54.6	49.8	56.5	57.3	68.4	71.3	60.4	69.3	62.1	73.4
HS grad +	42.3	56.6	59.4	64.2	72.3	71.3	73.2	74.3	74.2	72.7	75.2	75.8	77.5	79.5

Prepared by the California Department of Health Services, Cancer Surveillance Section.

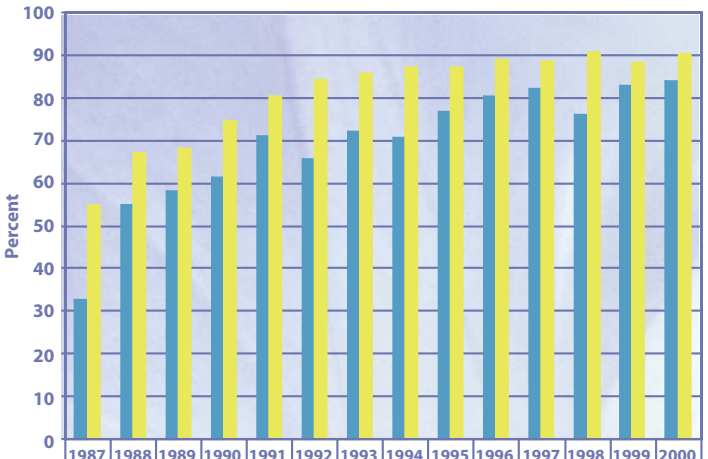
Table 7.4 Women Who Reported Having a Mammogram by Income Level: California 1987 - 2000

	Income of Less Than $15,000									Income of $15,000 or More								
		Ever Had (%)			Had Within Last Two Years (%)			Had Within Last Year (%)			Ever Had (%)			Had Within Last Two Years (%)			Had Within Last Year (%)		
Year	N	%	95% CI* Lower	95% CI* Upper	%	95% CI* Lower	95% CI* Upper	%	95% CI* Lower	95% CI* Upper	N	%	95% CI* Lower	95% CI* Upper	%	95% CI* Lower	95% CI* Upper	%	95% CI* Lower	95% CI* Upper
Age 40 and Over																				
1987	143	32.5	23.6	41.4	25.2	16.9	33.5	18.7	11.5	25.9	239	54.9	47.9	61.9	47.2	40.2	54.2	38.7	31.9	45.5
1988	184	55.0	46.0	64.1	49.0	40.0	58.0	38.5	30.2	46.9	372	66.9	61.5	72.3	59.2	53.6	64.9	48.4	42.6	54.1
1989	143	58.1	48.3	67.8	50.3	40.5	60.1	43.5	33.8	53.2	358	68.0	62.3	73.6	59.5	53.7	65.4	47.1	41.2	53.0
1990	188	61.4	53.3	69.5	48.7	40.4	56.9	40.4	32.4	48.4	430	74.6	70.0	79.1	66.9	62.0	71.9	53.4	48.2	58.7
1991	204	71.2	64.0	78.4	60.1	52.4	67.8	47.9	40.0	55.7	473	80.3	76.1	84.6	73.7	69.1	78.3	58.8	53.8	63.8
1992	301	65.5	59.4	71.6	54.7	48.3	61.1	42.8	36.4	49.1	641	84.3	81.2	87.4	73.5	69.6	77.3	59.3	55.1	63.5
1993	274	72.0	66.0	78.1	55.5	48.9	62.1	42.0	35.4	48.6	685	85.6	82.5	88.7	75.6	71.9	79.2	59.2	55.2	63.3
1994	276	70.7	64.3	77.1	56.4	49.7	63.0	43.4	36.8	50.0	744	87.1	84.5	89.8	76.0	72.6	79.4	57.7	53.7	61.6
1995	260	76.8	70.9	82.6	65.6	59.1	72.0	50.8	44.0	57.6	737	87.2	84.4	90.0	75.3	71.8	78.8	58.1	54.1	62.0
1996	257	80.2	74.8	85.6	68.2	62.0	74.5	53.3	46.5	60.2	793	88.8	86.4	91.2	74.0	70.6	77.4	58.8	55.0	62.5
1997	274	82.0	76.7	87.3	66.2	59.7	72.6	49.8	43.1	56.6	875	88.6	86.2	91.1	74.3	71.0	77.6	56.5	52.8	60.1
1998	241	76.1	69.9	82.2	64.3	57.2	71.3	49.5	42.0	56.9	840	90.7	88.6	92.8	77.4	74.3	85.5	60.9	57.2	64.6
1999	256	82.7	77.2	88.2	62.4	55.6	69.1	47.6	40.8	54.5	938	88.1	85.6	90.5	78.0	75.0	81.0	62.1	58.6	65.6
2000	187	84.0	77.7	90.2	69.0	61.4	76.6	59.8	51.8	67.9	931	90.5	88.4	92.7	79.3	76.3	82.3	63.2	59.7	66.7
Age 50 and Over																				
1987	124	35.2	25.2	45.1	27.4	18.1	36.8	20.2	12.0	28.3	142	54.0	45.0	62.9	43.2	34.4	52.1	37.2	28.5	45.9
1988	155	53.9	43.9	63.8	47.0	37.0	56.9	34.7	26.1	43.3	193	72.2	65.2	79.1	62.6	55.1	70.2	50.9	43.1	58.8
1989	119	65.1	54.5	75.6	57.5	46.7	68.3	50.0	39.1	60.9	207	73.7	66.7	80.8	62.3	54.8	69.8	49.9	42.2	57.6
1990	154	61.9	53.3	70.5	49.9	41.1	57.8	43.5	34.7	52.3	235	77.1	71.2	83.0	68.5	62.0	75.1	59.5	52.6	66.4
1991	173	72.7	64.9	80.6	59.9	51.5	68.3	47.8	39.3	56.3	284	80.1	74.4	85.8	74.5	68.5	80.5	61.5	55.1	68.0
1992	245	66.5	59.7	73.3	56.9	49.8	64.0	46.1	39.0	53.2	361	90.6	87.3	93.8	80.5	76.1	85.0	66.3	61.0	71.7
1993	223	76.3	69.9	82.8	59.5	52.2	66.8	46.2	38.8	53.7	370	89.9	86.1	93.6	79.5	74.7	84.3	64.8	59.4	70.3
1994	195	76.4	69.8	83.0	60.7	53.2	68.2	48.4	40.7	56.0	441	88.7	85.3	92.0	79.1	74.9	83.3	60.8	55.8	65.9
1995	200	79.1	72.6	85.5	67.7	60.5	74.8	53.3	45.7	61.0	416	92.5	89.5	95.5	83.6	79.7	87.6	70.1	65.3	74.9
1996	208	84.3	78.9	89.8	72.7	66.1	79.3	58.7	51.1	66.2	469	92.0	89.3	94.7	81.1	77.1	85.0	68.3	63.8	72.9
1997	205	90.1	85.8	94.5	73.1	66.2	79.9	58.5	50.9	66.1	535	92.8	90.2	95.4	80.5	76.6	84.4	65.8	61.2	70.3
1998	183	82.1	75.7	88.5	68.9	61.0	76.7	52.6	44.0	61.2	496	94.8	92.6	96.9	85.1	81.6	88.6	69.1	64.5	73.6
1999	173	87.6	81.9	93.2	72.1	64.8	79.5	54.1	46.0	62.2	537	91.6	88.6	94.6	83.6	79.9	87.3	68.5	64.0	73.0
2000	133	89.1	82.3	96.0	73.7	65.2	82.2	63.2	53.8	72.5	566	94.8	92.5	97.0	85.1	81.6	88.6	68.6	64.2	73.0

Excludes women whose most recent mammogram was done for a breast problem or cancer.
*Confidence Interval.
Source: California Behavioral Risk Factor Surveillance System. Weighted to the 1990 California population.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

screening mammogram in 1987, 84 percent reported this in 2000 (Table 7.4 and Figure 7.6). Women with higher incomes reported having had a screening mammogram in 2000 as well. The screening rate among this group increased from 54.9 percent in 1987 to 90.5 percent in 2000. A similar screening pattern occurred among women aged 50 and older.

Figure 7.6
Women Age 40+ Who Reported Ever Having a Mammogram by Income, California, 1987-2000



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
< $15,000	32.5	55.0	58.1	61.4	71.2	65.5	72.0	70.7	76.8	80.2	82.0	76.1	82.7	84.0
$15,000+	54.9	66.9	68.0	74.6	80.3	84.3	85.6	87.1	87.2	88.8	88.6	90.7	88.1	90.5

Prepared by the California Department of Health Services, Cancer Surveillance Section.

The proportion of lower income women reporting having received a mammogram within the prior two years continues to lag behind that of higher income women. Among women aged 40 and older, lower income women are close to but have not achieved the HP2010 objective for screening, whereas women in the higher income group have achieved this objective since 1991 (Table 7.4 and Figure 7.7). The picture is somewhat brighter for women aged 50 and older. Both lower and higher income women achieved this objective. However, regardless of income, both lower and higher income women fall short of achieving the ACS goal for annual mammogram screening.

Table 7.5 Mammography Screening Among Women Aged 40 and Over by Race/Ethnicity, California 1987 - 2000

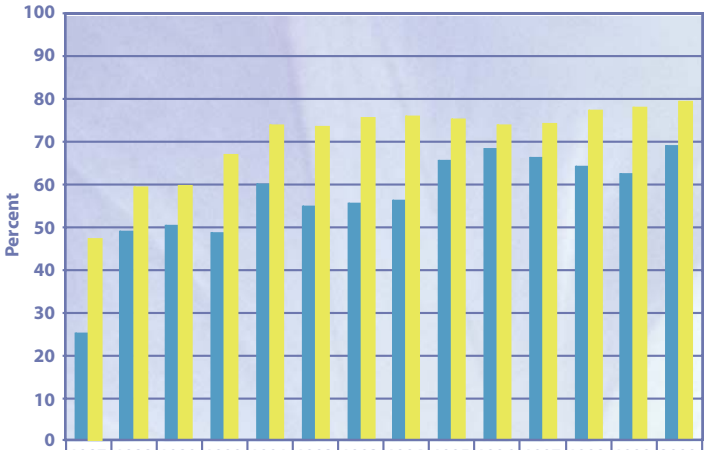
Year	N	Ever Had (%)			Had Within Last Two Years (%)			Had Within Last Year (%)		
		%	95% CI*		%	95% CI*		%	95% CI*	
			Lower	Upper		Lower	Upper		Lower	Upper
White										
1987 - 1989	1,314	61.4	58.5	64.3	53.0	50.0	56.0	42.9	40.0	45.9
1990 - 1992	1,825	79.0	76.9	81.1	69.8	67.5	72.2	56.1	53.5	58.6
1993 - 1994	1,590	86.4	84.5	88.4	74.2	71.8	76.6	56.8	54.1	59.5
1995 - 1996	1,721	86.5	84.6	88.3	72.8	70.4	75.2	55.6	53.0	58.2
1997 - 1998	1,798	88.7	87.0	90.4	74.2	71.9	76.5	57.0	54.4	59.5
1999 - 2000	1,738	90.0	88.3	91.6	77.6	75.4	79.9	62.0	59.4	64.5
Black										
1987 - 1989	104	73.3	64.0	82.6	62.1	51.8	72.3	50.5	39.7	61.3
1990 - 1992	133	78.5	71.2	85.9	65.7	56.9	74.5	54.8	45.4	64.3
1993 - 1994	130	85.5	78.5	92.4	71.5	62.7	80.3	52.3	42.5	62.0
1995 - 1995	121	94.1	89.9	98.3	81.7	74.3	89.2	65.3	56.0	74.6
1997 - 1998	119	88.0	81.7	94.3	75.8	67.5	84.0	63.2	53.6	72.9
1999 - 2000	138	93.5	88.9	98.1	79.5	72.2	86.8	60.8	51.6	70.0
Hispanic										
1987 - 1989	149	47.9	37.3	58.5	43.2	32.7	53.8	31.8	22.9	40.6
1990 - 1992	340	66.8	61.0	72.6	56.5	50.5	62.6	44.7	38.6	50.7
1993 - 1994	304	71.4	65.4	77.4	62.5	56.1	68.9	52.7	46.1	59.4
1995 - 1996	349	82.3	77.8	86.8	72.2	66.8	77.5	56.8	50.7	62.9
1997 - 1998	358	81.7	77.1	86.3	70.7	65.1	76.3	54.4	48.0	60.8
1999 - 2000	391	82.9	78.2	87.7	73.8	68.5	79.1	59.6	53.7	65.5
Asian/Other										
1987 - 1989	75	52.9	37.5	66.4	43.2	29.4	57.1	35.9	22.0	49.8
1990 - 1992	117	66.5	56.1	76.9	60.0	49.4	70.5	50.1	39.5	60.8
1993 - 1994	140	70.3	60.9	79.6	61.3	51.6	71.1	51.6	41.8	61.4
1995 - 1996	127	83.1	75.7	90.5	63.1	53.3	73.0	50.7	40.4	61.0
1997 - 1998	143	87.1	80.8	93.4	73.7	65.4	82.0	59.5	49.9	69.1
1999 - 2000	144	78.7	70.2	87.1	66.3	57.0	75.7	52.3	42.6	61.9

Excludes women whose most recent mammogram was done for a breast problem or cancer.
*Confidence Interval.
Source: California Behavioral Risk Factor Surveillance System. Age-adjusted to the 1990 California population.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Race/Ethnicity

Regardless of race or ethnicity, the proportion of California women reporting having ever received a screening mammogram increased between 1987 and 2000 (Table 7.5, Figure 7.8). Rate differences are noted, however. Screening among white women increased significantly between the years 1987-1989 and 1993-1994, but increases in screening rates stabilized after 1994. A similar pattern of screening was seen among black women with screening rate increases stabilizing during the mid-1990s. Hispanic women reported significant increases in ever having a screening mammogram between 1987-1989 and 1990-1992, and again between 1993-1994 and 1995-1996. Screening rate increases among Hispanic women stabilized during the late 1990s. More intermittent increases in screening were reported by women in the Asian/Other category.

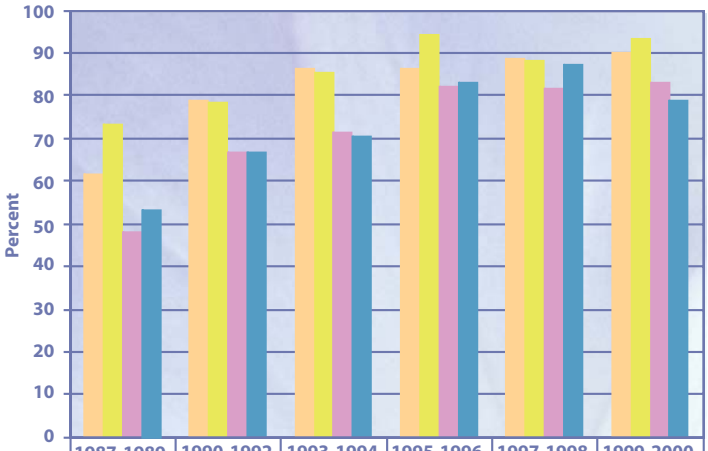
Figure 7.7
Women age 40+ Who Reported Having a Mammogram in the Last Two Years by Income, California, 1987-2000



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
< $15,000	25.2	49.0	50.3	48.7	60.1	54.7	55.5	56.4	65.6	68.2	66.2	64.3	62.4	69.0
$15,000+	47.2	59.2	59.5	66.9	73.7	73.5	75.6	76.0	75.3	74.0	74.3	77.4	78.0	79.3

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 7.8
Women Age 40+ Who Reported Ever Having a Mammogram by Race/Ethnicity, California, 1987-2000



	1987-1989	1990-1992	1993-1994	1995-1996	1997-1998	1999-2000
White	61.4	79.0	86.4	86.5	88.7	90.0
Black	73.3	78.5	85.5	94.1	88.0	93.5
Hispanic	47.9	66.8	71.4	82.3	81.7	82.9
Asian\Other	52.9	66.5	70.3	83.1	87.1	78.7

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 7.6 Mammography Among Women by Age and Race/Ethnicity: California 1999-2000

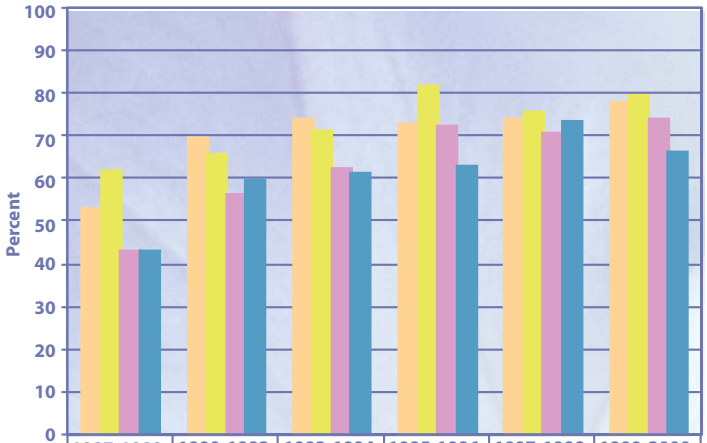
Race/Ethnicity	N	Ever Had (%)			Had Within Last Two Years (%)			Had Within Last Year (%)		
		%	95% CI*		%	95% CI*		%	95% CI*	
			Lower	Upper		Lower	Upper		Lower	Upper
Age 40 - 49										
White	582	82.2	78.6	85.8	66.5	62.1	70.9	50.9	46.3	55.5
Black	61	94.2	88.7	99.7	79.9	69.5	90.2	60.1	46.7	73.5
Hispanic	198	79.6	73.4	85.8	66.6	59.2	73.9	55.3	47.5	63.0
Asian/Other	69	66.5	53.0	80.0	53.6	40.1	67.1	36.0	23.8	48.2
Age 50 - 59										
White	475	95.8	93.8	97.8	84.8	81.2	88.5	66.7	61.9	71.5
Black	28	97.2	91.8	100.0	87.8	77.1	98.5	52.3	31.6	73.1
Hispanic	94	85.7	76.4	95.1	77.5	67.0	87.9	64.3	52.6	75.9
Asian/Other	38	80.5	66.2	94.8	72.3	55.7	89.0	55.3	37.1	73.5
Age 60 - 69										
White	281	94.2	91.4	97.1	86.0	81.6	90.3	71.5	65.8	77.2
Black	30	90.6	80.2	100.0	73.3	55.9	90.7	60.3	40.7	79.8
Hispanic	41	87.6	76.6	98.5	82.1	69.4	94.8	64.8	48.7	81.0
Asian/Other	24	82.9	61.2	100.0	74.1	52.1	96.0	68.5	46.2	90.7
Age 70+										
White	400	92.6	89.4	95.8	81.2	76.9	85.5	67.6	62.5	72.7
Black	19	92.0	77.0	100.0	78.2	58.9	97.5	70.2	48.8	91.6
Hispanic	58	81.7	69.1	94.2	74.9	61.6	88.3	57.3	42.5	72.1
Asian/Other	13	100.0	100.0	100.0	77.0	52.7	100.0	63.2	35.0	91.4

Excludes women whose most recent mammogram was done for a breast problem or cancer.
*Confidence Interval.
Source: California Behavioral Risk Factor Surveillance System. Age-adjusted to the 1990 California population.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

The pattern of women who reported receiving a mammogram during the past two years was similar to that seen among women who reported having ever had a screening mammogram (Table 7.5, Figure 7.9). The proportion of white women reporting having a mammogram during the prior two years increased from 1987-1989 to 1990-1992 and then reached a plateau. Black and Hispanic women reported increases in screening during the past two years for each period until 1995-1996 and then stabilized. For Asian/Other women, increases in rates reported for screening during the prior two years was intermittent.

A comparison of women by age group and race/ethnicity shows that, in general, a larger proportion of white and black women reported having had a screening mammogram in 1999 - 2000 than did Hispanic and Asian/Other women (Table 7.6, Figure 7.10). However, none of the differences was statistically significant. White,

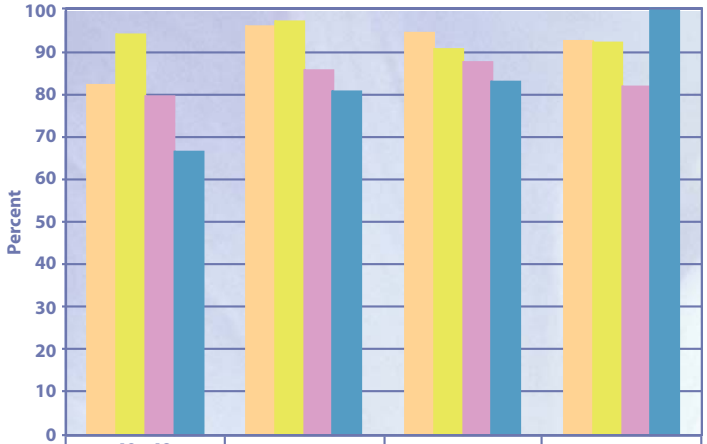
Figure 7.9
Women Age 40+ Who Reported Having a Mammogram During the Last Two Years by Race/Ethnicity, California, 1987-2000



	1987-1989	1990-1992	1993-1994	1995-1996	1997-1998	1999-2000
White	53.0	69.8	74.2	72.8	74.2	77.6
Black	62.1	65.7	71.5	81.7	75.8	79.5
Hispanic	43.2	56.5	62.5	72.2	70.7	73.8
Asian\Other	43.2	60.0	61.3	63.1	73.7	66.3

Prepared by the California Department of Health Services, Cancer Surveillance Section.

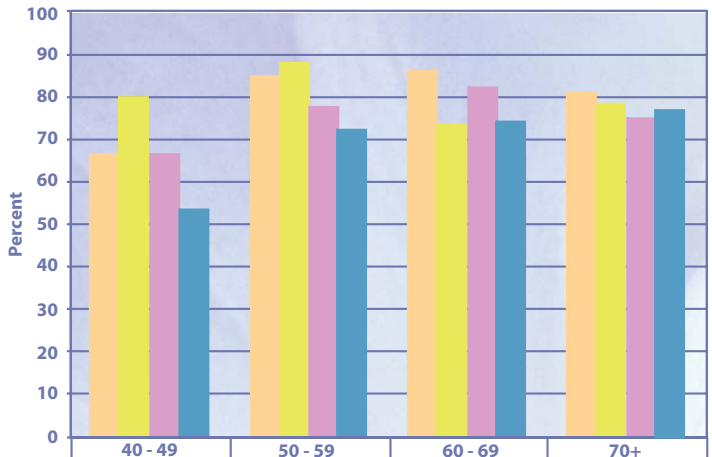
Figure 7.10
Women Who Reported Ever Having a Mammogram by Age and Race/Ethnicity, California, 1999-2000



	40 - 49	50 - 59	60 - 69	70+
White	82.2	95.8	94.2	92.6
Black	94.2	97.2	90.6	92.0
Hispanic	79.6	85.7	87.6	81.7
Asian\Other	66.5	80.5	82.9	100.0

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 7.11
Women Who Reported Having a Mammogram in the Last Two Years by Age and Race/Ethnicity, California, 1999-2000



	40 - 49	50 - 59	60 - 69	70+
White	66.5	84.8	86.0	81.2
Black	79.9	87.8	73.3	78.2
Hispanic	66.6	77.5	82.1	74.9
Asian\Other	53.6	72.3	74.1	77.0

Prepared by the California Department of Health Services, Cancer Surveillance Section.

black, and Hispanic women aged 50 to 59, 60 to 69, and 70 and older met the HP2010 objective that 70 percent be screened during the prior two years. Among women aged 40 to 49, only black women met this objective (Table 7.6, Figure 7.11). However, regardless of age or race/ethnicity, all women fell short of the more challenging ACS goal that 90 percent be screened during the past year.

Summary

Screening mammography use in California increased significantly between 1987 and 2000. However, most of this increase was achieved by the early 1990s. Since the mid-1990s, increases in the proportion of women aged 40 and over who report ever receiving a screening mammogram and the proportion of those receiving a mammogram in the prior year or prior two years, leveled off. The period since 1994 saw a reduction in the screening gap between less- and more-educated women, between poorer and richer women, among women regardless of race/ethnicity, and among women aged 70 and older. For the most part, California women have achieved the HP2010 objectives; however, much work remains if California women are to achieve the ACS screening goal by 2008.

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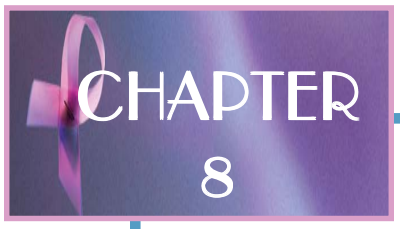

Stage at Diagnosis of Female Breast Cancer in California, 1988-1999

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Introduction

Breast cancer is the most commonly diagnosed cancer among women in California and the U.S. Each year in California approximately 25,000 women will be diagnosed with this disease and 4,000 will die from it (1). Like any form of cancer an early diagnosis (i.e., a diagnosis of an *in situ* cancer or a cancer that is locally disseminated) confers a much better prognosis than a diagnosis made at a later stage in the natural history of the disease. Nationwide, women with localized breast cancer have a five-year relative survival of 96.8 percent, whereas women who are not diagnosed with their disease until it has reached a remote stage have a five-year relative survival of only 22.5 percent (2). Therefore, early diagnosis is a critical issue and efforts to expand the numbers of women diagnosed at an early stage must be maintained and expanded.

