MONOGRAPH
III of IV

The Orange County Affiliate of Susan G. Komen for the Cure® & UCI Data Project:

Breast Cancer Incidence & Prevalence in Orange County

III of IV Monographs

I. Disparities in Stage at Diagnosis of Breast Cancer in Orange County: Implications for Early Detection

II. Disparities in Breast Cancer Mortality in Orange County

III. Young Women with Breast Cancer in Orange County and California

IV. Planning for Breast Cancer in Orange County

Susan G. Komen for the Cure® Orange County

Monograph III

Young Women with Breast Cancer in Orange County and California

Prepared for the Orange County Affiliate of Susan G. Komen for the Cure® by

Sarah F. Marshall, MA
Argyrios Ziogas, PhD
Hoda Anton-Culver, PhD

Department of Epidemiology
University of California, Irvine

Under contract number SGKOC-42564
and the direction of community advisory group members

Diana Chingos
Cheryl Cooky
Travers Ichinose
Sandra Rose
Deborah Ryan
Raúl Sobero
Chris Tannous
Lisa Wolter

For more information, contact:

Erin Touslee
Komen Orange County Affiliate
3191-A Airport Loop Drive
Costa Mesa, CA 92626
714-957-9157
etouslee@komenoc.org

Table of Contents

Executive Summary

Series of Four Monographs

This series of monographs examining breast cancer incidence and mortality in Orange County, are the result of a collaborative data analysis project conducted by researchers from the University of California, Irvine under the guidance of the Orange County Affiliate of Susan G. Komen for the Cure, and the project's community advisory group.

Focus on Young Women with Breast Cancer

In our first monograph (1) we reported that young breast cancer patients (aged <40 years) were more likely to be diagnosed late stage. In our second monograph (2) we found that young breast cancer patients were also at increased risk of dying from their diagnosis, compared to older women. In this third monograph we focus on young women with breast cancer in Orange County, describing numbers, racial/ethnic distribution, incidence rates, mortality rates, and we model risk of five-year mortality among young patients in order to identify who is most at risk of dying from their disease. This version of monograph II, updated in 2009, utilizes an additional two years of breast cancers in Orange County by including those diagnosed 2006-07.

Methods

We analyzed California Cancer Registry records for 250,873 female residents of California who were diagnosed with primary, invasive breast cancer between January 1, 1991 and December 31, 2005. Tumor and patient characteristics were abstracted from patients' medical records, neighborhood measures of socioeconomic status and education and population statistics were taken from the Census, and causes of death came from registry linkages with state and national death indices.

Number of Young Women with Breast Cancer

Every year approximately 100 female residents of Orange County are diagnosed with invasive breast cancer before they are aged 40 years; our report includes 1,648 young breast cancer patients who were diagnosed between 1991 and 2007, but many of tables focus on the 689 breast cancers diagnosed among young women in 2001-07 for a more up to date description.

Tumor Characteristics

Young women with breast cancer had a higher prevalence of regional and distant disease compared with older women and a higher prevalence of higher grade tumors. Patients younger than 40 years also had larger tumors, more nodal involvement, more estrogen receptor-negative, progesterone receptor-negative, HER2-neu positive and ductal tumors; these are indicators of poorer prognosis.

Socioeconomic Characteristics

Young women with breast cancer were more frequently uninsured or covered by managed care/HMO/PPO insurance in comparison to the patients diagnosed at age 50 or older who were more frequent users of Medicaid/Medicare. Young breast cancer patients more frequently resided in neighborhoods with lower education, higher proportions of blue-collar workers, and more poverty. They were more frequently single and less frequently divorced/separated or widowed in comparison to older patients. Religion did not differ substantially by age at diagnosis.

Treatment

In accordance with their more aggressive type of breast cancer, young breast cancer patients were more likely to have a mastectomy, whereas older patients were more likely to have breast conserving surgery.

Incidence Rates

Age-adjusted incidence of breast cancer increases with age; 19 per 100,000 women younger than 40 were diagnosed in Orange County 1991-2005 compared to 140 per 100,000 women aged 40-49, and 315 per 100,000 women aged 50 or older. Incidence among young women in Orange County was highest for African Americans (21.3 per 100,000) and non-Hispanic whites (20.8 per 100,000), followed by Asian Pacific Islanders (16.6 per 100,000) and Hispanics (15.8 per 100,000).

Changes in Incidence

The incidence of breast cancer in Orange County has declined significantly during the last 15 years among women who were aged 40-49 years or 50 years or older. However incidence for women younger than 40 has not declined over the same time (R^2 for trend = .01). Incidence among young African Americans has declined slightly,

bringing the rate more in line with the rates seen among young women of other racial/ethnic groups. Incidence for other racial/ethnic groups has not changed.

Mortality Rates

444 (4.2%) of the 10,686 women in California who died from breast cancer over the last 15 years were younger than 40 years. The annual age-adjusted breast cancer mortality rate increases with age; 0.5 per 100,000 women younger than 40 died of breast cancer in Orange County 1991-2005 compared to 3.5 per 100,000 women aged 40-49, and 13.6 per 100,000 women aged 50 or older.
Mortality rates among young women were highest for non-Hispanic whites (0.6 per 100,000), followed by African Americans (0.4 per 100,000) and Hispanics (0.4 per 100,000), and then lowest for Asian Pacific Islanders (0.3 per 100,000).