Female breast cancer incidence, mortality, and survival patterns differ by race/ethnicity and age group. Nationwide, time trends in the early diagnosis of breast cancer have been improving for decades, but not all population subgroups may have benefited equally (3). This report is based on data collected by CCR. Breast cancer stage at diagnosis patterns for the 12-year period from 1988-1999 in California are presented by several demographic and diagnostic variables including age at diagnosis, race/ethnicity, SES, county and region of residence at diagnosis, and year of diagnosis. Since breast cancer has an association with increasing age and female hormonal balance, age at diagnosis was grouped into cases diagnosed ages 0-49 (premenopausal) and 50 and older (postmenopausal), for selected analysis.

Methods

Stage at diagnosis categories used in this report's analyses were based on the SEER summary stage system (SSS) (4), and were analyzed by the various demographic and diagnostic variables stated above. For each age group and race/ethnic group, both counts of newly diagnosed breast cancers and age-adjusted incidence rates (per 100,000 population) are presented. In this report we use four race/ethnic categories including non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic Asian/Pacific Islander. Race/ethnic categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.

Staging

Several different coding systems exist for describing stage at diagnosis. The American Joint Committee on Cancer (AJCC) classification of tumors uses information on tumor size (T), lymph node involvement (N), and spread of disease to other organs (M). This

classification is commonly used in the clinical settings (5). A second system used to stage cancers at the time of diagnosis is referred to as the SSS (4). This system is less complex than TNM and has remained relatively stable over the years. It does not take tumor size, depth of penetration, or grade into account, which are critical for the TNM (5).

In this report, tumors were staged consistent with SSS definitions (4) through conversion of SEER Extent of Disease (EOD) fields (6) present in the CCR database. Staging "*in situ*" describes tumors with characteristics of malignancy but which have not penetrated the basement membrane of the tissue nor extended beyond the epithelium. A "localized" tumor is defined as one which is malignant and invasive but confined entirely to the organ of origin. "Regional" neoplasms have extended beyond the organ of origin into surrounding tissues; involve regional lymph nodes; or both. Finally, "remote" tumors have spread to remote parts of the body either by direct extension or metastasis. For some of the analyses, stage is separated into early (*in situ* and localized) and late (regional and distant).

Socioeconomic Status (SES)

CCR does not collect information on the patient's SES. The five SES levels used in this report were derived from characteristics describing the patient's 1990 U.S. Census block group of residence. Research has shown that census data measured at the census block group level can be used to approximate an individual's SES level (7). SES characteristics were grouped in an index combining measures of occupation, income, education, and cost of living. The SES index was further categorized in five levels or quintiles, from the lowest (level 1) to the highest (level 5). A detailed description of the methodology used to create the SES index is available elsewhere (8).

Results

From 1988 through 1999, 258,849 women in California were diagnosed with breast cancer. For this 12-year period, the age-adjusted breast cancer incidence rate among women of all ages and race/ethnic groups combined was 128.8 per 100,000 for invasive disease (1). This overall rate is composed of several stage-specific rates of breast cancer and may mask any differences among the different stages.

Table 8.1
Age-Adjusted (2000 U.S. Population) Rates of Female Breast Cancer per 100,000 Population by Stage at Diagnosis, Age, and Race/Ethnicity, California , 1995-1999

	In Situ		Local		Regional		Remote		Unstaged	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate
All Races										
All ages	17,762	23.1	63,540	81.6	29,817	38.4	3,969	5.1	3,465	4.3
0-39	749	1.5	2,874	5.7	2,549	5.0	264	0.5	203	0.4
40-49	3,813	31.7	9,765	81.2	6,688	55.6	663	5.5	409	3.4
50-59	4,519	57.5	13,097	166.5	7,002	89.1	827	10.5	522	6.6
60-69	3,943	70.3	14,167	252.5	5,800	103.6	891	15.9	565	10.1
70+	4,738	63.2	23,637	314.1	7,778	103.3	1,324	17.5	1,766	23.0
Asian/Pacific Islander										
All ages	1,500	18.4	4,485	55.8	2,263	27.3	247	3.0	181	2.4
0-39	95	1.6	372	6.4	253	4.3	25	0.4	16	0.3
40-49	473	32.5	1,181	81.2	711	48.9	66	4.5	36	2.5
50-59	418	49.3	1,135	133.9	622	73.4	69	8.1	40	4.7
60-69	283	47.9	903	152.7	398	67.4	48	8.1	39	6.6
70+	231	37.9	894	147.5	279	46.0	39	6.4	50	9.0
Black										
All ages	944	19.9	3,044	64.4	2,000	41.0	356	7.5	237	5.2
0-39	58	1.6	254	6.8	251	6.7	36	1.0	16	0.4
40-49	211	25.1	591	70.1	493	58.5	76	9.0	34	4.0
50-59	230	44.5	708	136.8	489	94.6	68	13.1	42	8.1
60-69	228	66.5	663	192.6	372	108.2	80	23.3	43	12.5
70+	217	58.1	828	222.3	395	106.0	96	25.7	102	27.8
Hispanic										
All ages	1,733	12.8	6,488	48.8	4,059	28.1	522	3.8	413	3.0
0-39	110	0.8	603	4.2	643	4.5	74	0.5	59	0.4
40-49	472	18.0	1,449	55.0	1,225	46.3	117	4.4	90	3.4
50-59	457	31.4	1,459	100.4	910	62.6	121	8.3	94	6.5
60-69	379	40.1	1,454	153.9	668	70.6	107	11.3	70	7.4
70+	315	34.7	1,523	168.2	613	68.0	103	11.4	100	11.2
White										
All ages	13,140	26.2	48,871	93.9	21,259	42.3	2,796	5.4	2,277	4.1
0-39	463	1.7	1,616	6.1	1,382	5.2	127	0.5	91	0.3
40-49	2,570	36.6	6,430	91.6	4,212	60.0	396	5.6	176	2.5
50-59	3,307	66.3	9,678	194.0	4,924	98.8	560	11.2	273	5.5
60-69	2,955	80.1	11,026	298.1	4,317	117.1	644	17.4	353	9.6
70+	3,845	69.2	20,121	358.4	6,424	114.4	1,069	18.9	1,384	23.6

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Stage by Race/Ethnicity and Age at Diagnosis

Stage at diagnosis of breast cancer from 1995 through 1999 was examined by age and by race/ethnicity in Table 8.1. In this time period, for all ages and race/ethnic groups combined, the rate of *in situ* breast cancer was 23.1 per 100,000. This rate was found to be highest among white women (26.2 per 100,000) and was lowest among Hispanic women (12.8 per 100,000). Rates of *in situ* disease were intermediate among black and Asian/Pacific Islander women. In contrast, the rate of breast cancer diagnosed at remote stage was highest among blacks (7.5 per 100,000) and lowest among

Asian/Pacific Islander (3.0 per 100,000). Interestingly, the highest rate of unstaged breast cancer was also among black women (5.2 per 100,000). Rates of local disease paralleled the rates of *in situ* disease in regards to race/ethnicity. Rates for this stage were highest among white women and lowest among Hispanics.

From 1995-1999, for women diagnosed with breast cancer who were less than 40 years old, *in situ* diagnosis rate was 1.5 per 100,000, localized rate was 5.7 per 100,000, regional rate was 5.0 per 100,000, and remote rate was 0.5 per 100,000 (Table 8.1). Within each race/ethnic group, the rate of *in situ* breast cancer increased with age until the age group 60-69 and declined in the oldest age category of 70+ years (Table 8.1). Rates for localized and remote disease increased steadily with age. Regional rates increased steadily until age group 60-69 and remained steady for the 70+ group. The drop in the *in situ* rate at older ages for each race/ethnic group was accompanied by an increase in the local and remote rates. Regardless of age category, white and Asian/Pacific Islander women were more likely than black or Hispanic women to be diagnosed at an early stage.

Table 8.2
Percentage of Breast Cancers Diagnosed at an Early Stage (*In Situ* or Localized Tumors) by Socioeconomic Status (SES Level) and Race/Ethnicity, California, 1995-1999

SES Level[1]	All Stages Count	Early Stages Count	Early Stages Percent
All Races			
1 (Lowest)	10,947	6,603	60.3
2	16,442	10,818	65.8
3	19,203	12,788	66.6
4	21,437	14,593	68.1
5 (Highest)	25,464	17,924	70.4
All Levels	93,493	62,726	67.1
Asian/Pacific Islander			
1 (Lowest)	504	310	61.5
2	693	452	65.2
3	931	620	66.6
4	1,146	740	64.6
5 (Highest)	1,301	883	67.9
All Levels	4,575	3,005	65.7
Black			
1 (Lowest)	2,017	1,095	54.3
2	1,105	654	59.2
3	932	543	58.3
4	660	384	58.2
5 (Highest)	370	243	65.7
All Levels	5,084	2,919	57.4
Hispanic			
1 (Lowest)	2,470	1,337	54.1
2	2,032	1,154	56.8
3	1,712	1,029	60.1
4	1,439	908	63.1
5 (Highest)	1,068	677	63.4
All Levels	8,721	5,105	58.5
White			
1 (Lowest)	5,956	3,861	64.8
2	12,612	8,558	67.9
3	15,628	10,596	67.8
4	18,192	12,561	69.0
5 (Highest)	22,725	16,121	70.9
All Levels	75,113	51,697	68.8

1 SES level defined as an index combining seven Census 1990 block group measures of occupation, income, education, and cost of living.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Stage by SES

The analysis of data in Table 8.2 shows a clear association between stage at diagnosis and SES level in the patient's block group of residence. Such association was statistically significant for women of all race/ethnic groups. Breast cancer patients living in more affluent neighborhoods were more likely to be diagnosed at an early stage (i.e., with an *in situ* or localized tumor) than those living in lower SES areas. The impact of SES on stage at diagnosis was most pronounced among black patients, followed by Hispanic patients. Black women living in the most affluent areas were 60 percent more likely to be diagnosed at an early stage than those living in the poorest areas.

Patients among the white and Asian/Pacific Islander groups were also more likely to have their tumors diagnosed at an early stage if they lived in more affluent neighborhoods. However, the association between SES and stage at diagnosis within these two race/ethnic groups was less marked than what was observed among black and Hispanic women.

Time Trends

Trends of breast cancer incidence by stage at diagnosis between 1988 and 1999 were examined by age at diagnosis and race/ethnicity. For all race/ethnic groups combined (Table 8.3 and Figure 8.1), the rate of *in situ* breast cancer increased from 16.1 per 100,000 in 1988 to 25.0 per 100,000 in 1999, an increase of 55.3 percent. The rate of local disease increased as well, though not as dramatically as *in situ* disease, from 77.0 to 81.2 per 100,000. Increases in early stage diagnosis of breast cancer corresponded to a decline in the rates of

Table 8.3
Age-Adjusted (2000 U.S. Population) Female Breast Cancer Incidence Ratesper 100,000 Population by Stage at Diagnosis, Race/Ethnicity, and Year of Diagnosis, California, 1988-1999

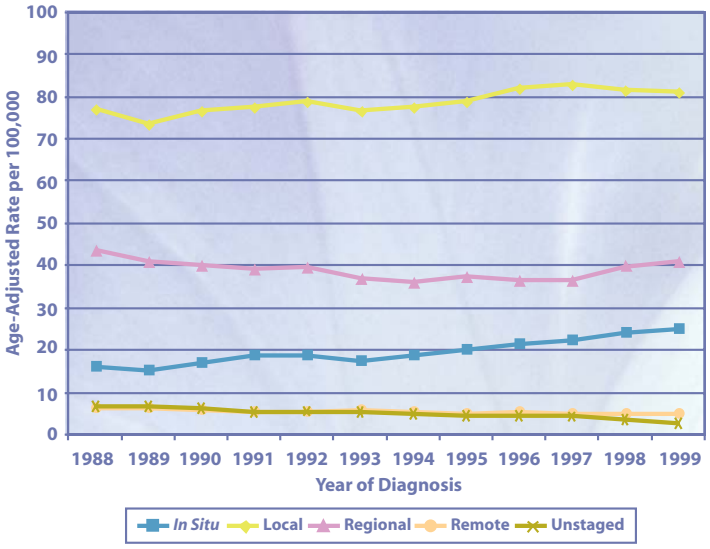
	In Situ		Local		Regional		Remote		Unstaged	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate
All Races										
1988	2,009	16.3	9,861	77.3	5,502	43.6	780	6.1	914	7.1
1989	1,938	15.3	9,642	73.8	5,294	41.0	795	6.1	891	6.8
1990	2,270	17.3	10,389	76.8	5,352	40.1	790	5.9	890	6.5
1991	2,540	18.8	10,762	77.7	5,360	39.2	757	5.5	806	5.8
1992	2,665	19.3	11,222	79.1	5,555	39.5	739	5.2	859	6.0
1993	2,539	17.9	11,058	76.9	5,268	36.7	830	5.8	868	6.0
1994	2,771	19.2	11,401	77.9	5,270	36.2	804	5.5	781	5.2
1995	3,007	20.5	11,797	79.1	5,577	37.6	746	5.0	757	5.0
1996	3,258	21.8	12,496	82.4	5,514	36.5	840	5.5	772	5.0
1997	3,531	23.0	12,950	83.3	5,646	36.3	778	5.0	758	4.8
1998	3,865	24.5	13,047	81.9	6,372	40.1	809	5.1	655	4.0
1999	4,101	25.4	13,250	81.4	6,708	41.2	796	4.9	523	3.1
Asian/Pacific Islander										
1988	77	7.9	424	47.0	229	23.6	25	2.7	32	3.4
1989	91	9.3	419	41.9	255	24.7	39	4.0	34	4.0
1990	121	11.1	507	46.4	285	24.8	47	4.4	54	5.5
1991	144	12.0	473	39.7	303	25.1	31	2.9	35	3.0
1992	132	10.3	612	50.8	318	25.0	34	2.9	51	4.2
1993	153	11.7	630	48.4	300	22.2	43	3.2	39	3.3
1994	203	14.3	658	47.3	331	23.2	39	3.1	37	3.1
1995	222	15.4	740	51.1	385	25.9	46	3.0	29	2.1
1996	271	17.6	817	54.4	415	25.8	58	3.8	45	3.3
1997	294	17.9	966	60.0	400	24.4	52	3.2	37	2.4
1998	323	18.7	954	55.9	510	29.3	42	2.4	35	2.1
1999	390	21.7	1,008	57.0	553	30.4	49	2.8	35	2.1
Black										
1988	91	12.4	440	59.2	374	48.5	84	11.1	66	9.4
1989	90	11.7	446	57.1	324	41.1	67	8.7	49	7.0
1990	105	13.1	468	58.1	363	45.3	78	9.5	53	7.0
1991	129	15.9	487	59.2	355	41.6	76	9.5	57	7.4
1992	125	14.8	532	63.3	374	43.0	70	8.4	46	5.6
1993	130	15.3	564	64.9	313	34.4	84	9.7	53	6.5
1994	161	18.8	557	62.9	359	40.1	86	9.4	56	6.9
1995	168	18.9	587	66.0	352	37.6	64	7.2	56	6.7
1996	167	18.0	587	63.5	388	41.1	84	9.2	58	6.5
1997	203	21.1	605	63.4	414	42.3	69	7.2	48	5.3
1998	191	19.2	602	61.9	392	39.0	75	7.5	43	4.6
1999	215	22.0	663	67.1	454	44.6	64	6.3	32	3.3
Hispanic										
1988	124	6.7	746	44.6	611	34.6	82	5.0	91	5.3
1989	137	7.2	768	43.4	612	31.4	94	5.2	97	5.6
1990	194	9.9	858	45.0	586	29.2	79	4.0	84	4.6
1991	199	9.6	884	43.5	679	31.5	88	4.1	85	4.4
1992	225	10.3	960	45.1	705	30.8	83	3.9	95	4.4
1993	219	9.7	991	45.1	644	26.8	104	4.4	84	3.7
1994	254	10.7	1,072	46.5	674	26.5	87	3.6	88	3.7
1995	238	9.6	1,124	46.6	715	27.1	112	4.4	86	3.6
1996	282	10.8	1,229	48.6	740	26.9	85	3.2	97	3.8
1997	329	12.4	1,317	49.1	748	26.1	111	4.1	88	3.1
1998	448	15.9	1,412	50.7	883	29.4	104	3.5	73	2.6
1999	436	14.6	1,406	48.5	973	30.4	110	3.8	69	2.3
White										
1988	1,685	19.3	8,169	87.1	4,254	46.9	586	6.2	685	7.1
1989	1,595	17.9	7,924	83.3	4,068	44.3	591	6.1	671	6.8
1990	1,810	19.8	8,474	86.9	4,088	43.6	576	5.9	657	6.4
1991	2,020	21.6	8,841	89.4	3,994	42.1	557	5.6	586	5.7
1992	2,115	22.4	9,023	90.2	4,137	42.8	546	5.4	603	5.7
1993	1,965	20.4	8,775	87.4	3,991	40.8	596	5.9	622	5.8
1994	2,083	21.4	9,002	89.3	3,876	39.7	586	5.9	544	5.0
1995	2,295	23.5	9,241	90.6	4,084	41.6	514	5.1	508	4.6
1996	2,441	24.9	9,711	94.9	3,923	39.8	604	6.0	507	4.7
1997	2,615	26.2	9,937	95.6	4,058	40.4	536	5.2	504	4.5
1998	2,814	27.6	9,931	94.4	4,525	44.3	580	5.5	440	3.8
1999	2,975	28.8	10,051	94.3	4,669	45.2	562	5.3	318	2.7

Prepared by the California Department of Health Services, Cancer Surveillance Section.

breast cancer diagnosed at regional and remote stages, 43.6 per 100,000 in 1988 to 41.2 in 1999, and 6.1 in 1988 to 4.9 per 100,000 in 1999, respectively. The rate of unstaged breast cancers also declined steadily from 7.1 to 3.1 per 100,000 by 1999.

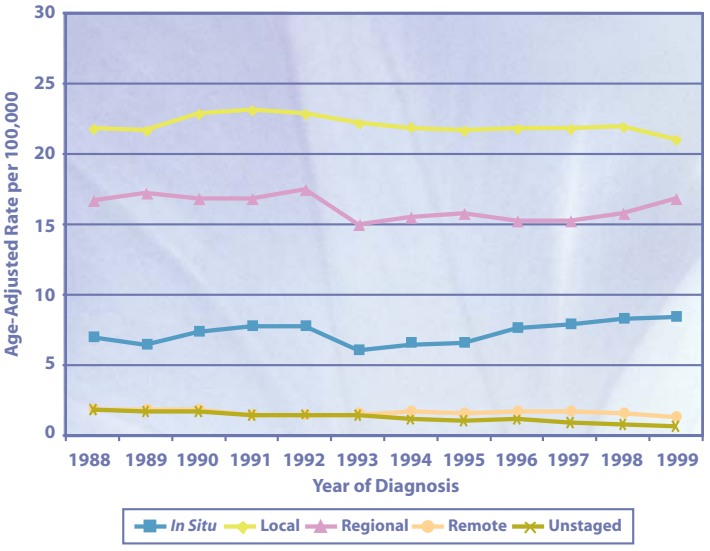
These changes over time varied by race/ethnic groups (Table 8.3). Although the rate of *in situ* breast cancer increased dramatically in the four race/ethnic groups, the increase between 1988 and 1999 was greatest in the Asian/Pacific Islander group. In this segment of the population, the rate of *in situ* disease increased almost three-fold, from 7.9 per 100,000 to 21.7 per 100,000. For Hispanics, *in situ* breast cancer rates more than doubled from 6.7 to 14.6 per 100,000, followed by a 77.4 percent increase for blacks from 12.4 to 22.0 per 100,000. *In situ* rates for non-Hispanic whites also increased by 49.2 percent from 19.3 to 28.8 per 100,000. The rate of localized breast cancer also increased between 1988 and 1999 although the increase was not as steep as for *in situ* disease. Most race/ethnic groups experienced an increase in local stage disease of about 10-20 percent between 1988 and 1999. These increases in the rates of *in situ* and local stage diseases were accompanied by decreases in the rates of breast cancer diagnosed at the regional

Figure 8.1
Age-Adjusted (2000 U.S. Population) Female Breast Cancer Incidence Rates by Stage at Diagnosis, All Races Combined, California, 1988-1999, All Ages



Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 8.2
Age-Adjusted (2000 U.S. Population) Female Breast Cancer Incidence Rates by Stage at Diagnosis, All Races Combined, California, 1988-1999, Ages 0-49

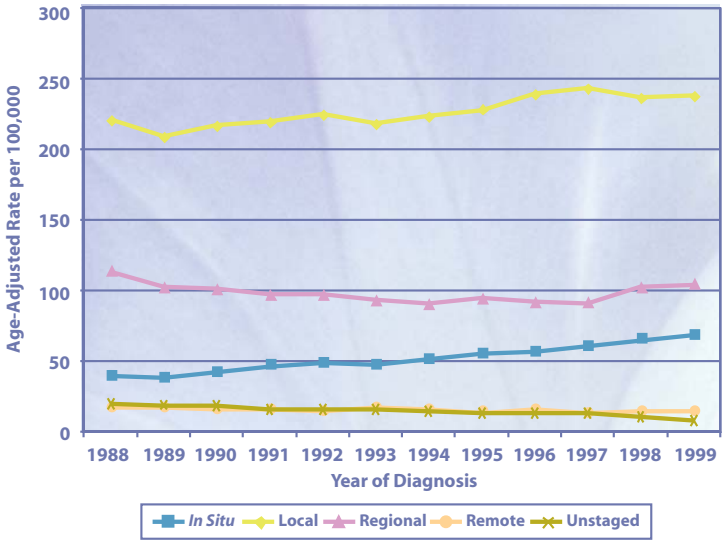


Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

and remote stages for all race/ethnic groups. The rate of regional disease among white women decreased from 46.9 to 45.2 per 100,000, from 48.5 to 44.6 per 100,000 in black women, and from 34.6 to 30.4 per 100,000 in Hispanic women. However, among the Asian/Pacific Islander, the rate of regional disease increased from 23.6 to 30.4 per 100,000.

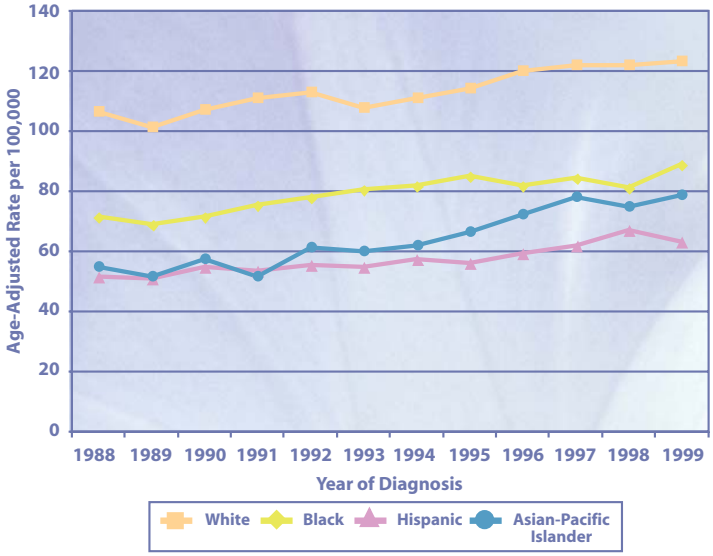
While comparing the rates of breast cancer in younger women (0-49) to those of older women (50+) for the time period of 1988-1999 (Figures 8.2 and 8.3), it is encouraging to note that in both age categories the rates of remote cancers declined. In both age groups, the rates of *in situ* disease increased, but the same was not true for localized disease. The rates of local disease remained stable among younger women as compared to older women, whereas the rates of localized breast cancer have increased over the 12-year period by 7.1 percent. From 1988 through 1999, rates of early stage breast cancer (*in situ* and local disease combined) increased for all race/ethnic groups (Figure 8.4), but were most pronounced among Asian/Pacific Islander women. Among younger women (0-49), rates of early disease

Figure 8.3
Age-Adjusted (2000 U.S. Population) Female Breast Cancer Incidence Rates by Stage at Diagnosis, All Races Combined, California, 1988-1999, Ages 50+



Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

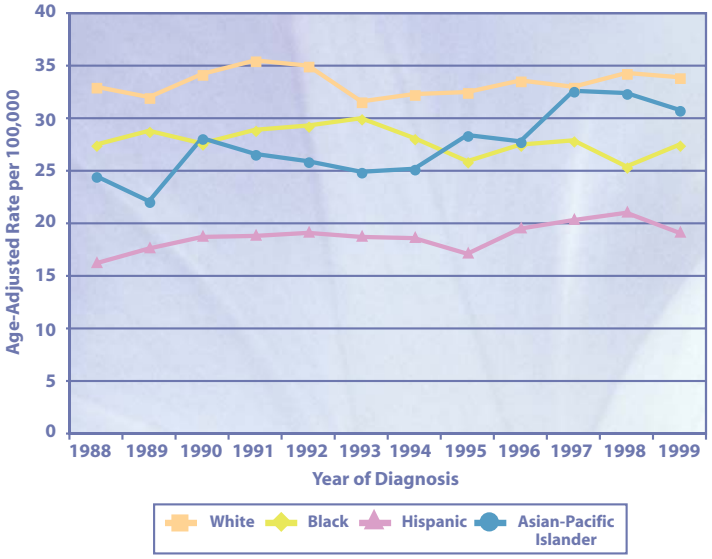
Figure 8.4
Age-Adjusted (2000 U.S. Population) Incidence Rates of Female Breast Cancer Diagnosed at Early Stage (*In Situ* and Localized Tumors) by Race/Ethnicity,[1] California, 1988-1999, All Ages



[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

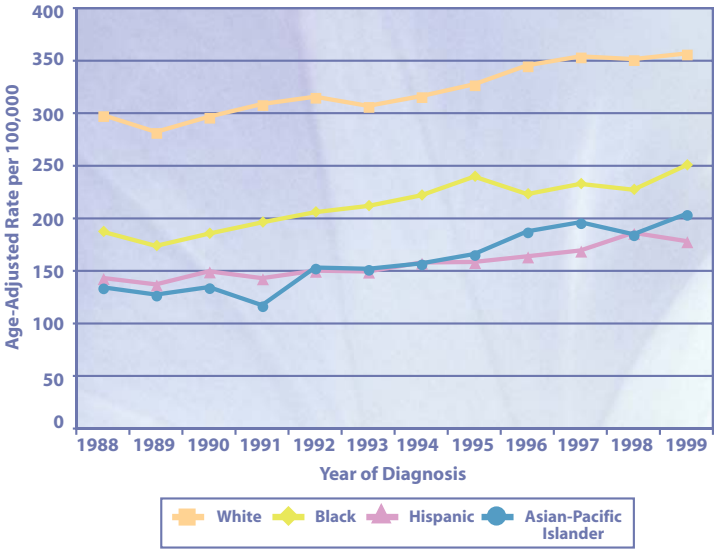
increased by 17.9 percent and 25.7 percent, respectively, in women of Hispanic and Asian/Pacific Islander race/ethnicity (Figure 8.5). However, rates of early disease in younger white and black women remained stable during the same time period (Figure 8.5). Increases in rates of early stage breast cancer were observed among women 50 years and older (Figure 8.6). In this age group, rates of early disease increased markedly in all race/ethnic groups, particularly among Asian/Pacific Islanders. Among Hispanic women, a slight decline in early stage disease was observed in 1999, which may be due to incomplete reporting.

Figure 8.5
Age-Adjusted (2000 U.S. Population) Incidence Rates of Female Breast Cancer Diagnosed at Early Stage (*In Situ* and Localized Tumors) by Race/Ethnicity,[1] California, 1988-1999, Ages 0-49



[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 8.6
Age-Adjusted (2000 U.S. Population) Incidence Rates of Female Breast Cancer Diagnosed at Early Stage (*In Situ* and Localized Tumors) by Race/Ethnicity,[1] California, 1988-1999, Ages 50+



[1] Race/ethnicity categories are mutually exclusice. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Geographic Variation

In Table 8.4, the rates of breast cancer by early and late stage disease are presented by county of residence. The highest rate of early disease is experienced by women residing in Marin County (168.0 per 100,000) and the lowest rate in Imperial County (59.4 per 100,000). These rates should be interpreted with extreme caution because for a number of counties the overall number of breast

cancer diagnoses was very small. The largest county in the state is Los Angeles County, which experienced a rate of early stage diagnosis of 94.2 per 100,000. However, much of the geographic variation in breast cancer rates may be explained by race/ethnic composition of each county or geographic area. Because of the small size of their populations, some counties were grouped based on geographic, racial, and historical sociopolitical considerations.

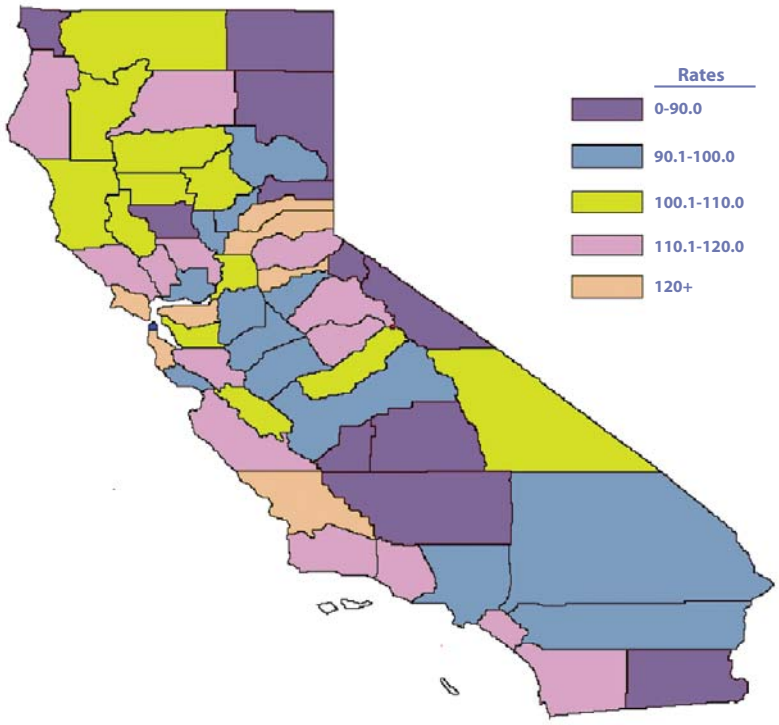
Since the numbers of breast cancers available for analysis are often too small at the county level, particularly after stratifying cases according to stage at diagnosis, an evaluation of diagnostic patterns was also performed at regional level (Table 8.5). CCR is composed of ten regions throughout California, which correspond to the general geographic features of the state. With exception of Region 9 (Los Angeles County), each region contains several counties (see Technical Notes). Among white females, the rate of early stage breast cancer was highest in the San Francisco Bay Area (Region 8), which experienced a rate of 137.6 per 100,000. The lowest rate of early stage disease was experienced by women in the Inland Empire Counties (Region 5) where the rate was 101.0 per 100,000 among white women (Figure 8.8). Since Hispanics comprise nearly 30 percent of the California population the rate of early diagnosed breast cancer was examined for this ethnic group by

Table 8.4
Age-Adjusted (2000 U.S. Population) Female Breast Cancer Incidence Rates per 100,000 Population by Stage at Diagnosis and County of Residence at Diagnosis, California, 1995-1999

	Early Stage		Late Stage	
	Count	Rate	Count	Rate
Alameda	3,718	107.8	1,586	45.5
Alpine/Amador/Calaveras	268	109.0	106	47.3
Butte	645	102.5	254	42.7
Colusa/Glenn/Tehama	284	98.5	115	43.0
Contra Costa	2,935	123.0	1,111	46.4
Del Norte/Humboldt	427	107.6	174	43.4
El Dorado	460	115.1	200	50.0
Fresno	1,690	99.7	659	39.2
Imperial	173	59.4	93	32.5
Inyo/Mono	78	94.9	30	38.4
Kern	1,231	89.7	576	42.1
Kings	162	76.2	100	46.6
Lake	199	104.1	64	35.5
Lassen/Modoc/Plumas	110	65.8	44	28.1
Los Angeles	20,110	94.2	9,353	43.4
Madera	273	103.1	127	48.1
Marin	1,116	168.0	364	54.7
Mariposa/Toulomne	265	117.7	90	41.3
Mendocino	261	107.7	93	39.2
Merced	378	92.2	163	39.5
Monterey	947	115.7	328	39.7
Napa	405	112.4	135	39.1
Nevada	396	129.3	111	38.4
Orange	6,879	112.2	2,842	45.7
Placer	734	127.2	286	49.8
Riverside	3,584	99.2	1,542	44.2
Sacramento	3,049	108.0	1,324	46.8
San Benito	109	105.4	38	36.8
San Bernardino	2,998	90.9	1,412	42.1
San Diego	7,117	114.8	2,816	46.3
San Francisco	2,421	106.7	900	40.7
San Joaquin	1,189	94.4	480	38.6
San Luis Obispo	740	121.5	283	48.1
San Mateo	2,540	128.6	840	42.9
Santa Barbara	1,127	113.1	391	40.4
Santa Clara	4,487	116.9	1,668	42.8
Santa Cruz	641	105.3	252	40.8
Shasta	527	110.6	228	49.3
Sierra/Yuba	131	90.6	65	44.9
Siskiyou/Trinity	186	102.8	64	39.2
Solano	738	90.1	340	41.0
Sonoma	1,435	119.3	519	43.8
Stanislaus	970	97.8	395	39.9
Sutter	200	100.0	89	46.7
Tulare	664	84.0	284	36.7
Ventura	1,935	113.0	688	39.9
Yolo	370	116.5	164	51.0

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 8.7
Map of California Showing the Variations in Rates of Early Diagnosed Female Breast Cancer by County, 1988-1999. Rates are per 100,000 and are Age-Adjusted to the 2000 U.S. (Five-Year Groups) Standard.



Prepared by the California Department of Health Services, Cancer Surveillance Section.

region of residence. Among Hispanic females, the rate of early staged breast cancer was highest in the Sacramento area (Region 3) where the rate was 76.8 per 100,000. The lowest rate of early stage disease was experienced by Hispanic women in Los Angeles County where the rate was 52.8 per 100,000. Among blacks, the rate of early stage disease was highest in the Inland Empire Counties (Region 5) where the rate was 92.0 per 100,000. The rate of early stage breast cancer was lowest in black women in the Central Coast counties of Ventura, Santa Barbara, and San Luis Obispo (75.8 per 100,000). For women of Asian /Pacific Islander background, the rate of early stage breast cancer was highest in the San Francisco Bay Area (78.5 per 100,000). The rate of early diagnosed disease in this group was lowest in the counties of the Central San Joaquin Valley (53.9 per 100,000).

Discussion

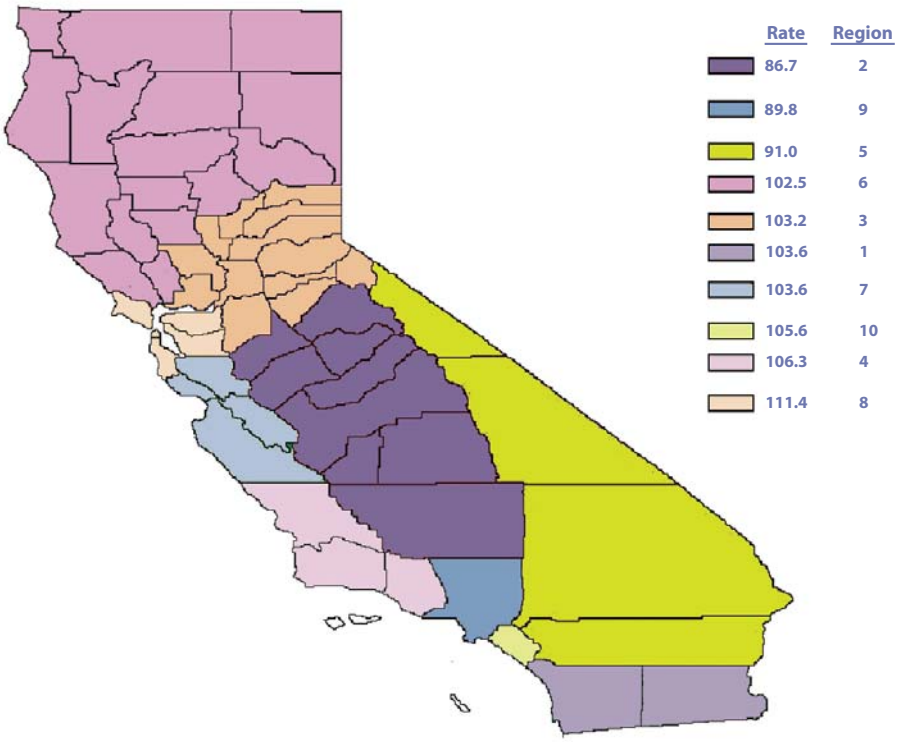
This analysis uncovered several patterns concerning the stage of diagnosis of breast cancer among women in California between 1988 and 1999. Overall, rates of *in situ* disease increased during the period, as did rates of localized disease. This result is consistent with earlier reports (3, 9). Menck HR, Mills P, et al. found that, between 1994 and 1997, there was a 12 percent increase in the diagnosis of *in situ* tumors and a two percent improvement in diagnosis of local stage tumors of small size. These findings probably reflect an increased access to screening for breast cancer via clinical breast examinations and mammography. It should be pointed out that only a small proportion of all women found to have a suspicious lesion in their breast by mammogram actually are diagnosed with breast cancer. Perhaps two out of ten such lesions eventually are found to be cancerous (10). Whatever their biologic activity, the detection of *in situ* tumors probably reflect the intensity of screening efforts for breast cancer in the population. While rates of *in situ* and local disease have increased, rates of late stage disease have decreased, which represents an encouraging trend. Even though rates of early stage diagnosis increased from 1988 through 1999 among all age categories, the increase was not of the same magnitude in younger women (0-49) versus older women (50+). Clear recommendations for screening in women 50 years and older are likely to account for a higher increase in early stage diagnosis in this age group, as compared to younger women. However, the four major race and ethnic groups in California did not equally experience trends towards early diagnosis. The increase of *in situ* disease was highest among white women and lowest among Hispanics. The rate of late stage disease continued to be highest among black women.

Table 8.5
Age-Adjusted (2000 U.S. Population) Female Breast Cancer Incidence Rates per 100,000 Population by Stage at Diagnosis, Race/Ethnicity, and Region of Residence at Diagnosis, California, 1995-1999

	Early Stage		Late Stage	
	Count	Rate	Count	Rate
All Races				
Region 1	6,184	115.4	2,286	42.1
Region 2	5,633	94.5	2,394	40.5
Region 3	7,535	106.2	3,165	44.8
Region 4	3,802	114.4	1,362	41.4
Region 5	6,660	95.3	2,984	43.1
Region 6	4,479	108.3	1,690	42.2
Region 7	7,290	112.3	2,909	45.7
Region 8	12,730	118.1	4,801	44.6
Region 9	20,110	94.2	9,353	43.4
Region 10	6,879	112.2	2,842	45.7
Asian/Pacific Islander				
Region 1	632	78.5	263	31.2
Region 2	150	53.9	64	22.2
Region 3	417	69.8	150	24.4
Region 4	114	73.4	41	24.8
Region 5	165	61.2	97	34.7
Region 6	50	66.2	11	14.4
Region 7	403	76.7	161	29.9
Region 8	1,559	82.1	585	30.5
Region 9	2,012	72.1	921	32.4
Region 10	483	71.9	217	30.9
Black				
Region 1	103	88.2	42	35.0
Region 2	152	78.9	99	51.1
Region 3	298	82.4	195	53.8
Region 4	36	75.8	24	47.3
Region 5	309	92.0	226	62.1
Region 6	24	86.4	8	28.7
Region 7	186	76.2	108	42.5
Region 8	897	85.6	460	43.0
Region 9	1,936	84.4	1,158	49.7
Region 10	47	83.3	36	44.3
Hispanic				
Region 1	636	73.0	288	31.4
Region 2	709	61.3	405	32.5
Region 3	511	76.8	221	30.9
Region 4	318	62.5	179	33.6
Region 5	796	67.4	462	36.2
Region 6	147	74.2	61	30.0
Region 7	678	64.0	395	34.8
Region 8	806	73.8	400	34.7
Region 9	3,036	52.8	1,857	29.9
Region 10	584	67.9	313	31.7
White				
Region 1	4,641	129.1	1,655	46.20
Region 2	4,505	104.5	1,798	43.00
Region 3	6,270	114.7	2,594	48.30
Region 4	3,291	126.1	1,113	43.90
Region 5	5,285	101.0	2,167	43.00
Region 6	4,202	111.6	1,584	43.70
Region 7	5,912	127.0	2,220	50.10
Region 8	9,238	137.6	3,281	49.50
Region 9	12,990	122.4	5,392	52.00
Region 10	5,677	123.0	2,251	49.00

Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 8.8
Map of California Showing Region-Wide Variation in the Rates of Early Diagnosed Female Breast Cancer, 1988-1999. Rates are Age-Adjusted to the 2000 U.S. Standard Population and per 100,000.



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Previous research found that black women with breast cancer had a higher risk of death compared to white women, even after controlling for major prognostic factors, particularly in localized and regional disease (11).

As previously reported (9), SES continued to be an important factor with respect to the stage at which breast cancer is diagnosed. Women of all race/ethnicities living in less affluent areas were more likely to be diagnosed at a later stage than those living in more affluent areas. In terms of geographic distribution, the rates of early disease were highest in those areas of the state characterized by urban centers and affluence. Lowest rates of early disease were found in the rural, poorer areas of the state. Examining this variation by reporting region, Region 2 (Central San Joaquin Valley) and Region 9 (Los Angeles) need most attention in terms of early screening for breast cancer. When

comparing rates between counties, the race/ethnic composition of the county's population should be kept in mind, since Hispanics and Asian/Pacific Islanders experience lower rates of breast cancer than non-Hispanic whites. Rates presented should be interpreted with caution. Rural versus urban differences and the relationship with access to care need to be examined further. Despite disparities in early and late stage of diagnosis by race/ethnicity and geographic region, diagnosis of early stage breast cancer in California has increased steadily over the time period evaluated in this report. However, efforts are still needed to ensure early detection of breast cancers affecting women in rural or impoverished areas and women of Hispanic or black race/ethnicity.

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Laterality, Detailed Site, and Histology of Female Breast Cancer, California, 1988–1999

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Introduction

Breast cancer is the most common cancer among women in California and the second cancer-related leading cause of death. In 1999, one of every three (32.2 percent) newly diagnosed cancers among women occurred in the breast. Though the term "breast cancer" groups all types of cancer diagnoses in the breast as one type of cancer, the location of the tumor in the breast and the type of tissue involved have important etiologic, treatment, and prognostic implications. This chapter examines female breast cancer by laterality, primary site, and histology diagnosed in California from 1988 through 1999, as reported to the population-based CCR (1).

Primary site and histology classifications are based on the International Classification of Diseases for Oncology, Second Edition (ICD-O-2) (2). ICD-O divides the breast into subsites to identify the specific location of the tumor. Vertical and horizontal axes divide the breast into four sections: upper-inner (ICD-O-2 code C50.2), lower-inner (C50.3), upper-outer (C50.4), and lower outer (C50.5). Three subsites identify other specific portions of the breast: nipple and areola (C50.0), central (C50.1), and axillary tail (C50.6). Subsite C50.8 includes tumors of the inner, lower, outer, upper, midline of breast without assigning the tumor to a specific quadrant. When the medical record does not contain enough information to assign the tumor to one of these subsites, the primary site is recorded as "Breast, Not Otherwise Specified (NOS)" (C50.9).

The female breast is composed of 15 to 20 separate mammary glands, or lobules, which are connected to the nipple by ducts. The mammary glands consist of a system of minute ducts and secretory cells, separated by connective tissue and surrounded by adipose tissue. As will be discussed, about 95 percent of all breast cancers arise from the glandular epithelial lining of the ducts. Coding procedures have been developed to distinguish the specific tissue of origin and clinical features of the tumor (2). A brief description of the most common histologic types of invasive breast cancer (3,4), focusing on the gross rather than microscopic features, is given in Table 9.1.

Female breast cancer incidence in California is presented by stage at diagnosis as well as for all invasive breast cancers combined. The following AJCC definitions for stage at diagnosis are used for invasive breast cancer (5): *In situ* tumors have not infiltrated the basement membrane of the epithelium and therefore have not invaded the surrounding breast tissue. Stage I tumors are less than 2 cm in greatest dimension with no spread to axillary lymph nodes. Stage IIa tumors are less than 2 cm, lymph nodes involved, but movable; or tumors 2-5 cm with no spread to axillary lymph nodes. Stage IIb tumors are 2-5 cm, lymph nodes involved, but movable or tumors more than 5 cm with no spread to lymph nodes. Stage III are tumors more than 5 cm, lymph nodes involved, but movable; or tumors of any size, lymph nodes involved and fixed

Table 9.1 Common Histologic Types of Invasive Breast Cancer

Histology	Description
Infiltrating Duct Carcinoma	A general term indicating that the tumor is in a duct of the breast, without any of the defining features described below; the tumor is generally hard and gritty.
Lobular Carcinoma	A tumor arising in the lobule of the breast, often infiltrating the surrounding connective tissue in single rows of cells and forming concentric rings of cells around normal ducts; often presents as an area of ill-defined thickening rather than as a discrete nodule.
Infiltrating Duct and Lobular Carcinoma	A tumor containing both duct and lobular components.
Comedocarcinoma	A ductal tumor characterized by a central area of necrosis which often produces a cheesy tumorous tissue which can be extruded from the ducts.
Mucinous Adenocarcinoma	A ductal tumor characterized by the production of mucin, giving the tumor a soft, gelatinous consistency.
Medullary Carcinoma	Typically a large, discrete, fleshy tumor with specific cytologic and histologic characteristics, often accompanied by intense infiltration with small lymphocytes and plasma cells.
Inflammatory Carcinoma	Widespread and diffuse redness, swelling and warmth of the skin of the breast due to distension of dermal lymphatics with tumor cells from an underlying tumor, which often cannot be palpated.
Tubular Adenocarcinoma	A ductal tumor characterized by small, well-formed tubular glands composed of a single layer of tumor cells which infiltrate the connective tissue of the breast; these tumors are often small.
Paget's Disease	A crusted, scaling, eczema-like lesion of the nipple and areola caused by invasion of the nipple by tumor cells from an underlying mass which often cannot be palpated.
Papillary Adenocarcinoma	A ductal tumor characterized by cells arranged in large, papillary fronds, often producing a soft, well-circumscribed, discrete mass.

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to each other or other structure. Stage IV cancers have spread to other organs. For a more detailed discussion of stage at diagnosis, please refer to Chapter 8 of this report.

In some sections of this chapter, California data are compared to national data represented by SEER Program. SEER data used in the analysis are from Connecticut; Hawaii; Iowa; New Mexico; Utah; Atlanta, Georgia; Detroit, Michigan; and Seattle-Puget Sound, Washington. San Francisco-Oakland Metropolitan Statistical Service Area (MSSA), a SEER registry in California, was excluded from the analysis for SEER regions. From 1988 through 1999, 166,229 cases of invasive and 28,435 cases of *in situ* breast cancer were diagnosed among women in the ten non-California SEER regions (6).

Laterality

A total of 224,137 new cases of invasive and 34,712 cases of *in situ* breast cancer were diagnosed among California women from 1988 through 1999 (1). Of these, 48.5 percent of all (invasive and *in situ*) breast cancers were diagnosed in the right breast, 50.4 percent in the left breast, and 0.1 percent were bilateral; 1.0 percent laterality was unknown.

In California, excluding bilateral tumors and those of unknown laterality, 49.1 percent occurred in the right breast and 50.9 percent were of the left, with a ratio of left to right tumors of 1.04 (Table 9.2). Other studies have also found an excess of left-sided tumors, with left/right ratios varying from 1.05 to 1.26 (7,8). The cause of the left-sided excess among women remains unclear.