Changes in Mortality

Among women younger than 40 mortality rates declined from 1991-95 to 1996-2000, but have remained steady between 1996-2000 and 2001-05, whereas for older women the decline in mortality continued throughout the 15 years.

Non-Hispanic white women, who had the highest age-adjusted breast cancer mortality rate, were the only racial/ethnic group to experience a significant decline in breast cancer mortality. During 2001-2005 breast cancer mortality was fairly similar across all racial/ethnic groups in California.

Risk of 5-Year Breast Cancer Mortality

The relative risk of breast cancer mortality within five-years of diagnosis is more than two and a half times higher for those diagnosed before age 35 and more than one and a half times higher for those diagnosed between the ages of 35 and 39, in comparison with women diagnosed in their forties. This is after adjustment for race/ethnicity, tumor type (including stage), socioeconomic status, health insurance status, and first line of treatment.

Factors Associated with 5-Year Breast Cancer Mortality Among Young Patients

In a multivariate model adjusting for all variables including race/ethnicity, tumor type (including stage), socioeconomic status, and treatment, we identified that young breast cancer patients with the following characteristics are at increased relative risk of breast cancer mortality; African American (60% increased risk) or Vietnamese race/ethnicity (75%), Christian sect (55%) or Christian religion (13%), living in a neighborhood where more than 20% of the adults aged 16 years or older have a blue collar job (28%), and Medicaid (30%), Medicare (90%) or no health insurance (45%). Overall we found that race/ethnicity was the factor that was most strongly associated with risk of breast cancer mortality among young patients.

Acknowledgements and Disclaimer

This is a collaborative data analysis project conducted by researchers from the University of California, Irvine under contract SGKOC-42564 awarded by the Orange County Affiliate of Susan G. Komen for the Cure, and guided by the project's community advisory group.

The authors thank the Orange County Affiliate of Susan G. Komen for the Cure for initiating and funding the project, and the project's community advisory group for their valuable input and advice; Diana Chingos, Cheryl Cooky, Travers Ichinose, Deborah Ryan, Raúl Sobero, Chris Tannous, Erin Touslee, and Lisa Wolter. We acknowledge the help and support of the Cancer Surveillance Program of Orange County, the California Cancer Registry, and all the women in Orange County who have suffered from breast cancer.

The collection of cancer incidence data used in this study was supported by the California Department of Public Health as part of the statewide cancer reporting program mandated by California Health and Safety Code Section 103885; the National Cancer Institute's Surveillance, Epidemiology and End Results Program under contract N01-PC-35136 awarded to the Northern California Cancer Center, contract N01-PC-35139 awarded to the University of Southern California, and contract N01-PC-54404 awarded to the Public Health Institute; and the Centers for Disease Control and Prevention's National Program of Cancer Registries, under agreement 1U58DP00807-01 awarded to the Public Health Institute. The ideas and opinions expressed herein are those of the authors and endorsement by the State of California, Department of Public Health, the National Cancer Institute, and the Centers for Disease Control and Prevention or their Contractors and Subcontractors is not intended nor should be inferred.

Introduction

Series of Monographs

This is a collaborative data analysis project conducted by researchers from the University of California, Irvine under the guidance of the Orange County Affiliate of Susan G. Komen for the Cure, and the project's community advisory group. The purpose of the project is to increase knowledge about breast cancer in Orange County, California, and to help the Orange County Affiliate of Susan G. Komen for the Cure to identify and address local unmet needs. This monograph is the third in a series of four analyzing existing cancer data collected by the California Cancer Registry. The fourth monograph will be published in September 2008.

Focus on Young Women with Breast Cancer

In our first monograph (1) we reported that young breast cancer patients (aged <40 years) were more likely to be diagnosed late stage, which is associated with poorer prognosis. In our second monograph (2) we found that young breast cancer patients were also at increased risk of dying from their diagnosis, compared to older women. Breast cancer is the leading cancer diagnosed, and the leading cause of cancer death, among women aged 20-39 years in the United States (U.S.) (3). However because the numbers are small, incidence rates for young women are not routinely produced and circulated.

In this third monograph, we describe the number and racial/ethnic distribution of young women with breast cancer in Orange County. We describe the types of tumor with which they are frequently diagnosed, as well as describe their health insurance, marital status, neighborhood socioeconomic characteristics, religion and the treatment that they received. We present age-adjusted incidence rates and mortality rates, by age group and race/ethnicity, and examine change in incidence and mortality over the last 15 years. Lastly, we examine risk of breast cancer mortality by age, and then using multivariate modeling attempt to identify the characteristics of the young breast cancer patients in California who are at increased risk of dying from their disease.

Methods

Breast Cancer Records

The breast cancer data used in this report are from the statewide, population-based California Cancer Registry (CCR). Reporting of cancer cases to the CCR is mandated by state law. This report includes 250,873 female residents of California diagnosed with primary invasive breast cancer, during the period January 1, 1991 and December 31, 2005. The annual case counts of breast cancer among males were too small to be included in the analysis. We excluded *in situ* (non-invasive) breast cancer, which is associated with an excellent prognosis, in order to focus on invasive disease.