Table 9.2
Female Breast Cancer Laterality: Frequency and Percent Distribution by Stage at Diagnosis and Age at Diagnosis, California, 1988-1999

	Total Cases	Right Breast (%)	Left Breast (%)	Left/Right Ratio
Total (*In situ* and Invasive)	251,754	49.1	50.9	1.04
In situ	34,680	48.0	52.0	1.08
< 50 years	9,261	48.9	51.1	1.04
50+ years	25,419	47.7	52.3	1.10
All Invasive	217,074	49.2	50.8	1.03
< 50 years	50,508	49.1	50.9	1.04
50+ years	166,566	49.3	50.7	1.03
Stage I	95,394	49.5	50.5	1.02
< 50 years	16,945	49.5	50.5	1.02
50+ years	78,449	49.5	50.5	1.02
Stage IIA	53,680	48.9	51.1	1.05
< 50 years	14,306	48.9	51.1	1.05
50+ years	39,374	48.9	51.1	1.05
Stage IIB	27,088	49.2	50.8	1.03
< 50 years	9,022	48.7	51.3	1.05
50+ years	18,066	49.5	50.5	1.02
Stage III	12,851	49.1	50.9	1.03
< 50 years	4,097	49.2	50.8	1.03
50+ years	8,754	49.1	50.9	1.04
Stage IV	8,863	49.1	50.9	1.04
< 50 years	1,955	48.4	51.6	1.07
50+ years	6,908	49.3	50.7	1.03
Unstaged	19,198	48.9	51.1	1.05
< 50 years	4,183	49.8	50.2	1.01
50+ years	15,015	48.6	51.4	1.06

Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 9.3
Female Breast Cancer Laterality: Frequency and Percent Distribution by Stage at Diagnosis and Race/Ethnicity,[1] Unilateral Tumors of Known Laterality, California, 1988-1999

Race/Ethnicity	Total Cases	Right Breast (%)	Left Breast (%)	Left/Right Ratio
In situ				
Asian/Pacific Islander	2,428	47.4	52.6	1.11
Black	1,779	47.4	52.6	1.11
Hispanic	3,100	48.4	51.6	1.07
White	26,580	48.1	51.9	1.08
Stage I				
Asian/Pacific Islander	5,308	49.2	50.8	1.03
Black	3,928	49.3	50.7	1.03
Hispanic	7,790	49.9	50.1	1.00
White	77,534	49.5	50.5	1.02
Stage IIA				
Asian/Pacific Islander	3,569	48.7	51.3	1.05
Black	3,203	50.2	49.8	0.99
Hispanic	6,128	47.7	52.3	1.10
White	40,438	49.0	51.0	1.04
Stage IIB				
Asian/Pacific Islander	1,891	48.5	51.5	1.06
Black	1,906	50.2	49.8	0.99
Hispanic	3,776	48.5	51.5	1.06
White	19,333	49.3	50.7	1.03
Stage III				
Asian/Pacific Islander	807	50.7	49.3	0.97
Black	1,146	48.0	52.0	1.08
Hispanic	1,890	49.6	50.4	1.01
White	8,937	49.1	50.9	1.04
Stage IV				
Asian/Pacific Islander	480	48.8	51.3	1.05
Black	868	50.1	49.9	1.00
Hispanic	1,085	49.3	50.7	1.03
White	6,365	49.1	50.9	1.04
Unstaged				
Asian/Pacific Islander	1,069	49.3	50.7	1.03
Black	1,108	49.6	50.4	1.01
Hispanic	2,041	50.1	49.9	1.00
White	14,133	48.6	51.4	1.06

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Left-sided tumors were found more often than right-sided tumors at all stages. This difference was especially pronounced for *in situ* cancers (left/right ratio=1.08). Among *in situ* breast cancers, the left-sided predominance was more marked for post-menopausal women (50 years old or older, left/right ratio=1.10) than for pre-menopausal women (less than 50 years old, left/right ratio=1.04) (Table 9.2). Invasive tumors had similar left-sided predominance in pre- and post-menopausal women (left/right ratio=1.04 and 1.03, respectively). When examined by stage and age, left-sided tumors were more marked for post-menopausal women except for stage IIb and stage IV (less than 50 years old, left/right ratio=1.05 and 1.07, respectively) (Table 9.2).

When laterality was examined by stage at diagnosis and race/ethnicity, left-sided predominance was seen among all race/ethnic groups for *in situ* breast cancer. A slight excess of right-sided tumors was seen for black women with stage IIa tumors (ratio=0.99), Hispanic women with stage IIb tumor (ratio=0.99), and Asian/Pacific Islander women with stage III tumors (ratio=0.97). All other stage- and race-specific comparisons showed left-sided predominance, with ratios varying from 1.00 to 1.11 (Table 9.3).

Table 9.4
Female Breast Cancer Laterality: Ratio of Left- to Right-Sided Tumors by Detailed Primary Site and Tumor Behavior of Known Laterality, California, 1988-1999

	In Situ		Invasive	
Primary Site (ICD-O)	Cases	Left/Right Ratio	Cases	Left/Right Ratio
Nipple and areola (C50.0)	586	1.23	2,197	1.05
Central portion (C50.1)	2,238	1.04	13,902	1.05
Upper-inner quadrant (C50.2)	2,456	1.09	21,070	1.09
Lower-inner quadrant (C50.3)	1,891	1.15	11,161	1.11
Upper-outer quadrant (C50.4)	11,683	1.06	81,307	0.99
Lower-outer quadrant (C50.5)	2,119	1.24	14,139	1.07
Axillary tail (C50.6)	110	1.39	1,918	1.00
Midline, inner, outer, upper, or lower (C50.8)	6,344	1.06	43,257	1.02
Breast, NOS* (C50.9)	7,253	1.07	32,363	1.06
Total	34,680	1.08	221,314	1.03

Source: California Cancer Registry (August 2002)
*NOS: Not Otherwise Specified.
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Laterality was also examined by location within the breast. At each location for *in situ* breast cancers, left-sided tumors were more common. Additionally for invasive breast cancers, left-sided tumors were more common than right-sided tumors for all locations except the most common location upper-outer quadrant where an equal proportion of left-and right-sided tumors were diagnosed (Table 9.4).

Detailed Primary Site

Invasive Tumors

Of the 224,137 new cases of invasive breast cancers diagnosed among California women from 1988 through 1999, about 15 percent had primary site reported as "Breast, NOS" (Table 9.5), lower than the comparable figure (19.7 percent) for SEER, 1988-1999.

Among the invasive female breast cancers in California for which a site was given, 36 percent were located in the upper-outer quadrant, 9 percent were located in the upper-inner quadrant, 6 percent each in the central portion and lower-outer quadrant, 5 percent in the lower-inner quadrant, and 1 percent each in the nipple and areola and the axillary tail, and 19 percent on the midline, inner, outer, upper, or lower portion of

Table 9.5
Female Breast Cancer Detailed Primary Site by Tumor Behavior, Age, and Race/Ethnicity,[1] California, 1988-1999

	All Races							
	All Ages		< 50	50+	Asian/ Pacific Islander	White	Black	Hispanic
	Cases	%	%	%	%	%	%	%
Invasive Tumors								
Nipple and areola (C50.0)	2,199	1.0	0.8	1.0	0.9	0.8	1.1	1.0
Central portion (C50.1)	13,904	6.2	5.3	6.5	7.3	5.4	6.7	6.1
Upper-inner quadrant (C50.2)	21,073	9.4	9.8	9.3	11.4	9.3	9.9	9.2
Lower-inner quadrant (C50.3)	11,164	5.0	4.3	5.2	5.0	5.4	4.8	5.0
Upper-outer quadrant (C50.4)	81,329	36.3	37.3	36.0	34.8	35.1	35.3	36.8
Lower-outer quadrant (C50.5)	14,141	6.3	6.4	6.3	5.9	6.3	6.4	6.4
Axillary tail (C50.6)	1,919	0.9	1.0	0.8	0.7	1.0	0.7	0.9
Midline, inner, outer, upper, or lower (C50.8)	43,279	19.3	19.6	19.2	19.7	18.3	19.3	19.5
Breast, NOS* (C50.9)	35,129	15.7	15.4	15.7	14.3	18.4	15.8	15.1
Total Invasive	224,137	100.0	100.0 (N=52,223)	100.0 (N=171,914)	100.0 (N=13,468)	100.0 (N=12,516)	100.0 (N=23,513)	100.0 (N=172,136)
***In Situ* Tumors**								
Nipple and areola (C50.0)	589	1.7	1.1	1.9	1.8	0.8	1.4	1.8
Central portion (C50.1)	2,239	6.4	5.3	6.9	6.9	6.5	7.0	6.4
Upper-inner quadrant (C50.2)	2,456	7.1	7.4	6.9	8.5	9.4	7.4	6.9
Lower-inner quadrant (C50.3)	1,891	5.4	5.2	5.5	5.7	7.4	5.3	5.4
Upper-outer quadrant (C50.4)	11,685	33.7	33.6	33.7	32.1	32.6	34.7	34.1
Lower-outer quadrant (C50.5)	2,119	6.1	6.7	5.9	5.8	6.3	5.8	6.2
Axillary tail (C50.6)	110	0.3	0.3	0.3	0.2	0.3	0.2	0.3
Midline, inner, outer, upper, or lower (C50.8)	6,347	18.3	17.9	18.4	20.8	17.6	18.3	18.3
Breast, NOS* (C50.9)	7,285	21.0	22.5	20.4	18.2	19.0	19.8	20.5
Total *In situ*	34,721	100.0	100.0 (N=9,273)	100.0 (N=25,448)	100 (N=2,429)	100.0 (N=1,780)	100.0 (N=3,102)	100.0 (N=26,601)

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
*NOS: Not Otherwise Specified.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 9.6 Female Breast Cancer Detailed Primary Site by Stage at Diagnosis, California, 1988-1999

	In Situ		Stage I		Stage IIA		Stage IIB		Stage III		Stage IV		Unstaged	
Primary Site	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Nipple and areola (C50.0)	589	1.7	676	0.7	487	0.9	256	0.9	148	1.1	72	0.8	333	1.6
Central portion (C50.1)	2,239	6.4	5,320	5.6	3,602	6.7	2,041	7.5	1,199	9.3	545	5.8	946	4.4
Upper-inner quadrant (C50.2)	2,456	7.1	11,389	11.9	5,162	9.6	1,943	7.2	615	4.8	476	5.0	1,268	5.9
Lower-inner quadrant (C50.3)	1,891	5.4	5,982	6.3	2,731	5.1	1,010	3.7	363	2.8	295	3.1	645	3.0
Upper-outer quadrant (C50.4)	11,685	33.7	36,251	38.0	21,379	39.8	11,406	42.1	3,737	29.0	2,176	23.0	5,059	23.7
Lower-outer quadrant (C50.5)	2,119	6.1	6,374	6.7	3,905	7.3	1,847	6.8	572	4.4	357	3.8	898	4.2
Axillary tail (C50.6)	110	0.3	810	0.8	482	0.9	227	0.8	105	0.8	93	1.0	132	0.6
Midline, inner, outer, upper, or lower (C50.8)	6,347	18.3	18,893	19.8	10,497	19.5	5,214	19.2	3,068	23.8	1,786	18.9	3,071	14.4
Breast, NOS* (C50.9)	7,285	21.0	9,720	10.2	5,455	10.2	3,153	11.6	3,071	23.8	3,664	38.7	8,978	42.1
Total	34,721	100.0	95,415	100.0	53,700	100.0	27,097	100.0	12,878	100.0	9,464	100.0	21,330	100.0

Source: California Cancer Registry (August 2002)
*NOS: Not Otherwise Specified.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 9.7
Invasive Female Breast Cancer Incidence: Frequency and Percent Distribution by Detailed Histology, Microscopically Confirmed, California, 1988-1999

Histology (ICD-O-2)		Cases	%
8000	Malignant neoplasm	333	0.15
8001	Malignant tumor cells	11	0.01
8004	Malignant tumor, spindle cell type	3	0.00
8010	Carcinoma, NOS*	3,029	1.39
8011	Epithelioma, malignant	2	0.00
8012	Large cell carcinoma, NOS*	34	0.02
8020	Undifferentiated carcinoma, NOS*	90	0.04
8021	Anaplastic carcinoma, NOS*	54	0.02
8022	Pleomorphic carcinoma	20	0.01
8030	Giant cell and spindle cell carcinoma	3	0.00
8031	Giant cell carcinoma	3	0.00
8032	Spindle cell carcinoma	57	0.03
8033	Pseudosarcomatous carcinoma	9	0.00
8041	Small cell carcinoma, NOS*	34	0.02
8050	Papillary carcinoma, NOS*	469	0.21
8070	Squamous cell carcinoma, NOS*	71	0.03
8071	Keratinizing squamous cell carcinoma, NOS*	10	0.00
8072	Squamous cell carcinoma, small cell,	2	0.00
8074	nonkeratinizing	8	0.00
8075	Spindle cell squamous cell carcinoma	1	0.00
8082	Squamous cell carcinoma, adenoid	1	0.00
8095	Lymphoepithelial carcin oma	1	0.00
8140	Metatypical carcinoma	4,076	1.87
8141	Adenocarcinoma, NOS*	569	0.26
8143	Scirrhous adenocarcinoma	2	0.00
8145	Superficial spreading adenocarcinoma	1	0.00
8190	Carcinoma, diffuse type	1	0.00
8200	Trabecular adenocarcinoma	152	0.07
8201	Adenoid cystic carcinoma	374	0.17
8210	Cribriform carcinoma	1	0.00
8211	Adenocarcinoma ademato us polyp	3,171	1.45
8230	Tubular adenocarcinoma	6	0.00
8240	Solid carcinoma, NOS*	10	0.00
8244	Malignant carcinoid tumor	4	0.00
8246	Composite carcinoid	45	0.02
8251	Neuroendocrine carcinoma	5	0.00
8260	Alveolar adenocarcinoma	184	0.08
8310	Papillary adenocarcinoma, NOS*	17	0.01
8314	Clear cell adenocarcinoma, NOS*	3	0.00
8315	Lipid rich carcinoma	6	0.00
8323	Glycogen rich carcinoma	11	0.01
8330	Mixed cell adenocarcinoma	1	0.00
8350	Follicular adenocarcinoma, NOS*	1	0.00
8401	Nonencapsulated sclerosing carcinoma	260	0.12
8430	Apocrine adenocarcinoma	1	0.00
8440	Mucoepidermoid carcinoma	1	0.00
8450	Cystadenocarcinoma, NOS*	3	0.00
8452	Papillary cystadenocarcinoma, NOS*	2	0.00
8470	Papillary cystic tumor	1	0.00
8471	Mucinous cystadenocarcinoma, NOS*	1	0.00
8480	Papillary mucinous, cystadenocarcinoma	5,513	2.53
8481	Mucinous adenocarcinoma	260	0.12
8490	Mucin producing adenocarcinoma	139	0.06
8500	Signet ring cell carcinoma	153,451	70.31
8501	Infiltrating duct carcinoma	4,884	2.24
8502	Comedocarcinoma, NOS*	21	0.01
8503	Juvenile carcinoma of the breast	796	0.36
8504	Intraductal papillary adenocarcinoma with invasion	315	0.14
	Intracystic carcinoma, NOS*		
8510	Medullary carcinoma, NOS*	2,952	1.35
8512	Medullary carcinoma with lymphoid stroma	67	0.03
8520	Lobular carcinoma, NOS*	17,324	7.94
8521	Infiltrating ductular carcinoma	327	0.15
8522	Infiltrating duct and lobular	13,138	6.02
8530	Inflammatory carcinoma	3,009	1.38
8540	Paget's disease, mammary	169	0.08
8541	Paget's disease & infiltrating duct carcinoma	1,097	0.50
8542	Paget's disease, extramammary	1	0.00
8543	Paget's disease and intraductal carcinoma	627	0.29
8550	Acinar cell carcinoma	12	0.01
8560	Adenosquamous carcinoma	62	0.03
8562	Epithelial myoepithelial carcinoma	10	0.00
8570	Adenocarcinoma with squamous metaplasia	41	0.02
8571	Adenocarcinoma with cartilaginous and	23	0.01
8572	osseus metaplasia	22	0.01
8573	Adenocarcinoma with spindle cell metaplasia	17	0.01
8600	Adenocarcinoma with apocrine metaplasia	1	0.00
8730	Thecoma, malignant	1	0.00
8800	Amelanotic melanoma	25	0.01
8801	Sarcoma, NOS*	25	0.01
8802	Spindle cell sarcoma	1	0.00
8810	Giant cell sarcoma	11	0.01
8811	Fibrosarcoma, NOS*	4	0.00
8830	Fibromyxoma	31	0.01
8832	Malignant fibrous histiocytoma	2	0.00
8840	Dermatofibrosarcoma, NOS*	1	0.00
8850	Myxosarcoma	3	0.00
8851	Liposarcoma, NOS*	1	0.00
8852	Liposarcoma, well differentiated	5	0.00
8854	Myxoid liposarcoma	2	0.00
8858	Pleomorphic rhabdomyosarcoma	2	0.00
8890	Dedifferentiated liposarcoma	17	0.01
8894	Leiomyosarcoma, NOS*	1	0.00
8895	Angiomyosarcoma	1	0.00
8901	Myosarcoma	1	0.00
8920	Pleomorphic rhabdomyosarcoma	1	0.00
8930	Alveolar rhabdomyosarcoma	17	0.01
8933	Stromal sarcoma, NOS*	5	0.00
8940	Adenosarcoma	1	0.00
8963	Mixed tumor, malignant, NOS*	1	0.00
8980	Rhabdoid sarcoma	70	0.03
8982	Carcinosarcoma, NOS*	4	0.00
8990	Malignant myoepithelioma	2	0.00
9020	Mesenchymoma, malignant	482	0.22
9040	Malignant Phyllodes tumor	2	0.00
9120	Synovial sarcoma, NOS*	92	0.04
9170	Hemangiosarcoma	1	0.00
9180	Lymphangiosarcoma	8	0.00
9220	Osteosarcoma, NOS*	6	0.00
9231	Chondrosarcoma, NOS*	1	0.00
9251	Myxoid chondrosarcoma	2	0.00
9500	Malignant giant cell tumor of soft parts	1	0.00
9560	Neuroblastoma, NOS*	1	0.00
9581	Neurilemmoma, malignant	1	0.00
	Alveolar soft part sarcoma		
	Total Invasive	178,533	100.00

Source: California Cancer Registry (August 2002)
*NOS: Not Otherwise Specified.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 9.8
Invasive Female Breast Cancer Incidence: Frequency and Percent Distribution by Histology and Race/Ethnicity,[1] Microscopically Confirmed, California, 1988-1999

	All Races		Asian/Pacific Islander		Black		Hispanic		White	
Histology (ICD-O)	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Breast - Invasive	218,264	100.0	13,211	100.0	12,067	100.0	22,961	100.0	167,767	100.0
Carcinoma	217,086	99.5	13,096	99.1	12,008	99.5	22,768	99.2	167,002	99.5
Epidermoid Carcinoma	94	0.0	1	0.0	8	0.1	13	0.1	71	0.0
Adenocarcinoma	210,562	96.5	12,710	96.2	11,368	94.2	21,773	94.8	162,617	96.9
Adenocarcinoma, NOS* (8140)	4,076	1.9	240	1.8	324	2.7	475	2.1	2,968	1.8
Tubular Adenocarcinoma (8211)	3,171	1.5	77	0.6	104	0.9	203	0.9	2,743	1.6
Infiltrating Duct Carcinoma (8500)	153,451	70.3	9,714	73.5	8,307	68.8	16,176	70.5	117,738	70.2
Scirrhous Adenocarcinoma (8141)	569	0.3	22	0.2	52	0.4	117	0.5	373	0.2
Comedocarcinoma, NOS* (8501)	4,884	2.2	493	3.7	356	3.0	607	2.6	3,394	2.0
Lobular Carcinoma (8520,8521)	17,651	8.1	573	4.3	658	5.5	1,456	6.3	14,781	8.8
Mucinous Adenocarcinoma and Mucin-Producing Adenocarcinoma (8480,8481)	5,773	2.6	442	3.4	322	2.7	509	2.2	4,435	2.6
Infiltrating Duct and Lobular (8522)	13,138	6.0	626	4.7	569	4.7	1,196	5.2	10,646	6.4
Inflammatory Carcinoma (8530)	3,009	1.4	147	1.1	278	2.3	490	2.1	2,081	1.2
Paget's Disease (8540-8543)	1,894	0.9	119	0.9	128	1.1	229	1.0	1,396	0.8
Papillary Adenocarcinoma (8050,8260,8503)	1,449	0.7	124	0.9	148	1.2	158	0.7	995	0.6
Adenoid Cystic/Cribriform Carcinoma (8200,8201)	526	0.2	49	0.4	27	0.2	32	0.1	411	0.2
Other Adenocarcinoma	971	0.4	84	0.6	95	0.8	125	0.5	656	0.4
Other Specific Carcinoma	3,201	1.5	216	1.6	397	3.3	604	2.6	1,961	1.2
Medullary Carcinoma, NOS* (8510,8512)	3,019	1.4	210	1.6	385	3.2	585	2.6	1,816	1.1
Other	182	0.1	6	0.1	12	0.1	19	0.1	145	0.1
Unspecified Carcinoma	3,229	1.5	169	1.3	235	1.9	378	1.6	2,353	1.4
Carcinoma, NOS* (8010-8011)	3,031	1.4	157	1.2	218	1.8	350	1.5	2,214	1.3
Undifferentiated Carcinoma (8012-8022)	198	0.1	12	0.1	17	0.1	28	0.1	139	0.1
Sarcoma	732	0.3	81	0.6	34	0.3	133	0.6	444	0.3
Phyllodes Tumor (9020)	482	0.2	75	0.6	22	0.2	102	0.4	274	0.2
Hemangiosarcoma (9120,9170)	93	0.0	4	0.0	2	0.0	15	0.1	69	0.0
Other Sarcoma	157	0.1	2	0.0	10	0.1	16	0.1	101	0.1
Other Specified Types	99	0.1	13	0.1	10	0.1	32	0.1	68	0.0
Unspecified (8000-8004)	347	0.2	21	0.2	15	0.1	28	0.1	253	0.2

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
*NOS: Not Otherwise Specified.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

the breast (Table 9.5). This distribution is very similar for cases of female breast cancer reported to SEER for 1988-1999. For SEER data from 1988-1999, 34 percent were located in the upper-outer quadrant of the breast, 8 percent located in the upper-inner quadrant, 6 percent for both the lower-outer and central portion of the breast, 5 percent in the lower-inner, 1 percent in the nipple/areola and axillary tail, and 20 percent in the midline and other positions (data not shown).

The location of invasive breast cancers was very similar for pre- and post-menopausal California women in each of the four race/ethnic groups (Table 9.5). Black women were more likely to have site reported as "Breast, NOS" (18.4 percent compared to 15.1 percent among non-Hispanic white women), whereas Asian/Pacific Islander women were least likely to have site reported as "Breast, NOS." The percent of female breast cancers reported as "Breast, NOS" increased with later stage at diagnosis: Stage I (10.2 percent), Stage IIa (10.2 percent), Stage IIb (11.6 percent), Stage III (23.8 percent), Stage IV (38.7 percent), and unstaged tumors (42.1 percent) (Table 9.6).

Table 9.9
Female Breast Cancer Incidence: Frequency of Histologic Type by Tumor Behavior, Race/Ethnicity,[1] and Age at Diagnosis, Microscopically Confirmed, California, 1988-1999

	All Races		Asian/Pacific Islander		Black		Hispanic		White	
Histology (ICD-O)	<50	50+	<50	50+	<50	50+	<50	50+	<50	50+
Invasive Tumors	51,523	166,741	5,130	8,081	3,986	8,081	8,536	14,425	33,328	134,439
Infiltrating Duct Carcinoma (8500)	37,468	115,983	3,800	5,914	2,830	5,477	6,097	10,079	24,344	93,394
Lobular Carcinoma (8520,8521)	2,701	14,950	174	399	152	506	369	1,087	1,975	12,806
Infiltrating Duct and Lobular (8522)	2,857	10,281	255	371	158	411	405	791	2,021	8,625
Mucinous and Mucin-Producing Adenocarcinoma (8480,8481)	724	5,049	159	283	44	278	92	417	419	4,016
Comedocarcinoma, NOS* (8501)	1,699	3,185	237	256	163	193	286	321	1,006	2,388
Adenocarcinoma, NOS* (8140)	903	3,173	77	163	101	223	170	305	545	2,423
Unspecificarcinoma or Cancer, NOS*	790	2,786	66	124	69	181	166	240	460	2,146
Tubular Adenocarcinoma (8211)	546	2,625	29	48	28	76	51	152	429	2,314
Inflammatory Carcinoma (8530)	1,053	1,956	56	91	111	167	253	237	629	1,452
Medullary Carcinoma, NOS* (8510-8512)	1,375	1,644	102	108	201	184	333	252	730	1,086
All Other Neoplasms	318	1,554	33	109	38	114	60	145	183	1,168
Paget's Disease (8540-8543)	468	1,426	41	78	40	88	89	140	294	1,102
Papillary Adenocarcinoma (8050,8260,8503)	214	1,235	28	96	25	123	40	118	117	878
Scirrhous Adenocarcinoma (8141)	85	484	9	13	10	42	31	86	35	338
Sarcoma	322	410	64	28	16	18	94	55	141	303
In Situ Tumors	9,266	25,435	952	1,476	509	1,270	1,103	1,994	6,474	20,116
Non-Infiltrating Intraductal Carcinoma, NOS* (8500)	4,603	13,406	515	824	236	665	521	1,016	3,226	10,575
Non-Infiltrating Comedocarcinoma (8501)	1,953	5,248	236	312	125	218	231	401	1,328	4,242
Lobular carcinoma *In Situ* (8520, 8521)	1,389	2,385	69	60	68	86	176	198	1,011	1,938
Papillary adenocarcinoma *In Situ* (8050, 8260, 8503)	525	2,072	67	151	42	169	73	203	334	1,516
Intraductal and Lobular Carcinoma *In Situ* (8522)	437	980	28	35	20	51	55	75	325	808
All Other *In Situ* Neoplasms	359	1,344	37	94	18	81	47	101	250	1,037

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
*NOS: Not Otherwise Specified.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 9.10
Female Breast Cancer Incidence: Percent Distribution of Histologic Type by Tumor Behavior, Race/Ethnicity,[1] and Age at Diagnosis, Microscopically Confirmed, California, 1988-1999

	All Races		Asian/Pacific Islander		Black		Hispanic		White	
Histology (ICD-O)	<50	50+	<50	50+	<50	50+	<50	50+	<50	50+
Invasive Tumors	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Infiltrating Duct Carcinoma (8500)	72.7	69.6	74.1	73.2	71.0	67.8	71.4	69.9	73.0	69.5
Lobular Carcinoma (8520,8521)	5.2	9.0	3.4	4.9	3.8	6.3	4.3	7.5	5.9	9.5
Infiltrating Duct and Lobular (8522)	5.5	6.2	5.0	4.6	4.0	5.1	4.7	5.5	6.1	6.4
Mucinous and Mucin-Producing Adenocarcinoma (8480,8481)	1.4	3.0	3.1	3.5	1.1	3.4	1.1	2.9	1.3	3.0
Comedocarcinoma, NOS* (8501)	3.3	1.9	4.6	3.2	4.1	2.4	3.4	2.2	3.0	1.8
Adenocarcinoma, NOS* (8140)	1.8	1.9	1.5	2.0	2.5	2.8	2.0	2.1	1.6	1.8
Unspecificarcinoma or Cancer, NOS*	1.5	1.7	1.3	1.5	1.7	2.2	1.9	1.7	1.4	1.6
Tubular Adenocarcinoma (8211)	1.1	1.6	0.6	0.6	0.7	0.9	0.6	1.1	1.3	1.7
Inflammatory Carcinoma (8530)	2.0	1.2	1.1	1.1	2.8	2.1	3.0	1.6	1.9	1.1
Medullary Carcinoma, NOS* (8510-8512)	2.7	1.0	2.0	1.3	5.0	2.3	3.9	1.7	2.2	0.8
All Other Neoplasms	0.6	0.9	0.6	1.3	1.0	1.4	0.7	1.0	0.5	0.9
Paget's Disease (8540-8543)	0.9	0.9	0.8	1.0	1.0	1.1	1.0	1.0	0.9	0.8
Papillary Adenocarcinoma (8050,8260,8503)	0.4	0.7	0.5	1.2	0.6	1.5	0.5	0.8	0.4	0.7
Scirrhous Adenocarcinoma (8141)	0.2	0.3	0.2	0.2	0.3	0.5	0.4	0.6	0.1	0.3
Sarcoma	0.6	0.2	1.2	0.3	0.4	0.2	1.1	0.4	0.4	0.2
In Situ Tumors	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Non-Infiltrating Intraductal Carcinoma, NOS* (8500)	49.7	52.7	54.1	55.8	46.4	52.4	47.2	51.0	49.8	52.6
Non-Infiltrating Comedocarcinoma (8501)	21.1	20.6	24.8	21.1	24.6	17.2	20.9	20.1	20.5	21.1
Lobular Carcinoma *In Situ* (8520, 8521)	15.0	9.4	7.2	4.1	13.4	6.8	16.0	9.9	15.6	9.6
Papillary Adenocarcinoma *In Situ* (8050, 8260, 8503)	5.7	8.1	7.0	10.2	8.3	13.3	6.6	10.2	5.2	7.5
Intraductal and Lobular Carcinoma *In Situ* (8522)	4.7	3.9	2.9	2.4	3.9	4.0	5.0	3.8	5.0	4.0
All Other *In Situ* Neoplasms	3.9	5.3	3.9	6.4	3.5	6.4	4.3	5.1	3.9	5.2

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
*NOS: Not Otherwise Specified.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

In Situ Tumors

In situ breast cancers had a larger percentage coded as "Breast, NOS" compared to invasive breast tumors (21.0 percent vs. 15.7 percent, respectively) (Table 9.5). The percentage of *in situ* breast cancers with an unspecified location was highest among non-Hispanic white women (20.5 percent) and lowest among Asian/Pacific Islanders (18.2 percent).

Histology

Invasive Tumors

Of the 221,314 invasive breast cancers diagnosed among women from 1988-1999, 218,264 (98.6 percent) were microscopically confirmed and included in the analysis. More than 100 distinct histologic types of invasive breast cancer were reported (Table 9.7). The majority of the invasive tumors (70.3 percent) were reported as infiltrating duct carcinoma (ICD-O histology code 8500). This was similar to the comparable statistic (70.9 percent) reported by SEER for 1988-1999.

Aggregating similar histologic types, lobular carcinoma was the next most frequently diagnosed invasive breast cancer in California (8.1 percent), followed by infiltrating duct and lobular carcinoma (6.0 percent), mucinous adenocarcinoma and mucin-producing adenocarcinoma (2.6 percent), comedocarcinoma, NOS (2.2 percent), and adenocarcinoma, NOS (1.9 percent) (Table 9.8).

The percentage of infiltrating duct carcinoma, the most common histologic type of breast cancer, varied by race/ethnic groups. The percentage of infiltrating duct carcinoma was 68.8 percent, 70.2 percent, 70.5 percent, and 73.5 percent among black, non-Hispanic white, Hispanic, and Asian/Pacific Islander female breast cancer cases, respectively. Race/ethnic differences were apparent among the less common histologies. Lobular carcinoma and infiltrating duct and lobular combined were more common among non-Hispanic white women, while comedocarcinomas, NOS, and mucinous adenocarcinomas were more common among Asian/Pacific Islander women. Black and Hispanic women had a higher percentage of medullary carcinoma, inflammatory carcinoma, adenocarcinoma, NOS, and unspecified carcinoma than non-Hispanic whites and Asian/Pacific Islanders.

Infiltrating duct carcinoma was the most common histology diagnosed among both pre- and post-menopausal women with breast cancer (72.7 percent and 69.6 percent, respectively). Less frequently diagnosed histologies varied with age (Table 9.9 and 9.10). Comedocarcinoma, NOS, and medullary carcinoma, NOS, were more common among pre-menopausal women in all four race/ethnic groups. Similarly, inflammatory carcinoma was more common in younger women, except for Asian/Pacific Islanders, where pre- and post-menopausal women were diagnosed with the same frequency.

Table 9.11
Invasive Female Breast Cancer Incidence: Distribution of Primary Site by Histologic Type, Microscopically Confirmed Cases with Specific Location in the Breast, All Ages Combined and by Age at Diagnosis, California, 1988-1999

Primary Site	Ductal Carcinoma, NOS*	Lobular Carcinoma	Dutal and Lobular Carcinoma	Comedocarcinoma	Mucinous & Mucin-Producing Adenocarcinoma	Medullary Carcinoma	Inflammatory Carcinoma	Tubular Carcinoma	Padget's Disease	Papillary Adenocarcinoma
All Ages										
Nipple and Areola (C50.0)	1.0	1.6	1.2	1.2	1.5	0.4	4.7	0.4	43.9	2.4
Central Portion (C50.1)	9.2	10.6	10.3	8.9	11.3	5.6	24.2	5.1	20.7	15.4
Upper-Inner Quadrant (C50.2)	15.2	11.8	14.1	12.8	15.9	16.6	7.9	16.7	4.3	15.3
Lower-Inner Quadrant (C50.3)	8.0	6.2	6.0	7.5	14.1	7.3	5.1	6.3	5.0	8.3
Upper-Outer Quadrant (C50.4)	56.7	59.9	59.2	60.4	44.3	60.1	50.0	63.6	21.9	47.8
Lower-Outer Quadrant (C50.5)	9.9	9.9	9.2	9.2	12.9	10.0	8.2	7.9	4.2	10.8
Total Cases (100%)	103,247	11,308	8,390	3,231	3,782	2,111	1,004	2,241	1,223	950
Less than 50 Years Old										
Nipple and Areola (C50.0)	0.8	1.3	1.2	0.9	2.1	0.1	2.5	0.0	34.9	3.9
Central Portion (C50.1)	7.9	10.0	10.4	7.1	11.1	4.8	18.1	3.3	14.4	11.7
Upper-Inner Quadrant (C50.2)	15.8	11.6	14.9	14.0	19.9	17.6	7.2	17.2	5.4	17.2
Lower-Inner Quadrant (C50.3)	7.0	5.8	4.6	6.8	9.0	6.3	4.7	5.7	7.9	7.8
Upper-Outer Quadrant (C50.4)	58.2	61.2	58.7	61.3	47.6	61.2	59.2	64.5	31.7	50.0
Lower-Outer Quadrant (C50.5)	10.3	10.1	10.1	9.8	10.3	9.9	8.3	9.3	5.8	9.4
Total Cases (100%)	24,946	1,648	1,787	1,168	477	947	360	389	278	128
50 Years Old and Older										
Nipple and Areola (C50.0)	1.1	1.6	1.2	1.4	1.4	0.7	5.9	0.5	46.6	2.2
Central Portion (C50.1)	9.6	10.8	10.2	9.9	11.3	6.3	27.6	5.5	22.5	15.9
Upper-Inner Quadrant (C50.2)	15.0	11.9	13.8	12.2	15.3	15.7	8.2	16.6	4.0	15.0
Lower-Inner Quadrant (C50.3)	8.3	6.3	6.4	7.9	14.8	8.1	5.3	6.5	4.1	8.4
Upper-Outer Quadrant (C50.4)	56.2	59.6	59.4	59.8	43.9	59.2	44.9	63.4	19.0	47.4
Lower-Outer Quadrant (C50.5)	9.8	9.9	9.0	8.9	13.3	10.1	8.1	7.6	3.7	11.1
Total Cases (100%)	78,301	9,660	6,603	2,063	3,305	1,164	644	1,852	945	822

Source: California Cancer Registry (August 2002)
*NOS: Not Otherwise Specified.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Lobular carcinoma, mucinous, tubular, and papillary adenocarcinomas were more common among post-menopausal women in all four race/ethnic groups. To examine the changes by age in more detail, Figure 9.2 shows the proportions of selected histologic types, among white females, examined by five-year age groups.

Histologies of invasive breast cancers diagnosed in California were compared to those in the SEER Regions from 1988 through 1999, where 144,424 white and 13,120 black cases were registered. CCR and SEER data were not strictly comparable because SEER includes both Hispanic and non-Hispanic white women in the category "white." Non-Hispanic whites and blacks in California had a lower proportion of breast cancer cases with nonspecific histologies (adenocarcinoma, NOS, and carcinoma, NOS). Both white and black women in California were approximately twice as likely to have inflammatory carcinoma than their counterparts in SEER. Also, both races in California were more frequently diagnosed with sarcoma than women in the SEER program. Otherwise, the histology of breast cancer among white and black women in California and SEER were very similar. It is unclear whether the differences reflect different diagnostic patterns among physicians or differences in the risk of developing certain types of breast cancer.

The ten most common histologic types of the breast are shown within specific location in the breast in Table 9.11. In general, the location of tumors was similar for most histologies. Tumors with specific site information occurred most often in the upper-outer quadrant, approximately 15 percent in the upper-inner quadrant, lower-outer quadrant, in the nipple, areola, and central portion combined, and lower-inner quadrant. The exceptions to this pattern were Paget's disease, which

Table 9.12
Invasive Female Breast Cancer Incidence: Distribution of Primary Site by Histologic Type and Race/Ethnicity,[1] Microscopically Confirmed Cases with Specific Location in the Breast , California, 1988-1999

Primary Site	Histology (%)				
	Infiltrating Duct Carcinoma	Lobular Carcinoma	Duct and Lobular Carcinoma	Mucinous & Mucin-Producing Adenocarcinoma	Comedocarcinoma
Asian/Pacific Islander					
Nipple and Areola (C50.0)	1.0	1.9	0.7	1.7	0.9
Central Portion (C50.1)	11.0	10.2	14.1	12.0	7.5
Upper-Inner Quadrant (C50.2)	17.5	16.8	19.8	18.4	15.6
Lower-Inner Quadrant (C50.3)	7.6	7.0	5.7	14.4	7.2
Upper-Outer Quadrant (C50.4)	53.6	54.5	52.7	42.1	60.7
Lower-Outer Quadrant (C50.5)	9.2	9.6	6.9	11.4	8.1
Total Cases	6,563	374	404	299	333
Black					
Nipple and Areola (C50.0)	0.7	1.2	0.6	2.0	1.7
Central Portion (C50.1)	8.3	8.8	7.6	10.4	8.1
Upper-Inner Quadrant (C50.2)	15.5	11.7	12.4	17.4	11.9
Lower-Inner Quadrant (C50.3)	9.0	7.6	5.7	14.9	8.5
Upper-Outer Quadrant (C50.4)	56.4	59.7	67.3	40.3	57.2
Lower-Outer Quadrant (C50.5)	10.1	11.0	6.3	14.9	12.7
Total Cases	5,470	409	315	201	236
Hispanic					
Nipple and Areola (C50.0)	1.2	1.2	1.4	2.6	2.3
Central Portion (C50.1)	9.7	11.8	12.8	12.1	10.1
Upper-Inner Quadrant (C50.2)	16.2	12.9	13.8	13.5	13.0
Lower-Inner Quadrant (C50.3)	7.7	5.3	6.2	12.4	6.7
Upper-Outer Quadrant (C50.4)	55.1	59.4	55.5	45.0	60.6
Lower-Outer Quadrant (C50.5)	10.1	9.4	10.3	14.4	7.3
Total Cases	10,979	919	759	347	386
White					
Nipple and Areola (C50.0)	1.0	1.6	1.2	1.3	1.1
Central Portion (C50.1)	9.0	10.6	9.9	11.2	8.9
Upper-Inner Quadrant (C50.2)	14.8	11.5	13.8	15.8	12.6
Lower-Inner Quadrant (C50.3)	8.0	6.1	6.0	14.2	7.6
Upper-Outer Quadrant (C50.4)	57.2	60.2	59.6	44.7	60.7
Lower-Outer Quadrant (C50.5)	9.9	10.0	9.4	12.8	9.2
Total Cases	79,599	9,518	6,867	2,909	2,261

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

predominantly occurred in the nipple, areola, and central breast (64.6 percent), and inflammatory carcinoma, which also had a relatively high proportion (28.9 percent) of tumors in the nipple, areola, and central breast. Mucinous and papillary adenocarcinomas also occurred somewhat less frequently in the upper-outer quadrant (44 percent and 48 percent, respectively).

Table 9.12 shows the location of invasive breast cancers for the five most common histologic types by race/ethnicity. The number of race- and histology-specific cases by race/ethnicity was small for black, Hispanic, Asian/Pacific Islander women. Each race/ethnic group experienced the same general pattern. However, Asian/Pacific Islander women had a higher proportion of the five common histologic types located in the upper-inner quadrant of the breast compared to non-Hispanic white women.

In Situ Tumors

From 1988 through 1999, 34,694 cases of microscopically confirmed *in situ* female breast cancer were diagnosed in California. More than 20 histologic types were identified (Table 9.13). Ductal carcinoma *in situ* (DCIS) (ICDO-2=8500) was the most common histologic type of *in situ* breast cancer. Unlike invasive breast cancer, DCIS accounted for a smaller proportion of cases, 52.1 percent versus 70.3 percent of invasive cases. DCIS made up more than half of all *in situ* carcinomas for all race/ethnic groups, except Hispanics who were slightly less than 50 percent. The proportion of DCIS of all *in situ* breast cancers has increased over the 12-year period. This may be due to increased mammography screening. Mammograms are particularly effective at detecting DCIS.

Table 9.13
***In Situ* Female Breast Cancer Incidence: Frequency and Percent Distribution by Detailed Histology, Miscroscopically Confirmed, California, 1988-1999**

Histology (ICD-O-2)		Cases	%
8010	Carcinoma *in situ*, NOS*	461	1.33
8012	Large cell carcinoma, NOS*	2	0.01
8050	Papillary carcinoma *in situ*	258	0.74
8051	Lymphoepithelial carcinoma	2	0.01
8070	Squamous cell carcinoma *in situ*, NOS*	6	0.02
8081	Lymphoepithelial carcinoma	1	0.00
8140	Adenocarcinoma *in situ*	35	0.10
8200	Eccrine dermal cylindroma	5	0.01
8201	Cribriform carcinoma	579	1.67
8210	Adenocarcinoma *in situ* in adenomatous polyp	1	0.00
8211	Tubular adenocarcinoma	3	0.01
8230	Solid carcinoma, NOS*	4	0.01
8260	Papillary adenocarcinoma *in situ*	38	0.11
8401	Apocrine adenocarcinoma	42	0.12
8480	Mucinous adenocarcinoma	21	0.06
8481	Mucin producing adenocarcinoma	1	0.00
8500	Non infiltrating intraductal carcinoma, NOS*	18,009	51.90
8501	Non infiltrating comedocarcinoma	7,201	20.75
8502	Juvenile carcinoma of the breast	3	0.01
8503	Non infiltrating intraductal papillary adenocarcinoma	2,301	6.63
8504	Non infiltrating intracystic carcinoma	214	0.62
8520	Lobular carcinoma *in situ*	3,768	10.86
8521	Ductular carcinoma *in situ*	6	0.02
8522	Intraductal carcinoma and lobular carcinoma *in situ*	1,417	4.08
8540	Paget's disease, mammary	127	0.37
8541	Paget's disease & infiltrating duct carcinoma	5	0.01
8542	Paget's disease, extramammary	1	0.00
8543	Paget's disease and intraductal carcinoma	188	0.54
8573	Adenocarcinoma with apocrine metaplasia	1	0.00
9020	Phyllodes tumor, NOS*	1	0.00
	Total *In situ*	34,701	100.00

Source: California Cancer Registry (August 2002)
*NOS: Not Otherwise Specified.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Comedocarcinomas were the second most common histologic type, accounting for 20.8 percent of *in situ* cancers. Lobular carcinoma was the third most common *in situ* breast cancer among all race/ethnic groups, followed by noninfiltrating intraductal papillary adenocarcinoma, and intraductal carcinoma, and lobular carcinoma *in situ*.

Table 9.14
***In Situ* Female Breast Cancer Incidence: Frequency and Percent Distribution by Histology and Race/Ethnicity,[1] Microscopically Confirmed, California, 1988-1999**

	All Races		Asian/Pacific Islander		Black		Hispanic		White	
Histology	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
In Situ Tumors	34,694	100.00	2,420	100.00	1,780	100.00	3,096	100.00	26,588	100.00
Epidermoid carcinoma	9	0.03	1	0.04	2	0.11	1	0.03	5	0.02
Adenocarcinoma	34,217	98.62	2,385	98.55	1,753	98.48	3,041	98.22	26,242	98.70
Non-infiltrating intraductal carcinoma (8500)	18,077	52.10	1,339	55.33	904	50.79	1,544	49.87	13,857	52.12
Non-infiltrating comedocarcinoma (8501)	7,225	20.82	548	22.64	343	19.27	632	20.41	5,592	21.03
Lobular carcinoma *in situ* (8520,8521)	3,779	10.89	128	5.29	154	8.65	374	12.08	2,953	11.11
Intraductal and lobular carcinoma *in situ* (8522)	1,423	4.10	64	2.64	71	3.99	130	4.20	1,137	4.28
Papillary adenocarcinoma *in situ* (8050,8260,8503)	2,601	7.50	218	9.01	211	11.85	277	8.95	1,853	6.97
Other adenocarcinoma *in situ*	1,112	3.21	88	3.64	70	3.93	84	2.71	850	3.20
All other carcinoma *in situ*	468	1.35	34	1.40	25	1.40	54	1.74	341	1.28

[1] Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Source: California Cancer Registry (August 2002)
Prepared by the California Department of Health Services, Cancer Surveillance Section.

These five histologic types comprise nearly 95 percent of all *in situ* cancers diagnosed in California from 1988 through 1999. DCIS was the predominant form of *in situ* breast cancer among all race/ethnic groups, followed by non-infiltrating comedocarcinomas.

Similar histologic patterns were seen in SEER data. DCIS was the most common histologic type of *in situ* breast cancer (53.3 percent), followed by comedocarcinoma (17.0 percent), lobular carcinoma (14.0 percent), papillary adenocarcinoma (5.9 percent), and ductal and lobular carcinoma (3.9 percent). Some differences existed when race-specific comparisons were made between CCR and SEER *in situ* breast cancer data. While CCR and SEER had similar proportions of DCIS, when examined by race, blacks in California had a lower proportion of DCIS than blacks in SEER, 50.7 percent and 57.2 percent, respectively. Non-Hispanic white and black women in California had a lower proportion of lobular carcinomas, 11.1 percent and 8.7 percent, respectively, versus 14.1 percent and 12.5 percent among SEER white and black women. Differences in coding of race between CCR and SEER may explain some of these differences.

Comedocarcinoma represented a considerably higher percentage of *in situ* breast cancers for both race groups in California, accounting for 21.0 percent and 19.3 percent of cases among white and black women in California, respectively, and 17.6 percent and 15.0 percent of cases among white and black SEER women, respectively. While differences did seem to exist, sufficient information is not available to interpret these differences.

Summary

Consistent with other research studies, CCR data show that breast cancer is somewhat more likely to occur in the left breast than in the right. Left-sided tumors were found more often than right-sided tumors at all stages at diagnosis, with the highest left/right ratio occurring among *in situ* cancers.

For most of the common histologic types of female breast cancer, tumors occurred most often in the upper-outer quadrant, regardless of age at diagnosis (pre- or post-menopausal), race/ethnicity, or stage at diagnosis.

More than 100 distinct histologic types of invasive breast cancer were reported in California; however, a majority of the tumors were infiltrating duct carcinomas (70.3 percent). Histologic types varied among the race/ethnic groups, particularly for the less common histologies. Asian/Pacific Islander women had higher proportions of comedocarcinomas and mucinous adenocarcinomas. Blacks and Hispanics had higher proportions of medullary carcinoma, inflammatory carcinoma, adenocarcinoma, NOS, and unspecified carcinoma. The proportion of comedocarcinomas, NOS, and medullary

carcinoma, NOS, was higher among pre-menopausal women and alternatively, lobular carcinoma, mucinous, tubular, and papillary adenocarcinomas among post-menopausal women.

While some differences were detected, women diagnosed with breast cancer in California and in SEER regions have many similar characteristics. California, in the near future, will be able to calculate survival rates and examine whether the survival experience of women in California and SEER are comparable. Breast cancer survival, limited to the San Francisco-Oakland MSSA, is discussed in Chapter 11.

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Surgical Treatment of Female Breast Cancer in California

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Introduction

The local management of breast cancer has changed substantially during the last two decades as a result of better understanding of tumor biology, early diagnosis, and increased patient participation in treatment choices. Some of the same principles that led to the replacement of Halsted's radical procedure with modified radical mastectomy have also contributed to the development of breast-conserving surgery (BCS) (1). Based on results of retrospective studies and randomized clinical trials since 1980, the 1990 National Institutes of Health Consensus Conference (2) recommended BCS followed by radiotherapy as an appropriate therapy for most women with stage I and II breast cancer. Results from two key BCS randomized studies released after a 20 year follow up confirmed these recommendations (3,4). This chapter focuses on current trends and demographic factors associated with surgical procedures performed as part of first course of breast cancer treatment in California. Special emphasis is given to patterns of treatment in early-stage breast cancer. Choice of surgery is evaluated by stage at diagnosis, age, race/ethnicity, and SES of the patient's neighborhood. Additional information on the frequency of patients receiving radiotherapy following BCS is also provided. CCR has collected statewide information on incident cancers in California for 15 years, and was the source of all data presented in this chapter. CCR is considered to have complete statewide coverage, and has consistently attained the North American Association of Central Cancer Registries' gold standard for data quality.

Methods

During the period between 1988 and 1999, a total of 219,744 women were diagnosed with primary breast cancer in California. This figure excludes women who had been previously diagnosed with cancer, women with unknown age at diagnosis, and breast cancer cases for which the only source of information was autopsy or the death certificate. The proportion of women receiving BCS or mastectomy was evaluated from 1995 through 1999, the most recent five-year period for which complete data is available to CCR. Because cancer treatment options and recommendations are dictated primarily by the stage of disease, possible associations between type of surgery and age, race/ethnicity, or SES were assessed after stratifying the data by stage at diagnosis. Temporal trends and possible associations were evaluated with chi-square tests. A p-value smaller than 0.05 was considered statistically significant. A detailed description of all factors included in the analysis of breast cancer surgical treatment is given below.

Type of Surgery

Surgery was categorized as mastectomy or BCS. Mastectomy included all breast removal procedures (subcutaneous, total [simple], modified radical, and radical mastectomy), with or without removal of uninvolved contralateral breast. BCS included

all procedures to remove the gross primary tumor plus part of the breast tissue (partial or segmental mastectomy, lumpectomy, quadrantectomy, tylectomy, wedge resection, nipple resection, or excisional biopsy), with or without dissection of axillary lymph nodes.