Tumor Characteristics

Tumor characteristics were abstracted from patient medical records. We categorized tumors using the Surveillance, Epidemiology and End Results (SEER) summary stages (4) which describe the spread of the cancer at diagnosis. We categorized tumors as; localized (confined to the breast tissue), regional (tumor has spread beyond the breast by direct extension and/or to regional lymph nodes), and distant (tumor has spread beyond the breast to distant sites or by further direct extension).

Histological grade or differentiation defines how closely the cancer cells resemble normal tissue, and is defined by the SEER Program Code Manual by increasing level of severity as; well differentiated, moderately differentiated, poorly differentiated, or undifferentiated (5). We grouped tumors into five broad histological types; ductal, lobular, mixed ductal and lobular, inflammatory, or other specified histology. We also include the size of the tumor (in centimeters (cm)), the number of positive lymph nodes, and three tumor markers; estrogen receptor status, progesterone receptor status, and HER2-neu marker status, which is a protein found in faster-growing cancers and an indicator of poorer prognosis.

Patient Characteristics

CCR records include patient characteristics such as age at diagnosis, race/ethnicity, religion health insurance payer, and marital status, ascertained from specific statements in medical records (6). Race/ethnicity was aggregated into five groups; African American, Asian Pacific Islander (which includes Chinese, Japanese, Korean, Hawaiian or Pacific Islander, Filipino, Vietnamese, South Asian and other), Hispanic (which includes Mexican, South and Central American, Caribbean specifically Puerto Rican, Cuban, and Dominican, and other), non-Hispanic white, and other or mixed race/ethnicity.

Health insurance payer is the primary source of payment to the hospital at the time of admission and we categorized payer into Managed Care/HMO/PPO (note: that these types could not be distinguished), Medicaid, Medicare, federal or other public finding (includes TRICARE, Veterans Affairs, county-funded and Indian/Public Health Service), not insured (includes self-pay), insured but unknown type, and unknown if insured. Marital status was categorized into five groups: single, married (includes cohabitating), widowed, divorced/separated, and unknown.

First Line of Treatment

We defined treatment as the type of surgery performed (breast conserving surgery, mastectomy, or no surgery) and whether or not radiation was delivered. Breast conserving surgery includes lumpectomy, segmental mastectomy, quadrantectomy, tylectomy, wedge resection, excision biopsy, and partial mastectomy.

Neighborhood Socioeconomic Status and Education

The measures of socioeconomic status and education used in the report are population-based and not individually-specific; using these indices is an accepted and valid practice (7). Values are assigned according to the census block group of residence at diagnosis; each block group is small, containing only approximately 1,000 people. We categorized neighborhoods according to whether 25% or more of adults aged 25 years or older are without a high school diploma, whether 20% or more of adults aged 16 years or older have a blue collar job, and whether 30% or more were living below poverty line.

County Statistics

The annual population estimates for Orange County and California used as denominators for the incidence rate calculations are taken from the 2000 U.S. Census (8) (9). County population estimates of race/ethnicity used are based on self-identification at the time of the census.

Age-Adjusted Incidence and Mortality Rates

Incidence and mortality rates were calculated per 100,000 women in the general population. Rates were calculated using five-year age groups and weighted to the 2000 U.S. population as described elsewhere (10). Age adjustment allows cancer rates to be compared by controlling for differences in the age distribution of two populations. Where appropriate, linear trend in incidence or mortality was tested using R-squared.

Statistical Modeling of Risk of Five-Year Mortality

The CCR routinely updates vital status and follow-up information for all patients with cancer, using linkages with state and national death indices, and other databases, as described (2). Patients were followed for vital status from diagnosis in 1991-2000 for 5 years; the last date of follow-up was 12/31/2005. We used Cox regression to calculate the relative risk (RR) of breast cancer death within five-years of diagnosis. We adjusted for age and year of diagnosis (because mortality rates have reduced over time).

In Cox regression, subjects with incomplete data are included in the model, but are 'censored' for example if they move out of the U.S. or die of causes other than breast cancer, as described (2), so we can still accurately analyze the data even if some women are not followed for the full 5 years. Generally, the largest category of each covariate was selected as the reference group to ensure that the RR calculated would be stable. All statistical analyses were conducted using SAS 9.2 (SAS Institute Cary, NC).

Number of Young Women with Breast Cancer

Between 1991 and 2007, 1,648 female residents of Orange County were diagnosed with invasive breast cancer before they were aged 40 years (Table 1). The age at diagnosis ranged from 16 to 39 years for these women, and the average age was 35 years. Breast cancer among young women is uncommon and only 6.7% of all invasive breast cancers diagnosed in the county were among women younger than 40.

TABLE 1. Number of invasive breast cancer diagnoses, according to age at diagnosis, Orange County (*n*=24,449) and California (*n*=250,873).

	Age at diagnosis		
	<40 years	40-49 years	≥50 years
Orange County 1991-2007			
Number diagnosed	1,648	4,793	18,008
Mean age (SD[a])	35.0 years (±3.6)	45.1 years (±2.8)	66.3 years (±10.7)
California 1991-2005			
Number diagnosed	16,022	47,480	187,371
Mean age (SD[a])	35.0 years (±3.6)	45.0 years (±2.8)	66.7 years (±10.7)

[a] SD = Standard Deviation

78.5% of all breast cancer patients in Orange County are non-Hispanic white. However the race/ethnicity of patients varies according to the age at diagnosis (Table 2). Among young breast cancer patients compared to patients who are diagnosed age 50 years or older, there are higher proportions of Hispanics (25.0% versus 8.3%), Asian Pacific Islanders (14.6% versus 7.0%), and African Americans (2.0% versus 0.8%).

Note that these raw numbers are for descriptive purposes only and to the most part, reflect the composition of the local population; only incidence rates (which take into account the number and age distribution of women in the general population by race/ethnicity) should be used for comparing risk of breast cancer in different populations.

TABLE 2. Race/ethnicity of patients with breast cancer, by age at diagnosis, Orange County (*n*=24,449), 1991-2007.

	Age at diagnosis						All ages	
	<40 years		40-49 years		≥50 years			
	n	%	*n*	%	*n*	%	*N*	%
African American	33	2.0	86	1.8	141	0.8	260	1.1
Asian Pacific Islander	240	24.9	670	14.0	1,268	7.0	2,178	8.9
Hispanic	410	24.9	735	15.3	1,487	8.3	2,632	10.8
Non-Hispanic white	953	57.8	3,256	67.9	14,971	83.1	19,180	78.5
Other/Unknown	12	0.7	46	1.0	141	0.8	199	0.8
Total	1,648		4,793		18,008		24,449	

Descriptive Characteristics

Tumor Characteristics

Young women with breast cancer had a higher prevalence of regional and distant disease (56.3%), compared with older women (45.8% aged 40-49 or 34.3% aged ≥50), and a lower prevalence of localized disease (43.7% versus 54.1% aged 40-49 or 65.7% aged ≥50) (Table 3). This confirms our finding in an earlier monograph that patients younger than 40 years were over twice as likely to be diagnosed with a late stage disease as women who were aged 55-69 years (1).

Younger breast cancer patients had a higher prevalence of hormone receptor negative disease; 29.5% were estrogen receptor negative, compared to 18.7% of tumors among patients aged 40-49 years and 15.4% of tumors found in women aged 50 years or older. 35.1% of tumors in young patients were progesterone receptor negative. These tumors are not responsive to hormone therapy and therefore these patients have fewer treatment options.

Over half of all tumors diagnosed, regardless of age at diagnosis, were HER2-neu negative. HER2-neu is another tumor marker for which specialized treatment is available if the marker is 'positive'. In contrast to the hormone receptors, however, a positive HER2-neu marker is associated with more advanced breast cancer. 24.5% of the tumors diagnosed among women younger than 40 were HER2-neu positive, compared to 14.3% of tumors among the oldest women.

Young women with breast cancer had a higher prevalence of lymph node involvement; 36.2% had four or more positive nodes, compared to 30.6% of patients aged 40-49 years, and 21.4% of patients over 50 years. Younger patients had a larger proportion of poorer grade tumors; 50.5% were poorly differentiated or undifferentiated tumors compared to 36.7% among patients aged 40-49 or 25.8% among patients aged 50 or older. Young women had larger tumors; 41.7% of tumors were 2cm or smaller, compared to 62.2% of tumors in women aged 50 years or older. The proportion of ductal and inflammatory cancer was higher for the youngest breast cancer patients; and again, these types of cancer are associated with poorer prognosis.

Our findings are confirmed by a number of other studies that have found that younger women appear to have a higher prevalence of more aggressive forms of breast cancer with poorer prognosis, compared to older women (3; 11; 12; 13; 14; 15; 16). Because mammography is not routinely recommended before age 40, it is rare for breast cancer to be detected in young women before it is palpable, which may explain some of the difference in type of tumor by age. Furthermore, an early age of onset of breast cancer is more common among women with inherited or familial breast cancer and there are indications that genetic cancer may be more aggressive.

TABLE 3. Tumor characteristics of patients with invasive breast cancer, by age at diagnosis (*n*=10,768), Orange County, 2001-07.

Tumor characteristic	Age at diagnosis (years) <40 (*n*=689) %	40-49 (*n*=2,189) %	≥50 (*n*=7,890) %
Stage			
Localized	43.7	54.1	65.7
Regional	49.9	42.6	30.0
Distant	6.4	3.2	4.3
Estrogen receptor status[a]			
Positive	56.5	68.8	71.6
Negative/Borderline	29.5	18.7	15.4
Unknown (includes no test)	14.1	12.4	13.1
Progesterone receptor status			
Positive	46.4	57.8	54.5
Negative/Borderline	35.1	25.4	26.6
Unknown (includes no test)	18.4	16.8	18.9
HER2/neu marker status			
Positive	24.5	19.9	14.3
Negative/Borderline	55.9	59.4	64.7
Unknown (includes no test)	19.6	20.7	21.1
Number of lymph nodes			
Negative nodes	44.4	53.7	63.9
1-3 positive nodes	14.1	12.4	8.8
>4 positive nodes	36.2	30.6	21.4
Unknown nodes (incl. inflammatory)	5.4	3.3	5.9
Histological grade/differentiation			
Well differentiated	6.2	16.3	22.7
Moderately differentiated	36.0	40.0	44.5
Poorly differentiated or undifferentiated	50.5	36.7	25.8
Grade and differentiation not stated	7.3	6.9	7.0
Tumor size (cm)			
≤2	41.7	52.9	62.2
2.1 – 5.0	39.2	33.8	27.7
>5	13.2	8.3	5.9
Diffuse	1.5	1.1	1.0
Unknown size (includes multifocal)	4.5	3.9	3.2
Mean size (where known)	3.0 cm	2.5 cm	2.1 cm
Histology			
Lobular	3.1	6.2	8.9
Ductal	80.0	74.9	67.7
Mixed ductal and lobular	8.9	12.3	14.1
Inflammatory	1.3	0.8	0.9
Other specified histology	6.8	5.9	8.4

Socioeconomic Characteristics

Older breast cancer patients (≥50 years) were more frequently covered by Medicaid/Medicare insurance, whereas patients younger than 40 and those aged 40-49 were more commonly covered by managed care/HMO/PPO insurance (Table 4). There were few uninsured patients, but the prevalence was almost twice as high for patients younger than 40 years (1.2%) than for those 50 or older (0.7%).