Stage at diagnosis

In this chapter, SEER extent of disease codes were converted to the AJCC staging system (5). The following AJCC definitions for stage at diagnosis were used:

Stage 0:	*in situ* tumor
Stage I:	tumor less than 2 cm in greatest dimension with no spread to axillary lymph nodes.
Stage IIa:	tumor less than 2 cm, lymph nodes involved, but movable or tumor 2 to 5 cm with no spread to axillary lymph nodes.
Stage IIb:	tumor 2 to 5 cm, lymph nodes involved, but movable or tumor more than 5 cm with no spread to lymph nodes.
Stage III:	tumor more than 5 cm, lymph nodes involved, but movable or tumor of any size, lymph nodes involved and fixed to each other or other structures.
Stage IV:	spread to other organs.

Age at Diagnosis

Age at diagnosis was grouped into five groups: under 40, 40-49, 50-64, 65-74, and over 74 years. These age groups were selected to represent factors thought to be associated with choice of treatment, such as menopausal status, eligibility to Medicare coverage, and older age.

Race/Ethnicity

Race/ethnicity was grouped into four mutually exclusive categories of Hispanic, white, black, and Asian/Pacific Islander. Hispanic ethnicity was based on information on the medical record or death certificate, and on surname. Women with race coded as white, black, or unknown with a last name (or maiden name, when present) on the 1980 U.S. Census list of 12,497 Hispanic surnames were categorized as Hispanic. The use of surname was adopted to more accurately classify Hispanic ethnicity, which is usually underreported in medical records and death certificates (6).

SES Data

Data from the 1990 U.S. Census block group of residence were used as surrogate measures of SES for individual cancer patients, since CCR does not collect such information. SES was defined as an index combining: (a) two measures of occupation (proportion with a blue-collar job and proportion older than 16 in the work force without a job), (b) two measures of income (proportion below 200 percent of the

poverty level and median household income), (c) an education index (proportion of people in a block group with a given level of education weighted by the number of years needed to attain that level of education), and (d) two measures of cost of living (median rent and median house value). A detailed description of the methodology used to create the SES index is available elsewhere (7).

Results

Table 10.1 shows surgical treatment by stage at diagnosis in California women diagnosed with breast cancer from 1988 through 1999. During this period, 49.2 percent of all breast cancers were diagnosed at a very early stage (*in situ* or stage I tumors). Surgical treatment was linked to stage of disease, with the percentage of women receiving BCS significantly declining with more advanced disease. Cancer-directed surgery was not included in the first course of treatment of almost half the women diagnosed with stage IV (metastatic) breast cancer.

Table 10.1
Surgical Procedures Performed as Part of the First Course of Treatment of Female Breast Cancer, by Stage at Diagnosis, California, 1988-1999

		Stage at Diagnosis						
Surgical Procedure		*In situ*	I	II	III	IV	Unknown	Total
BCS[1]	No.	17,552	45,208	24,717	1,143	1,629	5,082	95,331
	%	62.0	56.7	32.9	10.0	19.9	30.1	43.38
Mastectomy	No.	10,034	34,154	49,737	9,270	2,396	7,830	113,421
	%	35.5	42.8	66.1	80.9	29.3	46.4	51.6
Surgery, NOS*	No.	29	40	59	32	56	274	490
	%	0.1	0.1	0.1	0.3	0.7	1.6	0.2
No Cancer Surgery	No.	659	369	674	1,004	4,048	3,379	10,133
	%	2.3	0.5	0.9	8.8	49.7	20.0	4.6
Unknown	No.	15	3	3	10	39	299	369
	%	0.1	0.0	0.0	0.1	0.5	1.8	0.2
Total	No.	28,289	79,774	75,190	11,459	8,168	16,864	219,744
	%	12.9	36.3	34.2	5.2	3.7	7.7	100.0

[1] BCS: Breast-conserving surgery. BCS includes partial or segmental mastectomy, quadrantectomy, tylectomy, wedge resection, nipple resection, lumpectomy, or excisional biopsy, with or without dissection of axillary lymph nodes.
*NOS: Not Otherwise Specified.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

BCS Use by Race/Ethnicity, SES, Age, and Stage at Diagnosis

Tables 10.2 - 10.4 show the proportion of women receiving BCS or mastectomy from 1995 through 1999, stratified by stage at diagnosis. Among those diagnosed with *in situ* tumors, the proportion of white, black, and Hispanic women receiving BCS was similar (Table 10.2), while Asian/Pacific Islander women were significantly more likely to receive a mastectomy than white women (p-value < 0.001). Overall, differences in treatment between women diagnosed with stage I or *in situ* tumors were less marked than differences between these two very early stages and stage IIa tumors (i.e., tumors less than 2 cm, lymph nodes involved but movable, or tumors 2 to 5 cm with no spread to axillary lymph nodes). However, within stages I and IIa, Hispanic and Asian/Pacific

Islander women were significantly less likely to receive BCS than white women. Regardless of the stage of disease at the time of diagnosis, there were no significant differences in the type of surgery received by black and white women.

Table 10.2
Type of Surgery in Women with Early Stage Breast Cancer, by Race/Ethnicity[1] and Stage at Diagnosis,[2] California, 1995–1999

	Breast-Conserving Surgery[3]		Mastectomy		Total
Race/Ethnicity	No.	%	No.	%	No.
Stage 0 *(In situ)*					
All Races[4] Combined	9,840	69.6	4,295	30.4	14,135
Asian/Pacific Islander	826	65.0	444	35.0	1,270
Black	511	67.4	247	32.6	758
Hispanic	1,007	69.4	445	30.6	1,452
White	7,193	69.8	3,114	30.2	10,307
Stage I					
All Races[4] Combined	25,048	67.3	12,152	32.7	37,200
Asian/Pacific Islander	1,455	54.9	1,194	45.1	2,649
Black	1,056	68.0	496	32.0	1,552
Hispanic	2,233	64.1	1,251	35.9	3,484
White	20,001	68.7	9,121	31.3	29,122
Stage IIa					
All Races[4] Combined	10,014	48.8	10,492	51/2	20,506
Asian/Pacific Islander	651	37.8	1,071	62.2	1,722
Black	651	52.9	580	47.1	1,231
Hispanic	1,189	45.5	1,424	54.5	2,614
White	7,432	50.3	7,349	49.7	14,781

1 Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
2 Stage I: tumors 2 cm without lymph node involvement; stage IIa: (i) tumors 2 cm with positive lymph nodes or (ii) tumors 2.1 cm to 5 cm, regardless of nodal status.
3 Breast-conserving surgery includes partial or segmental mastectomy, quadrantectomy, tylectomy, wedge resection, nipple resection, lumpectomy, or excisional biopsy, with or without dissection of axillary lymph nodes.
4 Includes persons of other and unknown race/ethnicity
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Table 10.3 shows type of surgery by age and stage at diagnosis. Within stage 0 (*in situ* tumors), there was a very clear trend (p-value < 0.001) toward BCS with increasing age (women over 75 were about twice as likely to receive BCS than women under 40). This trend was not observed among women diagnosed with either stage I or IIa breast cancer. Within stage I, the likelihood of receiving BCS increased with age, peaked at the 50-64 age group, and then decreased. Within stage IIa, the only statistically significant difference detected in treatment was a 35 percent higher likelihood of receiving BCS among women who were 64 and younger at the time of diagnosis (p-value < 0.001).

Table 10.4 shows type of surgery by the patient's neighborhood SES level. A statistically significant trend towards BCS with higher SES levels was detected within all three stages at diagnosis. The association between surgery and SES was stronger among women diagnosed with stage I breast cancer; those residing in medium or high SES neighborhoods were 30 percent and 64 percent, respectively, more likely to receive BCS than women residing in a low SES area (p-value < 0.001). A similar, but weaker, association was detected among women diagnosed with stage IIa tumors. For this group of patients, residence in a medium or high SES area increased the likelihood of receiving BCS by 27 percent and 52 percent, respectively. A much less marked (but still

significant) trend toward BCS was also detected among women diagnosed with *in situ* tumors. Within this group of patients, the likelihood of receiving BCS increased by 8 percent and 14 percent, respectively, with residence in a medium or high SES neighborhood.

Table 10.3
Type of Surgery by Women with Early Stage Breast Cancer, by Age at Diagnosis and Stage of Disease,[1] California, 1995–1999

	Breast-Conserving Surgery[2]		Mastectomy		Total
Age at Diagnosis	No.	%	No.	%	No.
Stage 0 *(In situ)*					
All Ages	9,840	69.6	4,275	30.4	14,135
0 – 39	349	54.9	267	45.1	636
40-49	2,426	66.8	1,208	33.2	3,634
50-64	3,411	70.6	1,418	29.4	4,829
65-74	2,211	71.6	877	28.4	3,088
75+	1,443	74.1	505	25.9	1,948
Stage I					
All Ages	25,048	67.3	12,152	32.7	37,200
0 – 39	910	64.0	511	36.0	1,421
40-49	4,297	67.5	2,069	32.5	6,366
50-64	7,926	69.3	3,510	30.7	11,436
65-74	6,510	66.5	3,273	33.5	9,783
75+	5,405	66.0	2,789	34.0	8,194
Stage IIa					
All Ages	10,014	48.8	10,492	51.2	20,506
0 – 39	782	50.4	770	49.6	1,552
40-49	2,594	52.7	2,325	47.3	4,919
50-64	3,167	51.2	3,014	48.8	6,181
65-74	1,877	45.7	2,233	54.3	4,110
75+	1,594	42.6	2,150	57.4	3,744

[1] Stage I: tumors 2 cm without lymph node involvement; stage IIa: (i) tumors 2 cm with positive lymph nodes or (ii) tumors 2.1 cm to 5 cm, regardless of nodal status.
[2] Breast-conserving surgery includes partial or segmental mastectomy, quadrantectomy, tylectomy, wedge resection, nipple resection, lumpectomy, or excisional biopsy, with or without dissection of axillary lymph nodes.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Temporal Trends

In 1988, 32.4 percent of women diagnosed with stage 0, I, or IIa breast cancer received BCS as part of their first course of treatment. In 1999, the percentage of women receiving BCS increased to 65.8 percent (p-value for trend < 0.001). Temporal trends of BCS use were evaluated among women who would most likely be eligible for breast conservation, i.e., those diagnosed with a tumor staged 0, I, or IIa. Results presented here update a prior CCR study, which detected a steady increase in BCS utilization in California, adjusting for age, race/ethnicity, stage at diagnosis, and neighborhood education level (8). Figure 10.1 shows trends from 1988 through 1999, by stage at diagnosis. Despite clear differences according to the stage of disease at diagnosis, BCS use has increased monotonically among women in the three stages considered. Such increase was steeper among women diagnosed with stage I breast cancer, while it seems to have reached a plateau among those diagnosed with *in situ* tumors. Trends of BCS by race/ethnicity (also for women diagnosed with stage 0-IIa breast cancer) are shown in Figure 10.2. As previously detected, BCS use has increased among all race/ethnic groups, although a dip was observed among black women in 1999. Figure 10.3 displays similarly increasing trends by age group. An increase was observed in all age groups. However, while older age did not seem to represent an impediment for breast conservation, BCS use among women under 40 slowed down during the mid 1990s. A monotonically increasing trend among all three SES levels examined (Figure 10.4) was also clear during the

period. The proportion of women in the low, medium, and high SES levels receiving BCS increased by 32 percent to 34 percent from 1988 through 1999. However, differences in BCS use among the three levels still persisted at the end of the 1995-1999 period.

Radiation Following BCS

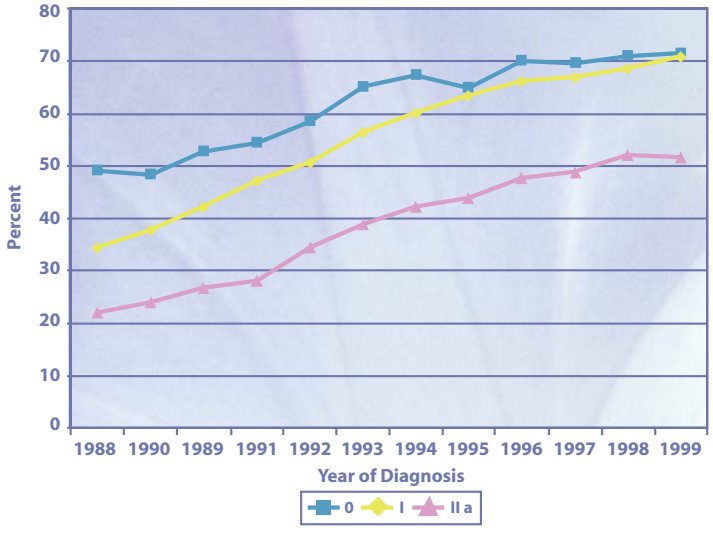
During 1995-1999, the most recent five-year period available to CCR, 65.6 percent of BCS patients received radiation following their surgery (Table 10.5). Patients diagnosed with *in situ* tumors were far less likely to receive radiation than those diagnosed with stage I or IIa breast cancer (Figure 10.5). There were significant differences in the percentage of patients receiving radiation according to their race/ethnicity (Figure 10.6): Asian/Pacific Islander and white women were about 18 percent and 30 percent more likely to be irradiated following BCS than Hispanic or black women, respectively (p-values < 0.001). Age at diagnosis was a significant factor as well: women in the 50-74 age group were more likely to receive radiation than either younger or older

Table 10.4
Type of Surgery in Women with Early Stage Breast Cancer, by Socioeconomic Status (SES)[1] and Stage at Diagnosis,[2] California, 1995–1999

	Breast-Conserving Surgery[3]		Mastectomy		Total
SES Level	No.	%	No.	%	No.
Stage 0 *(In situ)*					
All Levels	9,827	69.6	4,295	30.4	14,122
Low	1,919	68.0	904	32.0	2,823
Medium	4,953	69.6	2,169	30.4	7,122
High	2,955	70.7	1,222	29.3	4,177
Stage I					
All Levels	25,029	67.3	12,147	32.7	37,176
Low	4,851	61.3	3,069	38.7	7,920
Medium	12,837	67.3	6,240	32.7	19,077
High	7,341	72.1	2,838	27.9	10,179
Stage IIa					
All Levels	10,003	48.8	10,485	51.2	20,488
Low	2,203	43.2	2,897	56.8	5,100
Medium	5,038	49.2	5,197	50.8	10,235
High	2,762	53.6	2,391	46.4	5,153

[1] SES level defined as an index combining seven Census 1990 block group measures of occupation, income, education, and cost of living.
[2] Stage I: tumors 2 cm without lymph node involvement; stage IIa: (i) tumors 2 cm with positive lymph nodes or (ii) tumors 2.1 cm to 5 cm, regardless of nodal status.
[3] Breast-conserving surgery includes partial or segmental mastectomy, quadrantectomy, tylectomy, wedge resection, nipple resection, lumpectomy, or excisional biopsy, with or without dissection of axillary lymph nodes.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 10.1
Breast-Conserving Surgery in Women with Early-Stage Breast Cancer, by Stage[1] and Year of Diagnosis, California, 1988-1999



[1] Stage 0: *in situ* tumors; stage I: tumors up to 2 cm without lymph node involvement; stage IIa: tumors up to 2 cm with positive lymph nodes or tumors up to 5 cm, regardless of nodal status.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

patients. Women 75 years and older were far less likely to receive radiation than any other age group examined in this study. Figure 10.8 shows that SES may also play a role on the patient's decision or opportunity to receive radiation following BCS: patients residing in lower SES areas were significantly less likely to be treated with radiation than those in higher SES areas. The reasons why 34.4 percent of BCS patients did not have radiation included during their first course of treatment (Figure 10.9) were as follows: not recommended (70.2 percent), contraindicated (0.5 percent), patient refused (5.0 percent), recommended, unknown if given (9.9 percent), reason unknown (13.5 percent), and unknown if recommended or given (0.9 percent).

Table 10.5
Radiation as Part of the First Course of Treatment Among Women Receiving Breast-Conserving Surgery, California, 1995–1999

Radiation	No. Patients	%
Included	29,446	65.6
Not Included	15,283	34.1
Unknown	130	0.3

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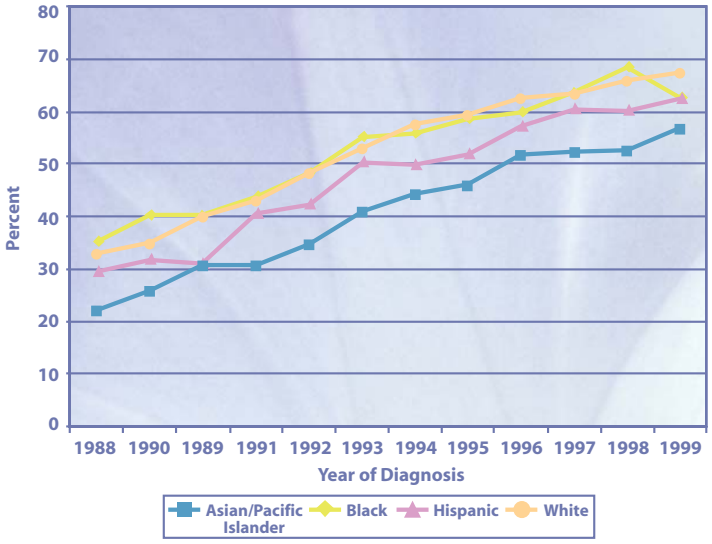
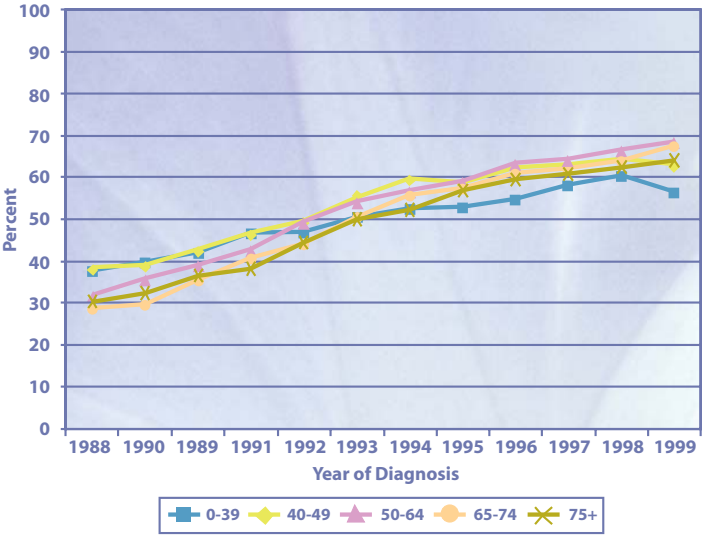
Figure 10.2
Breast-Conserving Surgery in Women with Stage 0 – IIa[1] Breast Cancer, by Race/Ethnicity[2] and Year of Diagnosis, California, 1988-1999



1 Stage 0: *in situ* tumors; stage I: tumors up to 2 cm without lymph node involvement; stage IIa: tumors up to 2 cm with positive lymph nodes or tumors up to 5 cm, regardless of nodal status.
2 Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 10.3
Breast-Conserving Surgery in Women with Stage 0 – IIa[1] Breast Cancer, by Age and Year of Diagnosis, California, 1988-1999



1 Stage 0: *in situ* tumors; stage I: tumors up to 2 cm without lymph node involvement; stage IIa: tumors up to 2 cm with positive lymph nodes or tumors up to 5 cm, regardless of nodal status.
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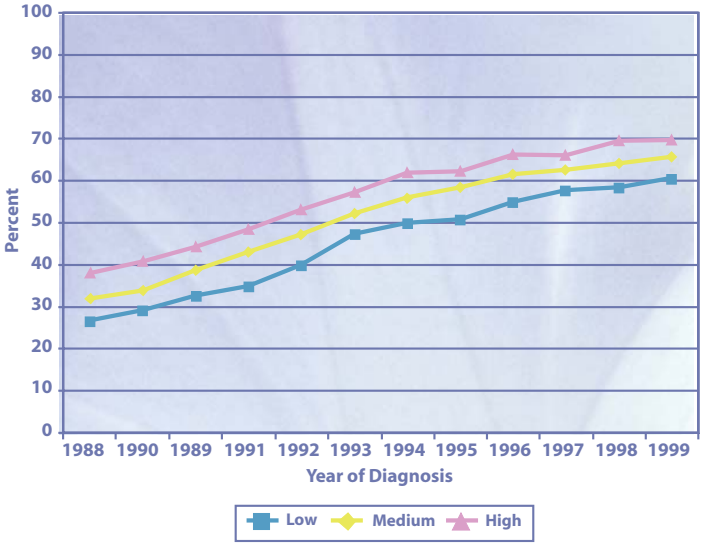
Figure 10.4
Breast-Conserving Surgery in Women with Stage 0-IIa[1] Breast Cancer, by Socioeconomic Status (SES)[2] and Year of Diagnosis, California, 1988-1999



1 Stage 0: *in situ* tumors; stage I: tumors up to 2 cm without lymph node involvment; stage IIa: tumors up to 2 cm with positive lymph nodes or tumors up to 5 cm, regardless of nodal status.
2 SES level defined as an index combining seven Census 1990 block group measures of occupation, income, education, and cost of living.

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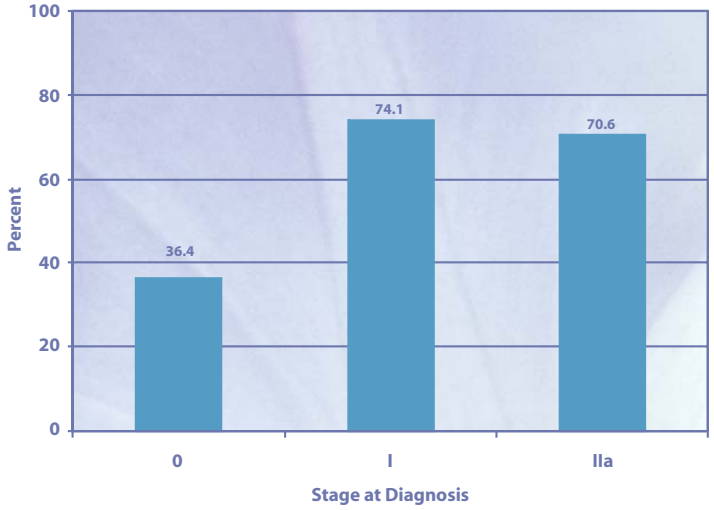
Figure 10.5
Percentage of Breast-Conserving Surgery Patients Receiving Radiation During First Course of Treatment, by Stage at Diagnosis,[1] California, 1995-1999



1 Stage 0: *in situ* tumors; stage I: tumors up to 2 cm without lymph node involvement; stage IIa: tumors up to 2 cm with positive lymph nodes or tumors up to 5 cm, regardless of nodal status.
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Figure 10.6
Percentage of Breast-Conserving Surgery Patients Receiving Radiation During First Course of Treatment, by Race/Ethnicity, California, 1995-1999

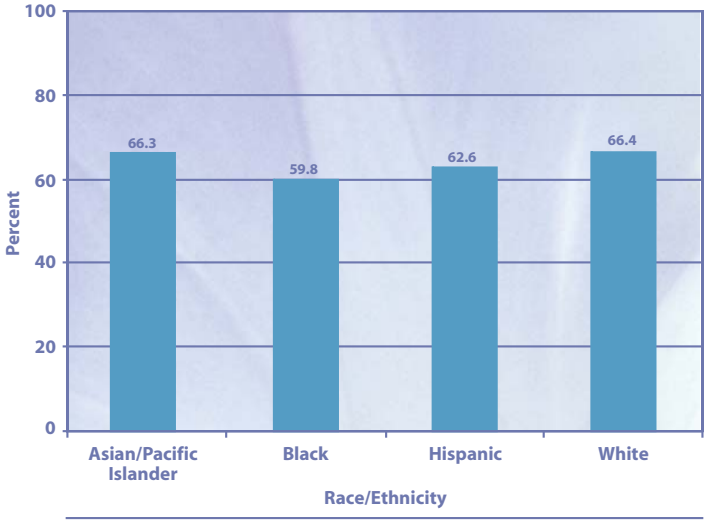

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Figure 10.7
Percentage of Breast-Conserving Surgery Patients Receiving Radiation During First Course of Treatment, by Age at Diagnosis, California, 1995-1999

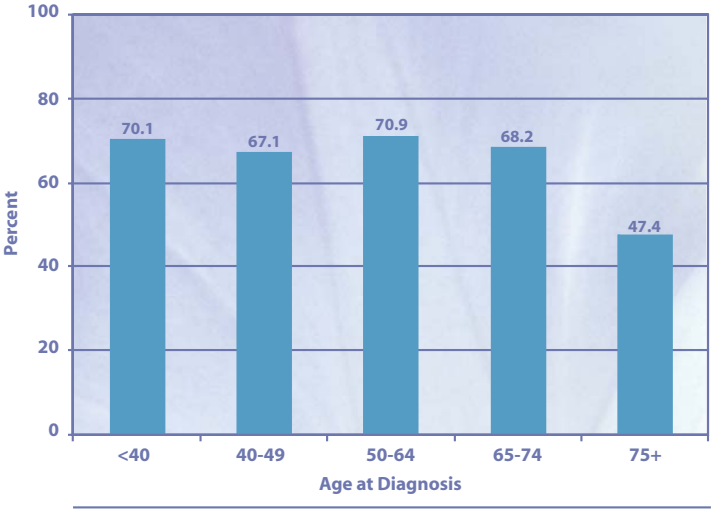

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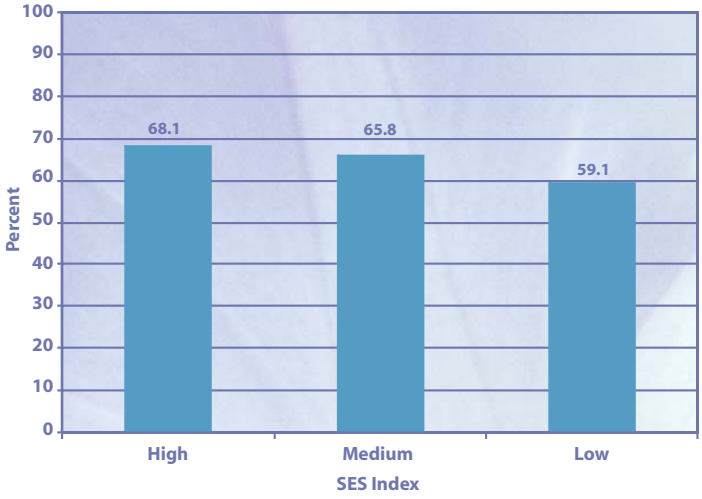
Figure 10.8
Percentage of Breast-Conserving Surgery Patients Receiving Radiation During First Course of Treatment, by Socioeconomic Status (SES) in Area of Residence,[1] California, 1995-1999



[1] SES level defined as an index combining seven Census 1990 block group measures of occupation, income, education, and cost of living.