Younger breast cancer patients were more frequently single and less frequently divorced/separated or widowed. The proportion of young patients that were married (65.6%) was about the same as patients aged 40-49 years (69.9%), but was higher than for patients aged 50 or older (56.4%). Young breast cancer patients more frequently resided in census tracts where 25% or more of adults did not have a high school diploma (26.6% versus 18.4%), where 20% or more of adults had a blue-collar job (13.5% versus 10.6% aged 40-49 or 8.2% aged ≥50), and where 30% or more were living below the poverty line (28.9% versus 20.3%).

TABLE 4. Socioeconomic characteristics of patients with breast cancer, by age at diagnosis, Orange County (*n*=10,768), 2001-07.

	Age at diagnosis (years)		
	<40 (*n*=689) %	40-49 (*n*=2,189) %	≥50 (*n*=7,890) %
Health insurance status			
Managed care, HMO, PPO	78.1	82.2	56.2
Not insured (including self-pay)	1.2	0.8	0.7
Medicaid/Medicare	10.9	8.3	36.8
Federal or other public funding	1.7	1.1	0.7
Insured, but unknown type	7.0	6.1	4.2
Unknown if insured	1.2	1.5	1.4
Marital status			
Married	65.6	69.9	56.4
Divorced/Separated	8.1	10.2	11.6
Single	22.9	15.9	10.3
Widowed	0.3	0.8	19.0
Unknown	3.1	3.2	2.9
Low education, neighborhood level [b]			
No	72.9	78.6	80.3
Yes	26.6	20.2	18.4
Unknown	0.6	1.2	1.3
Blue collar status, neighborhood level [c]			
No	86.2	88.8	89.5
Yes	13.5	10.6	8.2
Unknown	0.3	0.6	2.3
In poverty, neighborhood level [d]			
No	69.8	78.3	79.2
Yes	28.9	21.0	20.3
Unknown	1.3	0.7	0.6

[b] ≥25% of adults aged 25 years or older are without a high school diploma.
[c] ≥20% of adults aged 16 years or older have a blue collar job.
[d] ≥30% living below poverty line.

Religious Beliefs

There was little difference in the self-reported religion of breast cancer patients according to age at diagnosis, although there was a slightly higher proportion of Catholics among the younger women (Table 5).

TABLE 5. Religion of patients with breast cancer, by age at diagnosis, Orange County (*n*=10,768), 2001-07.

	Age at diagnosis (years)		
	<40 (*n*=689) %	40-49 (*n*=2,189) %	≥50 (*n*=7,890) %
None	42.1	41.9	40.8
Catholic	27.3	22.4	20.2
Christian	24.2	28.6	31.4
Christian sects	1.5	1.5	2.1
Eastern religions	3.5	2.9	1.8
Jewish	1.3	1.9	2.9
Other	0.2	0.7	0.9

Treatment

The first line of surgical and radiation treatment appeared to differ according to age at diagnosis, with the younger breast cancer patients more likely to have received mastectomy, with or without radiation, and less likely than older patients to have received breast conserving surgery, with or without radiation (Table 6). Selection of suitable treatment however is dependent on the type of tumor diagnosed so again these differences may be on account of the more aggressive type of disease diagnosed in young women.

TABLE 6. First line of treatment of patients with breast cancer, by age at diagnosis, Orange County (*n*=10,768), 2001-07.

Surgery and Radiation	Age at diagnosis (years)		
	<40 (*n*=689) %	40-49 (*n*=2,189) %	≥50 (*n*=7,890) %
Breast conserving surgery, radiation	23.4	32.1	38.9
Breast conserving surgery, no radiation	15.0	16.3	19.7
Mastectomy, no radiation	37.2	35.7	29.2
Mastectomy, radiation	17.9	11.1	6.2
No surgery, no radiation	4.9	4.0	5.2
No surgery, radiation	1.7	0.9	0.8

Incidence Rates

The annual age-adjusted incidence of invasive breast cancer was 18.8 per 100,000 women aged younger than 40 years, during 1991-2005 in Orange County; which was much lower than incidence for women aged 40-49 (140.1 per 100,000), and for women aged 50 or older (314.6 per 100,000) (Table 7). It is well documented that the risk of breast cancer increases with age (17). Breast cancer incidence rates in Orange County were similar to rates in California as a whole, at all ages.

TABLE 7. Annual age-adjusted incidence per 100,000 women of invasive breast cancer, by age at diagnosis, Orange County and California, 1991-2005.

	Age at diagnosis (years)		
	<40	40-49	≥50
Orange County			
Age-adjusted incidence*	18.8 (17.8, 19.7)	140.1 (135.8, 144.3)	314.6 (309.8, 319.4)
California			
Age-adjusted incidence*	17.7 (17.4, 18.0)	136.3 (135.1, 137.5)	300.0 (298.7, 301.4)

*Incidence per 100,000 women (95% confidence intervals)

Change in Incidence

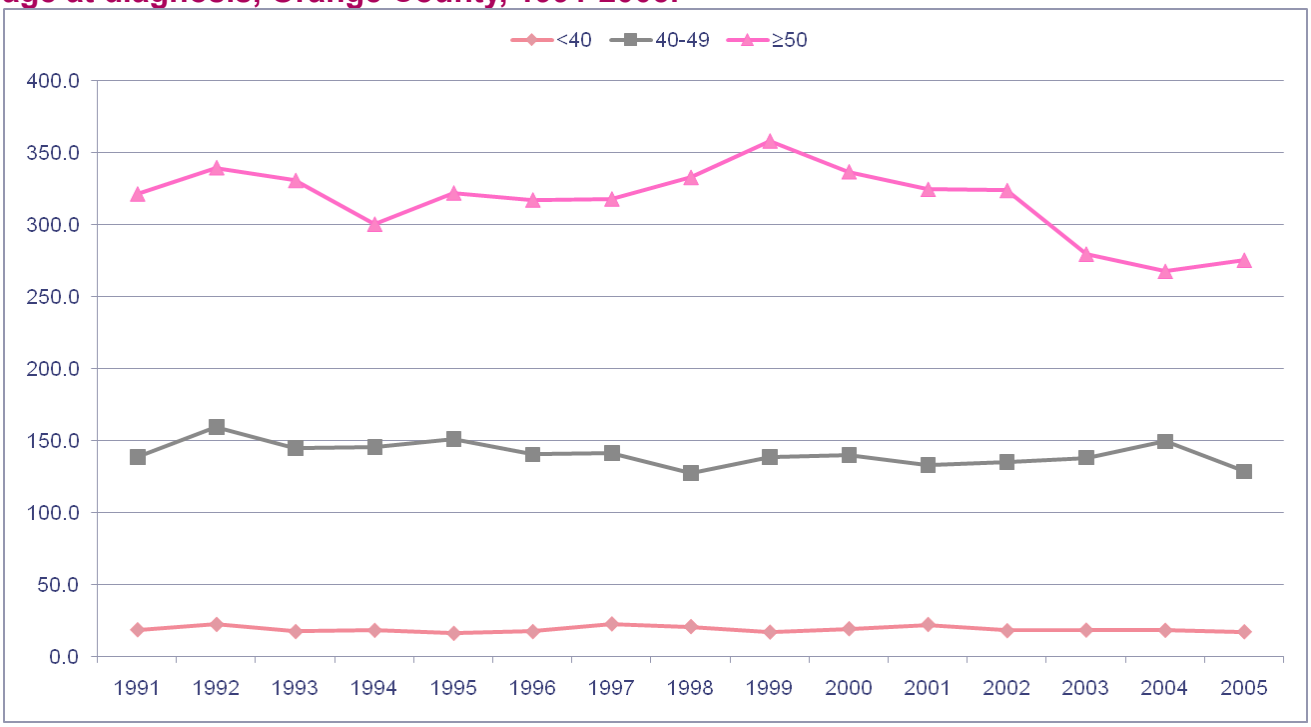
The incidence of invasive breast cancer in Orange County has declined significantly during the last 15 years among women who were 50 or older, from 322.2 to 293.1 per 100,000, and among women who were aged 40-49 years, from 147.8 to 136.7 per 100,000 (Table 8). Incidence for women younger than 40 has not changed significantly over the same time period.

TABLE 8. Change in age-adjusted incidence per 100,000 women of invasive breast cancer, by age at diagnosis, Orange County, 1991-2005.

	Age at diagnosis (years)		
	<40	40-49	≥50
1991-1995	18.3 (16.7, 20.0)	147.8 (139.7, 155.9)	322.2 (313.3, 331.3)
1996-2000	19.2 (17.6, 20.9)	137.2 (130.0, 144.4)	332.6 (324.0, 341.2)
2001-2005	18.7 (17.0, 20.3)	136.7 (129.9, 143.5)	293.1 (285.5, 300.6)
R^2 trend 1991 to 2005	.12 (no trend)	.78 (strong)	.51 (moderate)