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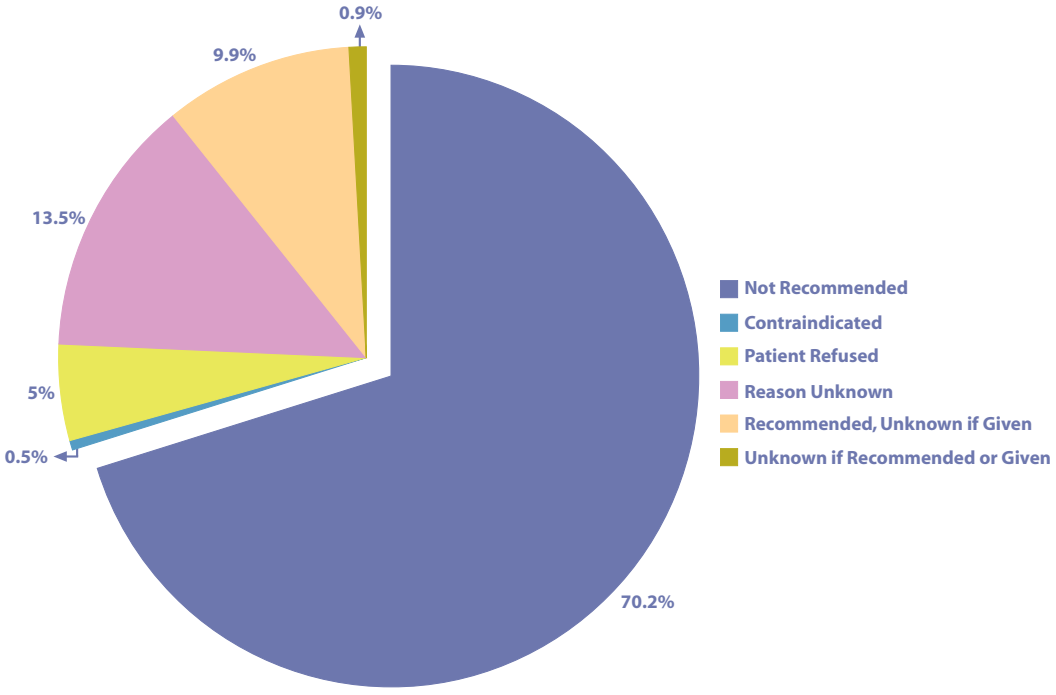
Figure 10.9
Reason Why Radiation Was Not Included in First Course of Treatment, Breast-Conserving Surgery Patients, California, 1995-1999



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Discussion

The size and the diversity of the California population enabled this study to detect marked differences in surgical treatment among the race/ethnic groups examined. The odds of receiving BCS for Hispanic and Asian/Pacific Islander women in California were substantially lower than the odds for white or black women. There were also substantial differences in surgical treatment according to the woman's age at diagnosis and SES in her neighborhood. The appropriate treatment for *in situ* carcinomas is still subject to controversy. However, results from this study show that BCS has been widely utilized for treatment of *in situ* breast cancers in California. Although most women with stage IIa breast cancer may be eligible for BCS, they were markedly less likely to receive BCS than women diagnosed with *in situ* or stage I tumors. Hospitals are the main source of CCR data, and radiotherapy is to some extent underreported. Therefore, it is possible that the proportion of women receiving radiation following BCS was somewhat higher than what is presented in this report. Despite all these differences, BCS utilization in California is increasing steadily for all race/ethnicities, age groups, stages at diagnosis, and SES levels examined in this study. A recent study (9) found that as many as 20 percent of breast cancer patients who seek a second opinion eventually change their treatment decision based on the new information, and that more than half of the women in the study felt they were not presented with the full range of treatment options. However, many nonclinical decisions factor into the complex choice of surgical treatment, and BCS may not be the patient's option even when presented with appropriate information. For many women, the fear of recurrence and the hardship of radiotherapy may outweigh the benefits of breast conservation. Nonetheless, BCS represents an important advance in the treatment of breast cancer. The increasing trends towards its higher utilization in California are an indication that BCS is progressively gaining acceptance.

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Breast Cancer Survival in the San Francisco Bay Area

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Introduction

Breast cancer is the most frequently occurring cancer in California women and the second leading cause of cancer death. The prognosis for women with breast cancer is generally favorable, and, on average, 86 percent of women diagnosed with breast cancer are alive after five years and 76 percent live at least ten years after diagnosis (1). Breast cancer survival rates, which measure the proportion of patients living at a specific time after their diagnosis, are highly dependent on the extent of disease at diagnosis. Other factors, however, such as type of treatment, histology, tumor grade, age at diagnosis, race/ethnicity, and SES also influence survival. This chapter presents survival statistics for women diagnosed during the period 1988-1992 in the San Francisco (SF) Bay Area. Survival rates will be presented by demographic and tumor characteristics for four mutually exclusive racial/ethnic groups in the SF Bay Area: whites, blacks, Asians/ Pacific Islanders , and Hispanics.

Methods and Definitions

Data Source

Cancer data have been collected in Alameda, Contra Costa, Marin, SF, and San Mateo Counties since 1973 as part of the SEER program. These counties, referred to here as the SF Bay Area, also form one region (Region 8) of the CCR. This report includes 9,675 females diagnosed with histologically confirmed, primary invasive adenocarcinoma of the breast during the period 1988-1992. We excluded females with unknown stage at diagnosis, race/ethnicity, or survival time, and those diagnosed at autopsy or identified by death certificate.

Definitions

In this chapter, stage at diagnosis was defined according to the AJCC system (2). Data are routinely collected on surgery, chemotherapy, and radiation therapy provided during the first course of treatment. For this report, we categorized surgery as partial mastectomy (e.g., lumpectomy), simple mastectomy, modified radical, other mastectomy, or none. Using codes from the ICDO-02 (3), cases were grouped by histology into the following categories: infiltrating duct, lobular, mixed infiltrating duct and lobular, inflammatory breast carcinoma, and all other histologies. Grade was defined as well-differentiated, moderately differentiated, poorly differentiated, undifferentiated, and unknown. Estrogen and progesterone receptor status was defined as positive, negative/borderline, and unknown.

SES measures, such as education, occupation, and income level, are not collected by the registry. Therefore, we derived proxy measures from 1990 U.S. Census block group level data by assigning block group level socioeconomic measures to each patient's block group of residence at the time of her diagnosis. Using race-specific measures for

each block group, we created dichotomous variables for low education (25 percent or more residents over age 25 did not receive a high school diploma) and low income (20 percent or more residents living below the poverty line). We categorized a block group as "blue collar" if 66 percent or more of the residents over age 16 were employed in blue collar jobs. Census-based socioeconomic measures have been validated in previous studies of breast cancer in the SF Bay Area (4, 5).

Vital status was ascertained by physician contact, review of local obituaries, and linkage with Vital Statistics and the National Death Index. All cases were followed through August 2001. Survival time was measured in months from the time of diagnosis to death due to breast cancer or censoring (which included deaths from causes other than breast cancer). Survival curves were generated using Kaplan-Meier estimates, and differences were compared using the log-rank test. Survival probabilities, typically referred to as survival rates, expressed as a percentage, are provided in addition to survival curves.

Results

Case Description

Table 11.1 displays the characteristics of the women diagnosed with primary, invasive breast adenocarcinoma in the SF Bay Area between 1988 and 1992. Women were more likely to be white and to be between 50 and 64-years-old, with a mean age of 60.7 years at diagnosis, ranging from 11 to 102 years. Forty-one percent of the women died from any cause while 18 percent died from breast cancer. Most women were diagnosed with early stage disease (73.4 percent in stages I and IIa) and infiltrating duct carcinoma (74.3 percent). Modified radical mastectomy (57 percent) and partial mastectomy/lumpectomy (36 percent) were the most common types of surgery. Grade, estrogen receptor, and progesterone receptor status were missing for a substantial number of women as these variables were not consistently collected until 1990. Census-based SES analyses showed that 9 percent of women lived in poor neighborhoods, 19 percent lived in undereducated neighborhoods, and 32 percent lived in blue collar neighborhoods.

By Race/Ethnicity

Numerous studies have reported that black women have poorer survival following breast cancer than white women (6, 7), and less is known about the survival experience of Hispanic and Asian/Pacific Islander women (8, 9). Black women typically present with more advanced disease, and some studies have suggested that more aggressive tumors, younger age, differences in SES, and access to care may contribute to the disparity in survival (7, 10). Figure 11.1 shows the unadjusted survival curve by four mutually exclusive racial/ethnic groups. Whites had the highest breast cancer survival,

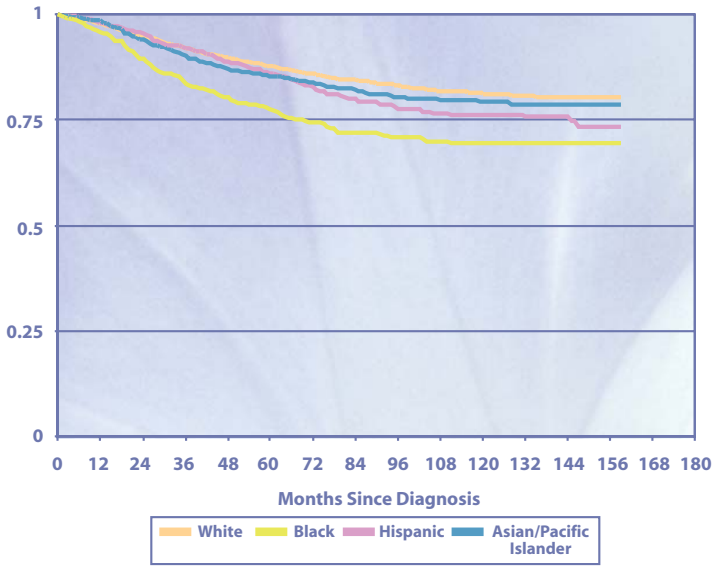
Table 11.1
Distribution of Characteristics of Females Diagnosed with Invasive Breast Cancer in the San Francisco Bay Area, 1988-1992 (N=9,675)

Characteristic	N	%	Characteristic	N	%
Race/Ethnicity[1]			Initial Treatment Summary		
White	7,250	74.9	None	28	0.3
Black	853	8.8	Surgery only	3,069	31.7
Hispanic	678	7.0	Radiation therapy only	10	0.1
Asian/Pacific Islander	894	9.2	Radiation therapy and surgery only	1,238	12.8
			Other	5,330	55.1
Year of diagnosis					
1988	1,891	19.6	Initial surgery type		
1989	1,884	19.5	No surgery done	261	2.7
1990	1,946	20.1	Lumpectomy/partial mastectomy	3,539	36.6
1991	1,971	20.4	Total (simple) mastectomy	267	2.8
1992	1,983	20.5	Modified radical mastectomy	5,577	57.6
			Other	31	0.3
Age at diagnosis (years)					
0-34	248	2.6	Histology		
35-49	2,310	23.9	Infiltrating duct	7,187	74.3
50-64	2,939	30.4	Lobular	713	7.4
65-74	2,322	24.0	Infiltrating duct and lobular	408	4.2
75+	1,856	19.2	Inflammatory carcinoma	117	1.2
			Other	1,250	12.9
Vital status[2]			Grade		
Dead	3,933	40.7	Well differentiated	624	6.5
Alive	5,742	59.4	Moderately differentiated	2,419	25.0
			Poorly differentiated	2,467	25.5
Death due to breast cancer			Undifferentiated/anaplastic	167	1.7
No	7,943	82.1	Grade and differentiation not stated	3,998	41.3
Yes	1,732	17.9			
			Estrogen receptor status		
AJCC[3] stage at diagnosis			Test not done	315	3.3
Stage I	4,454	46.0	Positive	3,497	36.1
Stage IIa	2,655	27.4	Negative/borderline	1,249	12.9
Stage IIb	1,310	13.5	Unknown	4,614	47.7
Stage II, not otherwise specified	208	2.2			
Stage III	616	6.4	Progesterone receptor status		
Stage IV	432	4.5	Test not done	344	3.6
			Positive	2,962	30.6
Tumor size (cm)			Negative/borderline	1,643	17.0
<= 2	5,734	59.3	Unknown	4,726	48.8
2.1-5.0	2,957	30.6			
> 5.0	510	5.3	Blue collar status, community level[4]		
Direct extension	150	1.6	No	6,536	67.6
Unknown size	324	3.4	Yes	3,139	32.4
Number of nodes			Undereducated, community level[5]		
Negative nodes	5,252	54.3	No	7,796	80.6
1-3 positive nodes	1,724	17.8	Yes	1,879	19.4
4+ positive nodes	1,248	12.9			
Unknown nodes (include inflammatory carcinoma)	1,451	15.0	In poverty, community level[6]		
			No	8,834	91.3
			Yes	841	8.7

Percentages may not sum up to 100 due to rounding.
1 Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
2 Vital status followed through August 2001.
3 American Joint Committee on Cancer staging converted from SEER Extent of Disease.
4 Living in 1990 census block group with 66 percent or greater proportion of adults (16+ years old) working in blue-collar job.
5 Living in 1990 census block group with 25 percent or greater proportion of adults (25+ years old), of the same racial/ethnic group, with no high school diploma.
6 Living in 1990 census block group with 20 percent or greater proportion of residents, of the same racial/ethnic group, living below poverty line.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

followed by Asian/Pacific Islanders, Hispanics, and blacks. Compared to whites, blacks and Hispanics experienced significantly lower rates of survival ($p < .0001$). The five-year survival rates ranged between 78 percent and 88 percent, while survival at ten years ranged between 70 percent and 82 percent (Table 11.2). Adjusting for stage of disease decreased the survival gap, but blacks still had significantly poorer survival (Figure 11.2).

Figure 11.1
Kaplan-Meier Breast Cancer Survival Estimates, by Race/Ethnicity, San Francisco Bay Area, 1988-1992



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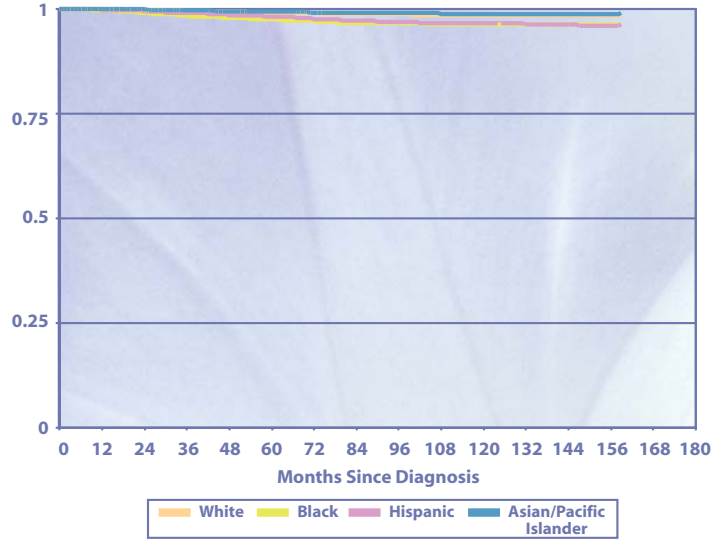
By Age at Diagnosis

Unlike many cancers, breast cancer survival is significantly worse in younger women than older women. Figure 11.3 shows the striking decrease in survival after 24 months in the youngest women, while there was little variation in the older age groups. Although the 0-34 year group accounts for only 2.6 percent of the sample, the number of women in this category was not insignificant; there were 248 women, with a mean age of 31. In these data, non-white women were significantly younger at diagnosis than white women. For example, six percent of Hispanics, five percent of Asian/Pacific Islanders, and five percent of blacks were in the under 35 category, compared to less than two percent of whites. Adjusting by race/ethnicity, however, did not alter the age-survival association (data not shown).

Figure 11.2
Kaplan-Meier Breast Cancer Survival Estimates, by Race/Ethnicity, Adjusted for American Joint Committee on Cancer Stage, San Francisco Bay Area, 1988-1992



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By Stage at Diagnosis

Early diagnosis increases the likelihood of survival, and the majority of women in this population presented with early stage disease (I and IIa). As there was little survival difference between women with stage IIIa and IIIb disease, the groups were combined into a single stage III category. As seen in Figure 11.4, there was considerable variation in survival by stage at diagnosis. Five- and ten-year survival for women with stage I disease was excellent, while barely a quarter of women with stage IV survived five years. Given the prognostic value of stage at diagnosis, we estimated survival curves for stage, adjusting for the other demographic and clinical characteristics. The only factor to alter the stage survival curves was age at diagnosis; by adjusting for age, stage-specific survival improved for females with stage II and IV disease (Figure 11.5).

Tumor size is a component of disease stage. Therefore, the survival rates reported in Table 11.2 are similar to those of stage. The survival deficit in those with direct extension is striking. Of the 150 women with direct extension, 117 were diagnosed with inflammatory breast carcinoma.

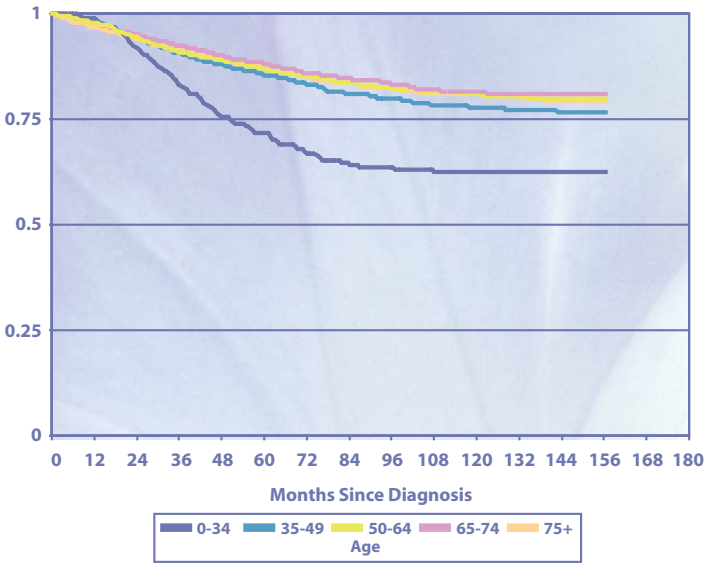
Table 11.2
Five and Ten Year Survival Probabilities with 95 Percent Confidence Intervals (CI) for Females Diagnosed with Invasive Breast Cancer in the San Francisco Bay Area, 1988-1992 (N=9,675)

Characteristic	5 Year Rate	95% CI	10 Year Rate	95% CI
Race/ethnicity[1]				
White	88	87-89	82	81-83
Black	78	75-80	70	67-73
Hispanic	86	83-87	77	73-80
Asian/Pacific Islander	86	83-88	80	77-83
Age at diagnosis (years)				
0-34	72	66-78	63	57-69
35-49	86	84-87	79	77-80
50-64	87	86-88	81	80-83
65-74	88	87-90	82	80-83
75+	87	85-89	81	79-83
AJCC[2] stage at diagnosis				
Stage I	97	97-97	95	94-95
Stage IIA	89	88-90	81	80-83
Stage IIB	77	75-79	65	62-68
Stage II, not otherwise specified	85	80-90	76	70-82
Stage III	59	55-63	44	40-49
Stage IV	26	21-30	16	12-20
Tumor size (cm)				
<= 2	94	94-95	90	90-91
2.1-5.0	81	79-82	71	69-73
> 5.0	58	54-63	46	41-51
Direct extension	31	23-39	21	14-28
Unknown size	69	63-74	59	53-65
Number of nodes				
Negative nodes	95	95-96	92	91-92
1-3 positive nodes	86	85-88	78	76-80
4+ positive nodes	67	64-70	52	49-55
Unknown nodes (includes inflammatory carcinoma)	72	69-74	64	61-67
Histology				
Infiltrating duct	87	87-88	81	80-82
Lobular	89	87-91	81	77-84
Infiltrating duct and lobular	88	86-92	82	78-86
Inflammatory carcinoma	85	83-87	80	78-83
Other	34	26-43	23	15-31
Grade				
Well differentiated	97	96-99	96	94-97
Moderately differentiated	92	91-93	86	85-88
Poorly differentiated	78	76-80	70	68-72
Undifferentiated/anaplastic	70	63-77	63	55-71
Grade and differentiation not stated	88	86-89	81	80-83
Initial surgery type				
No surgery done	25	19-31	15	10-21
Lumpectomy/partial mastectomy	93	92-94	88	87-89
Total (simple) mastectomy	75	69-81	70	64-77
Modified radicalmastectomy	86	85-87	79	78-80
Other	66	45-80	39	20-59
Estrogen receptor status				
Test not done	86	85-87	79	78-80
Positive	91	90-92	84	83-86
Negative/borderline	80	78-82	75	73-77
Progesterone receptor status				
Test not done	86	85-87	79	78-80
Positive	91	90-92	85	83-86
Negative/borderline	82	80-83	76	74-78
Blue collar status, community level[3]				
No	88	87-89	82	81-83
Yes	84	82-85	76	75-78
Undereducated, community level[4]				
No	88	87-88	81	80-82
Yes	83	81-85	75	73-77
In poverty, community level[5]				
No	87	86-88	81	80-82
Yes	82	79-85	71	68-74

Percentages may not sum up to 100 due to rounding.
1 Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
2 American Joint Committee on Cancer staging converted from SEER Extent of Disease.
3 Living in 1990 census block-group with 66 percent or greater proportion of adults (16+ years old) working in blue-collar job.
4 Living in 1990 census block-group with 25 percent or greater proportion of adults (25+ years old), of the same racial/ethnic group, with no high school diploma.
5 Living in 1990 census block-group with 20 percent or greater proportion of residents, of the same racial/ethnic group, living below poverty line.
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Lymph node involvement, the other component of disease stage, is an established prognostic indicator. These data confirm the improved survival of women with no nodal involvement (Table 11.2). The survival estimates for women with unknown nodal status should be interpreted with caution, as this is truly a heterogeneous group. It includes women with favorable histologies as well as all women diagnosed with inflammatory breast carcinoma.