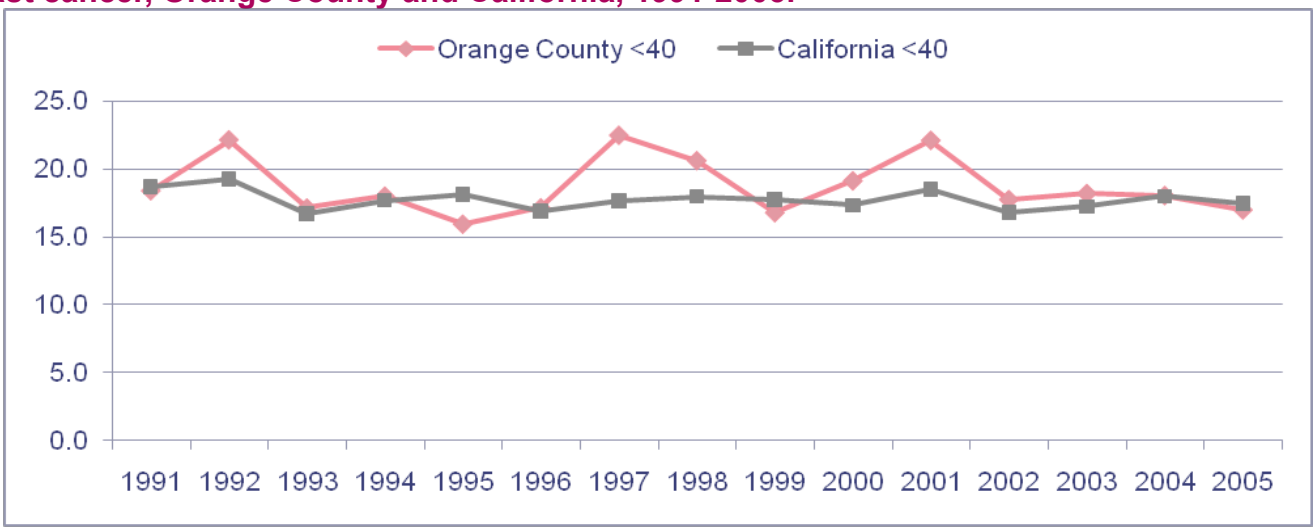
Annual rates of age-adjusted incidence of invasive breast cancer for the three age groups are shown in Figure 1. A recent decline in incidence is noticeable among women who were 50 years or older; during 2003-05 incidence rates were at the lowest that they have ever been since 1991. There appears to be no change in incidence of invasive breast cancer for women younger than 40, but since the rate is so much lower than for the other ages, it is hard to identify change on this scale; Figure 2 shows change over time for just the youngest women.

FIGURE 1. Annual age-adjusted incidence per 100,000 women of invasive breast cancer, by age at diagnosis, Orange County, 1991-2005.



Recent research suggests that rates of breast cancer among young women may have increased (18), but we could not find any data to support this from the U.S. and our analysis shows that incidence for women younger than 40 has remained stable between 1991 and 2005 in Orange County and California (Figure 2).

FIGURE 2. Annual age-adjusted incidence per 100,000 women younger than 40 of invasive breast cancer, Orange County and California, 1991-2005.



Orange County R^2 for trend = .01 (No trend)
California R^2 for trend = .11 (No trend)

Incidence Rates by Race/Ethnicity

Annual age-adjusted incidence of breast cancer among young women was highest for African American (21.3 per 100,000) and non-Hispanic white women (20.8 per 100,000) in Orange County, followed by Asian Pacific Islander (16.6 per 100,000) and Hispanic women (15.8 per 100,000) (Table 9). The population of African American women in Orange County is very small and the confidence intervals accordingly wide, however the estimate for incidence among young African American women in California (calculated from much larger numbers) is very similar (22.1 per 100,000) which suggests that our estimate is reliable.

Several studies have found that breast cancer tends to occur among African American women at an earlier age (3; 19; 20; 14) and it is known that incidence in the U.S. is higher for African Americans than for non-Hispanic whites until the age of 40 when rates for non-Hispanic whites exceed those for African Americans (17).

TABLE 9. Annual age-adjusted incidence of invasive breast cancer among women younger than 40, by race/ethnicity, Orange County and California, 1991-2005.