Figure 11.3
Kaplan-Meier Breast Cancer Survival Estimates, by Age Group, San Francisco Bay Area, 1988-1992



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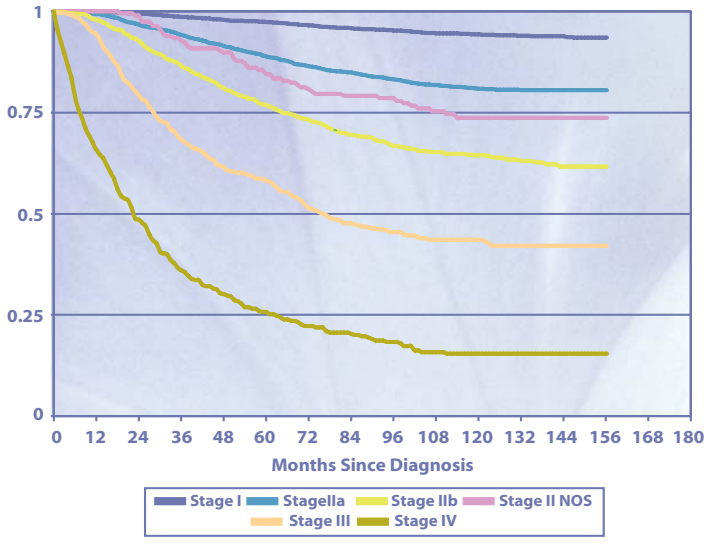
By Treatment

Treatment for breast cancer is correlated with the disease stage. BCS is recommended for most women with early-stage breast cancer. As expected, 89 percent of women diagnosed with stage I or IIa disease were treated with lumpectomy/partial mastectomy. On average, 96 percent of women receiving a breast-preserving surgery survived at least five years, and 92 percent were still alive after ten years (data not shown). Of the 261 women who received no surgery, 232 had stage III or higher disease. Table 11.2 shows survival by type of surgery. Overall, the majority of women received modified radical mastectomy, and these women had five- and ten-year survival rates of 86 percent and 79 percent, respectively.

Figure 11.4
Kaplan-Meier Breast Cancer Survival Estimates, by American Joint Committee on Cancer Stage, San Francisco Bay Area, 1988-1992

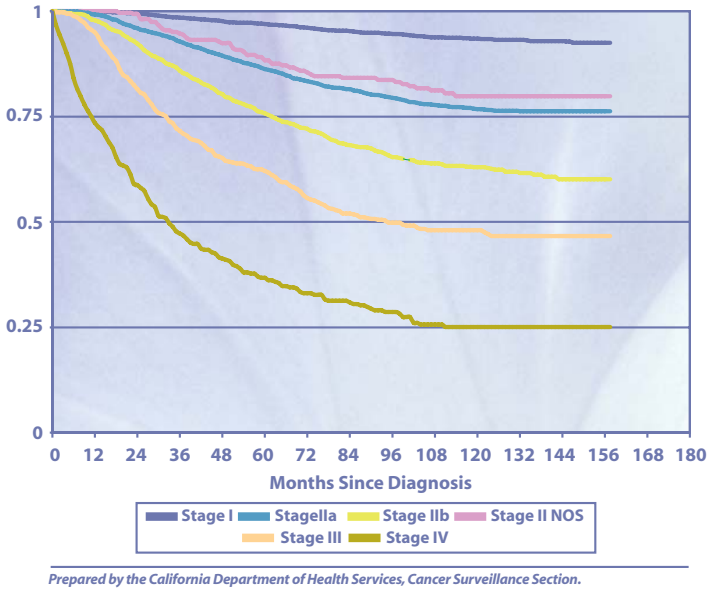


Prepared by the California Department of Health Services, Cancer Surveillance Section.

By Histology

As shown in Table 11.1, the most common histology was infiltrating duct carcinoma. Of the less common histologies, whites and Hispanics were significantly more likely to have lobular cancer, while blacks and Hispanics were more likely to have inflammatory breast cancer than other women. After preliminary analyses showed no difference in survival, the comedocarcinoma, mucinous/mucin-producing, medullary, tubular, and unspecified adenocarcinomas were combined into a single 'other' group. Most striking is the poorer survival of women diagnosed with inflammatory breast cancer, a rare and aggressive form of breast carcinoma. Five- and ten-year survival for women with inflammatory breast cancer was 34 percent and 23 percent, respectively (Table 11.2).

Figure 11.5
Kaplan-Meier Breast Cancer Survival Estimates, by American Joint Committee on Cancer Stage, Adjusted for Age Group, San Francisco Bay Area, 1988-1992



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By Grade

Information on tumor grade was not routinely collected until after 1990 and is unknown for 41 percent of the sample. Table 11.2 presents survival rates for 59 percent with known values. There was a clear survival gradient with more aggressively growing tumors such as poorly differentiated and undifferentiated having poorer survival. Adjusting for age and race/ethnicity had little impact on the relationship between grade and survival.

By Hormone Receptor Status

As with grade, estrogen receptor (ER) and progesterone receptor (PR) status were not collected until 1990. Women with ER positive tumors had better survival than those with ER negative/borderline tumors (Table 11.2). Black women were considerably more likely to have ER negative/borderline tumors; 37 percent of blacks had negative tumors compared with 30 percent of Hispanics, 23 percent of whites, and 31 percent of Asian/Pacific Islanders. Age was strongly associated with ER status; only 55 percent of women in the 0-34 age category were ER positive, compared to 80 percent in the 75 plus age group. Adjusting for age improved the survival of ER negative women (data not shown).

The PR survival rates mirror the ER rates (Table 11.2). Forty-nine percent of blacks were PR negative, compared to 40 percent of Hispanics, and 34 percent of whites and Asian/Pacific Islanders. PR positivity increased with age, ranging from 53 percent of women in the youngest age group to 71 percent in the oldest age group. Eighty-one percent of women who were ER positive were PR positive as well; conversely, 83 percent of those who tested negative/borderline did so for both ER and PR status.

By SES

Figures 11.6-11.8 display the survival curves for the three SES measures. The curves for the low education and blue collar measures were similar, while the curve for the poverty measure diverged more for those who reside in areas of high poverty compared to those who do not. The three community level measures of SES were strongly associated with race/ethnicity (Table 11.3). Blacks were significantly more likely to reside in poor and blue collar neighborhoods than were whites, Hispanics or Asian/Pacific Islanders. Hispanic women were more likely to live in neighborhoods characterized by low education (57 percent), followed by blacks (52 percent), Asian/Pacific Islanders (38 percent) and whites (10 percent). More importantly, the SES measures were

Figure 11.6
Kaplan-Meier Breast Cancer Survival Estimates, by Low Education, San Francisco Bay Area, 1988-1992

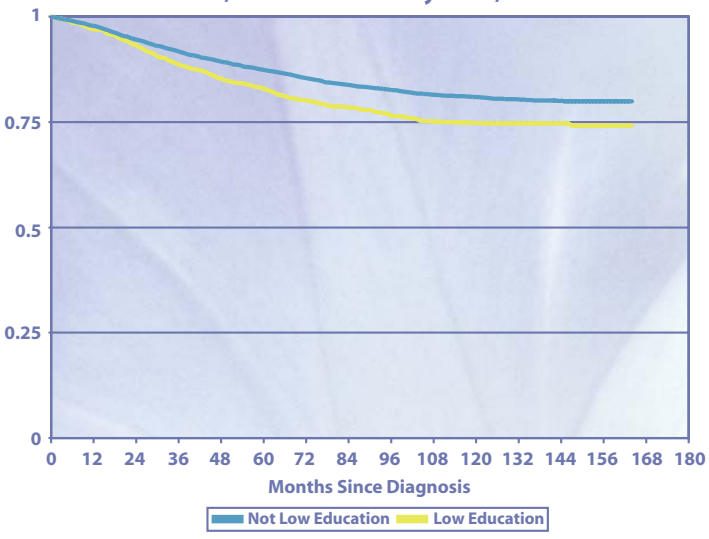

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Table 11.3
Community Level Socioeconomic Status, by Race/Ethnicity, and Disease Stage, of Females Diagnosed with Invasive Breast Cancer in the San Francisco Bay Area 1988-1992 (N=9,675)

Characteristic	Blue Collar Status[1] N	%	Undereducated[2] N	%	In Poverty[3] N	%
Race/Ethnicity[4]						
White	1900	26%	709	10%	200	3%
Black	515	60%	447	52%	377	44%
Hispanic	336	50%	386	57%	118	17%
Asian/Pacific Islander	388	43%	337	38%	146	16%
Early Stage (I, IIa and II NOS*)	2251	31%	1330	18%	566	8%
Late Stage (IIb, III and IV)	888	38%	549	23%	275	12%

1 Living in 1990 census block group with 66 percent or greater proportion of adults (16+ years old) working in blue-collar job.
2 Living in 1990 census block group with 25 percent or greater proportion of adults (25+ years old), of the same racial/ethnic group, with no high school diploma.
3 Living in 1990 census block group with 20 percent or greater proportion of residents, of the same racial/ethnic group, living below poverty line.
4 Race/ethnicity categories are mutually exclusive. Persons of Hispanic ethnicity may be of any race.
*NOS: Not Otherwise Specified.
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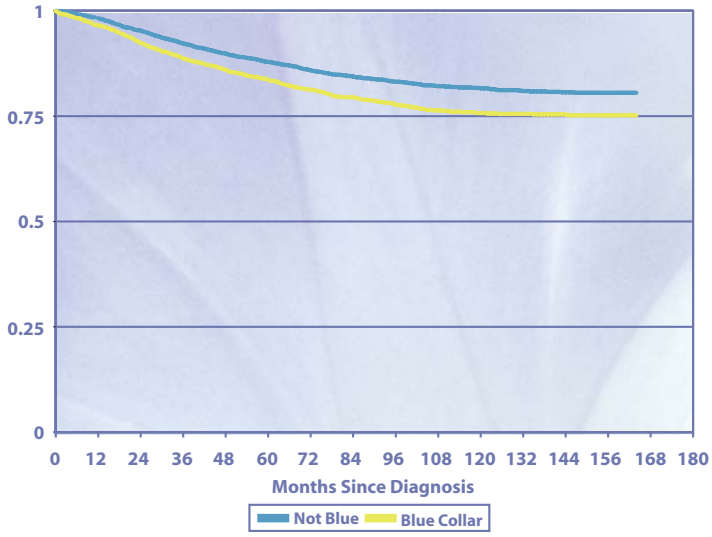
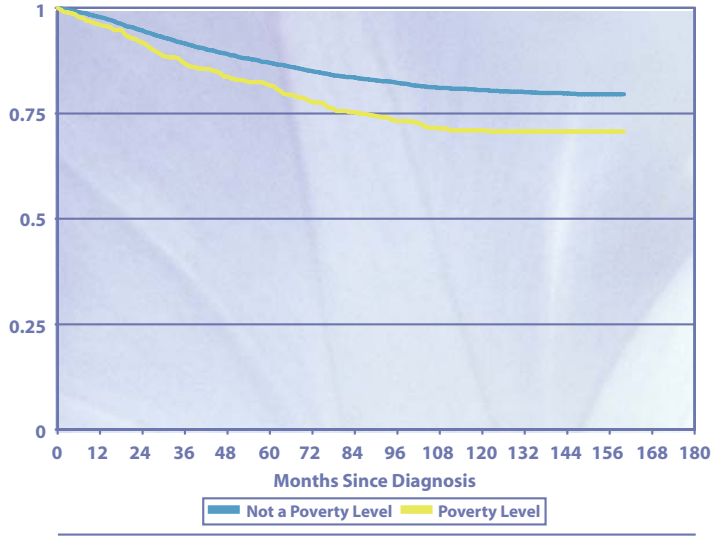
Figure 11.7
Kaplan-Meier Breast Cancer Survival Estimates, by Residence in Blue Collar Neighborhood, San Francisco Bay Area, 1988-1992



Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 11.8
Kaplan-Meier Breast Cancer Survival Estimates, by Poverty, San Francisco Bay Area, 1988-1992



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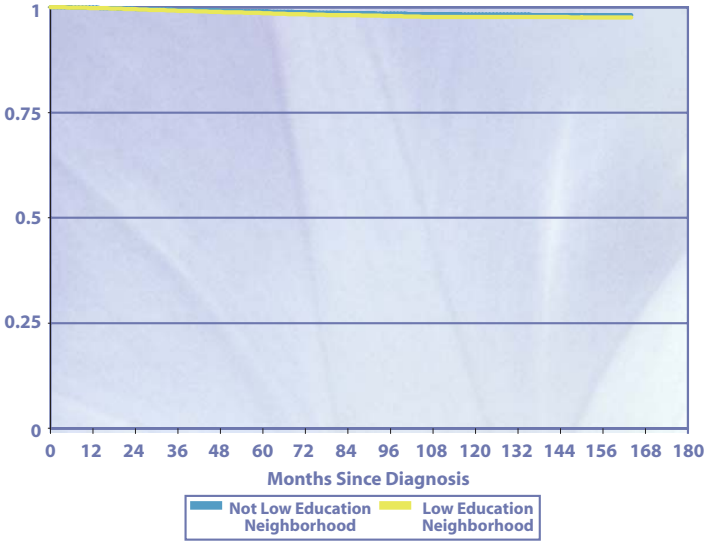
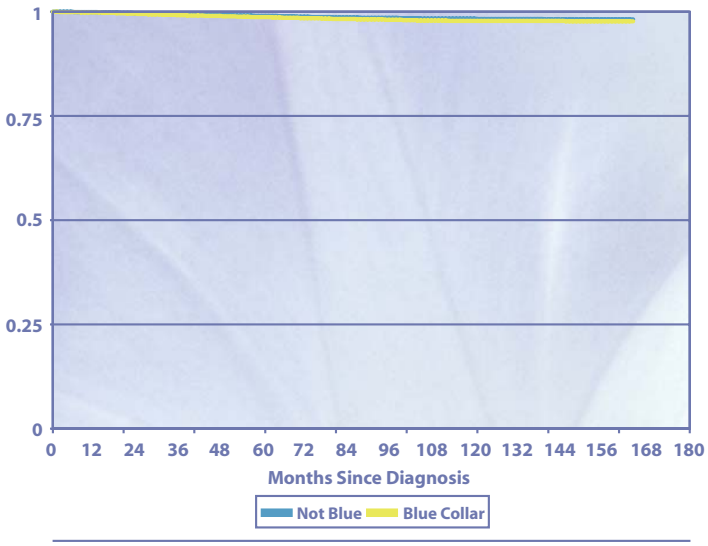
strongly associated with stage at diagnosis. Women with advanced disease (defined as stage IIb or higher) were more likely to live in lower SES neighborhoods. When the SES curves were adjusted for stage at diagnosis, the survival differences disappeared, suggesting that stage at diagnosis strongly contributes to differences in survival among social class groups (Figures 11.9-11.11). The complex relationship of stage, race/ethnicity, and SES has been reported previously and this study supports the concept that stage at diagnosis (or extent of disease) is an intricate composite of biologic and social factors (7, 11, 12).

Figure 11.9
Kaplan-Meier Breast Cancer Survival Estimates, by Low Education, Adjusted for Stage, San Francisco Bay Area, 1988-1992



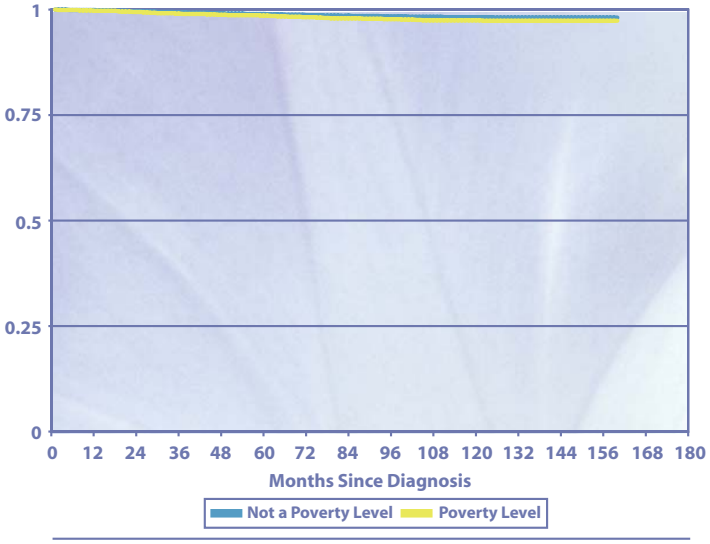
Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 11.10
Kaplan-Meier Breast Cancer Survival Estimates, by Residence in Blue Collar Neighborhood, Adjusted for Stage, San Francisco Bay Area, 1988-1992



Prepared by the California Department of Health Services, Cancer Surveillance Section.

Figure 11.11
Kaplan-Meier Breast Cancer Survival Estimates, Below Poverty Neighborhoods, Adjusted for American Joint Committee on Cancer Stage, San Francisco Bay Area, 1988-1992



Prepared by the California Department of Health Services, Cancer Surveillance Section.

Summary

Survival is an important endpoint for disease surveillance, as it has implications for disease prevention, screening, and treatment. Survival following invasive breast cancer is largely determined by the extent of disease at the time of diagnosis, whether it is measured by AJCC stage, the size of the tumor, or the extent of lymph node involvement. The excellent survival of women in this population is in large part due to the early diagnosis of their disease: 73 percent of women presented with stage I or IIa disease. As expected, tumor characteristics such as grade, ER status, and PR status also influence survival. With the exception of inflammatory breast cancer, histology had little impact on survival. This large sample demonstrates a survival gradient where Asian/Pacific Islanders, Hispanics, and blacks have poorer survival than whites. Adjusting for stage of disease decreased the survival gradient, but blacks still experienced significantly decreased survival. Like race/ethnicity, the impact of the census-level SES measures was attenuated when disease stage was included in the model. Given that stage of disease is so strongly associated with survival, early diagnosis should continue to be an important public health focus. These data highlight the need to focus screening interventions on non-white women and women living in lower SES communities.

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Technical Notes

CCR Data Collection

Statewide, population-based reporting of newly diagnosed cancers in California was fully implemented in January 1988. CCR, through a network of ten regional registries, collects information on all newly diagnosed cancers in California. These regional registries cover the entire state and report cancer incidence data to the Cancer Surveillance Section, California Department of Health Services. Cancer data are abstracted from records in medical treatment facilities throughout the state. Information collected include diagnosis, patient identifiers and demographic characteristics, tumor attributes, stage of disease at the time of diagnosis, first course of treatment, and follow-up. Standards for data abstracting, collection, and reporting are specified by the CCR (1-4).

Regional Registries

Region 1	Santa Clara Region	Monterey, San Benito, Santa Clara, and Santa Cruz Counties
Region 2	Central Region	Fresno, Kern, Kings, Madera, Mariposa, Merced, Stanislaus, Tulare, and Tuolomne Counties
Region 3	Sacramento Region	Alpine, Amador, Calaveras, El Dorado, Nevada, Placer, Sacramento, San Joaquin, Sierra, Solano, Sutter, Yolo, and Yuba Counties
Region 4	Tri-County Region	San Luis Obispo, Santa Barbara, and Ventura Counties
Region 5	Desert Sierra Region	Inyo, Mono, Riverside, and San Bernardino Counties
Region 6	North Region	Butte, Colusa, Del Norte, Glenn, Humboldt, Lake, Lassen, Mendocino, Modoc, Napa, Plumas, Shasta, Siskiyou, Sonoma, Tehama, and Trinity Counties
Region 7	San Diego Region	Imperial and San Diego Counties
Region 8	Bay Area Region	Alameda, Contra Costa, Marin, San Francisco, and San Mateo Counties
Region 9	Los Angeles County	
Region 10	Orange County	

Incident Cases and Deaths

Incidence data contained in this report were based on cases of primary breast cancer which were first diagnosed among California residents between January 1, 1988, and December 31, 1999, and which were reported to the CCR as of August 2001. Patients who were treated for breast cancer in California, but were residents of another state or county, were not included. Breast cancers were coded according to the International Classification of Diseases for Oncology, Second Edition (5). A "case" was defined as primary breast cancer, i.e., tumors with site codes C500 - C509, excluding types 9590 -9989, which refer to lymphohematopoietic neoplasms. In addition, breast cancers were distinguished by whether they were invasive, that is, have infiltrated the tissue of the organ of origin, or whether they were *in situ*, that is, have not yet penetrated the basement membrane or extended beyond the epithelial tissue. Mortality data in this report were obtained from the California Department of Health Services, Center for Health Statistics. "Deaths" were defined as the number of women residing in California who died with breast cancers as the underlying cause of death, according to the International Classification of Diseases, Ninth Edition (ICD-9, for deaths occurring from 1988 through 1998) (6), and the International Classification of Diseases, Tenth Edition (ICD-10, for deaths occurring from 1999 on) (7). All mortality analyses presented in this report are the responsibility of the authors, and were not reviewed or endorsed by the Center for Health Statistics prior to publication.

Population Estimates

Annual, mid-year population estimates by age, race/ethnicity, and gender were obtained from the California Department of Finance (DOF) Demographic Research Unit, as released December 1996 (8), revised June 1997 (9), and revised May 2000 (10). Population estimates are subject to periodic revisions, which may also modify the age-, race-, and sex-specific population distribution for all years in the series. The rates presented in this report are therefore not directly comparable to those in previous reports, but are internally consistent with the most recently released official population estimates.

Definition of Race/Ethnicity

Race/ethnicity was grouped into the mutually exclusive categories of non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic Asian/Pacific Islander. American Indian women were excluded from race-specific rates, but were included in data for all races combined. Race and ethnicity were reported as separate data items during data collection for both cases and deaths. Persons with race reported as white, black, or unknown, but with a last name on the 1980 U.S. Census list of 12,497 Hispanic surnames (1), were categorized as Hispanic for analyses in this report. Maiden name, when present,

was used instead of last name to identify Hispanic women by surname. Similarly, women with race coded as white, black, or unknown, but with a Vietnamese or Hmong surname, were categorized as Asian. The use of surname to identify persons of Hispanic ethnicity was adopted by CCR because of the recognized under-reporting of Hispanic ethnicity on the medical record and death certificate (11).

Technical Terms

Age-Adjusted Rate

Age-adjusted rates are a weighted average of the age-specific rates, where the weights represent the age distribution of a standard population. Rates in this report are age-adjusted by the direct method (12) to the 2000 U.S. population or the world standard population, and are calculated per 100,000 persons. Age-adjustment allows meaningful comparisons of cancer risk by controlling for differences in the age distribution of two populations, which can profoundly affect the crude cancer rates.

Age-Specific Rate

Age-specific rates were calculated by dividing the number of cases or deaths in a specific age group by the total population in that age group. Age at diagnosis or death was categorized into five-year age categories starting with birth to four years old and ending with age 85 and older. The race-, sex-, and age-specific number of cases or deaths over the five-year period 1995-1999 were divided by the race-, sex-, and age-specific population sum over the same five-year period. This rate was then multiplied by 100,000 to yield an average annual age-specific rate per 100,000 population.

Crude Rate

Crude rates are calculated by dividing the total number of cases or deaths by the total population at risk. The race- and sex-specific total number of cases or deaths over the five-year period were divided by the race- and sex-specific population sum over the same five-year period, and are then multiplied by 100,000 for an average annual crude rate per 100,000 population. Crude rates are useful in summarizing the cancer burden in a specific population. They are not useful for comparing the risk of developing cancer in different race/ethnic or sex groups, geographic areas, or time periods.

SEER Program

SEER Program of the National Cancer Institute currently collects and publishes cancer incidence and survival data from 11 population-based cancer registries and three supplemental registries covering approximately 14 percent of the U.S. population. In 2001, the SEER Program expanded coverage to include Kentucky, Greater California, New Jersey, and Louisiania. The expansion registries increase the SEER coverage to approximately 26 percent of the U.S. population (13).

Cautions on Interpretation

The validity of rates depends on the completeness of cancer reporting and on the accuracy of population estimates. Incidence data in this report are based on cases of primary breast cancer which were first diagnosed among California residents between January 1, 1988, and December 31, 1999, and which were reported to CCR as of August 2001. Case reporting for 1999 was estimated to be 99 percent complete as of that date for invasive cases. Population estimates released by the California DOF are also subject to periodic revisions. For these reasons, rates in this report are not directly comparable to those released in previous annual reports.

The reliability of race-specific rates depends on the accuracy of race classification in both cases and deaths, and in population estimates. Some variation in race-specific rates may reflect misclassification bias, rather than a true difference in cancer risk. Population estimates are based in part on self-identification at the time of the 1990 Census. The Census Bureau reports that the 1990 Census undercounted the total population by 1.6 percent; the estimated undercount was 2.3 percent for the Asian population, 4.4 percent for blacks, and 5 percent for Hispanics (14).

Race/ethnicity information for cancer cases is based primarily on information contained in the patient's medical record. This information may be based on self-identification by the patients, on assumptions made by an admissions clerk or other medical personnel, or on an inference using race/ethnicity of parents, birthplace, maiden name, or last name. Race/ethnicity for cancer deaths, on the other hand, is based on information on the death certificate, which is often completed by the funeral director or coroner, and may not always be based on information provided by next-of-kin. The reporting of race/ethnicity in either system may be influenced by the race/ethnic distribution of the local population, by local interpretation of data collection guidelines, and other factors. While the use of surname lists partially compensates for misclassification of some race/ethnic groups, it is likely that some differences in race-specific rates reflect biases of classification rather than true differences in risk.

Finally, statistically significant variation in rates can occur by chance alone, and additional assessment is required to separate chance occurrences from true public health problems. Statistical significance does not necessarily indicate the overall importance of the result.

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Notes

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