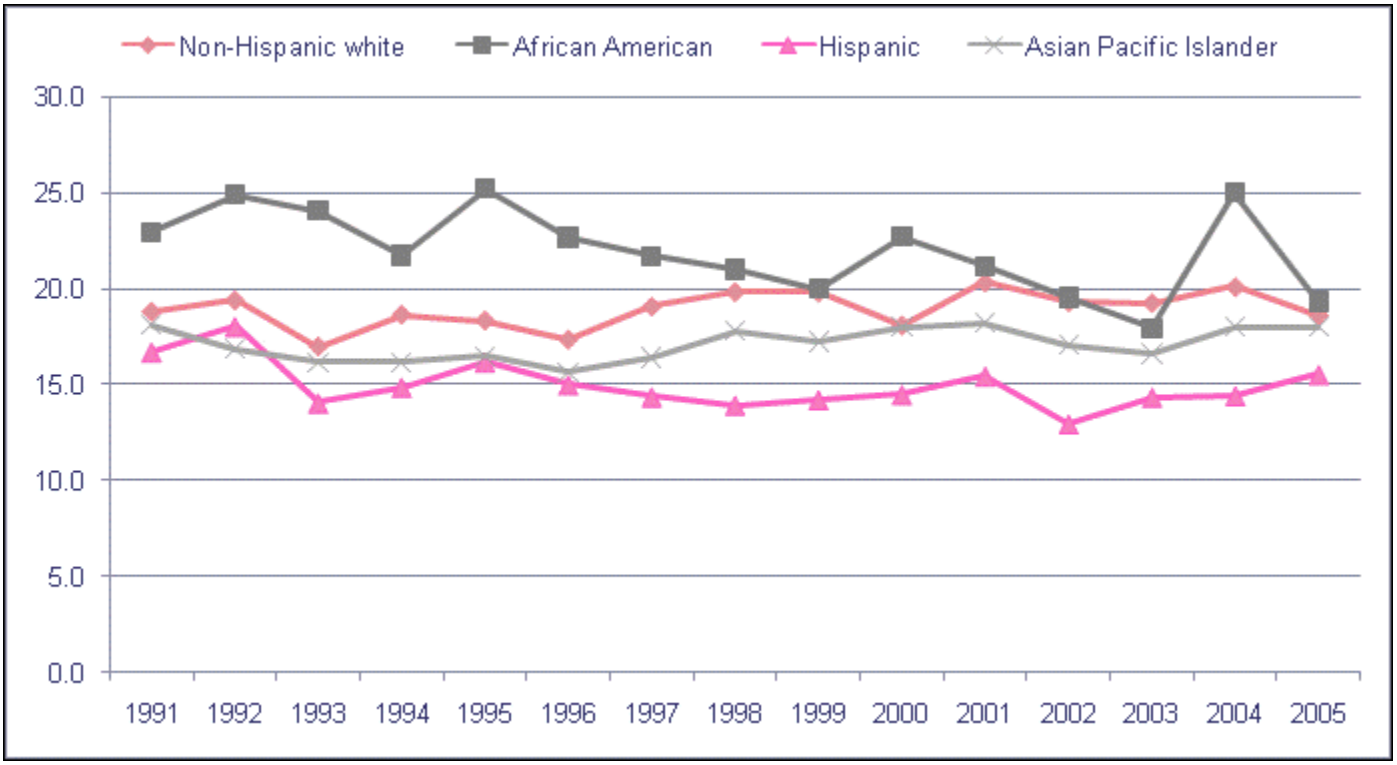
	Race/Ethnicity			
	Non-Hispanic white	African American	Hispanic	Asian Pacific Islander
Orange County				
Number diagnosed	856	32	356	196
Age-adjusted incidence*	20.8 (19.4, 22.2)	21.3 (13.9, 28.7)	15.8 (14.1, 17.4)	16.6 (14.3, 18.9)
California				
Number diagnosed	8,331	1,460	4,132	2,006
Age-adjusted incidence*	18.9 (18.5, 19.3)	22.1 (21.0, 23.2)	14.9 (14.5, 15.4)	17.2 (16.4, 17.9)

*Incidence per 100,000 women (95% confidence intervals).
Excludes women of other or unknown race/ethnicity.

Change in Incidence

The changes over the last 15 years in age-adjusted incidence of invasive breast cancer according to race/ethnicity in California are presented in Figure 3. The Orange County numbers were too small in which to examine annual change. There was very little change over the time although there is some evidence that incidence among African Americans has declined slightly (*p* trend = .31), bringing it more in line with the rates seen among young women of other racial/ethnic groups.

FIGURE 3. Annual age-adjusted incidence of invasive breast cancer among women younger than 40, according to race/ethnicity, California, 1991-2005.



	R^2 for trend
Non-Hispanic white	.17 (No trend)
African American	.31 (Low trend)
Hispanic	.25 (No trend)
Asian Pacific Islander	.19 (No trend)

Mortality Rates

Over the last fifteen years, 10,686 women in California died from breast cancer; of those 444 (4.2%) died before they were aged 40 (Table 10). The annual age-adjusted breast cancer mortality rate was 0.5 per 100,000 women aged younger than 40 years, during 1991-2005 in California; which was much lower than mortality for women aged 40-49 (3.5 per 100,000), and for women aged 50 or older (13.6 per 100,000).

TABLE 10. Number of breast cancer deaths and annual age-adjusted breast cancer mortality, California, 1991-2005.

	Age (years)		
California	<40	40-49	≥50
Total breast cancer deaths	444	1,244	8,998
Age-adjusted mortality*	0.5 (0.4, 0.5)	3.5 (3.3, 3.7)	13.6 (13.4, 13.9)

*Mortality per 100,000 women (95% confidence intervals)

Change in Mortality

Breast cancer mortality has declined significantly during the last 15 years, irrespective of the age of the woman (Table 11). Among women younger than 40 mortality rates primarily declined from 1991-95 to 1996-2000, but have remained steady between 1996-2000 and 2001-05 and so the overall decline has been more moderate than for women who were aged 40-49 years or 50 or older. U.S. statistics show that between 1980 and 1995 breast cancer mortality rates for American women younger than age 40 decreased (17).

TABLE 11. Change in age-adjusted breast cancer mortality, California, 1991-2005.

	Age (years)		
	<40	40-49	≥50
1991-1995	0.6 (0.5, 0.7)	4.2 (3.8, 4.6)	15.6 (15.0, 16.1)
1996-2000	0.5 (0.4, 0.5)	3.4 (3.1, 3.8)	13.7 (13.2, 14.2)
2001-2005	0.5 (0.4, 0.5)	3.1 (2.8, 3.4)	12.0 (11.6, 12.4)
R^2 trend 1991 to 2005	.64 (moderate)	.95 (strong)	.99 (strong)

The change in breast cancer mortality by age group is also shown in Figure 4.

FIGURE 4. Annual age-adjusted breast cancer mortality per 100,000 women, according to age, California, 1991-2005.

Mortality Rates by Race/Ethnicity

Death from breast cancer before the age of 40 years is rare and there is very little difference in rates according to race/ethnicity although the age-adjusted rate may be higher for non-Hispanic white women in comparison to the other racial/ethnic groups (Table 12).

TABLE 12. Number of breast cancer deaths and annual age-adjusted breast cancer mortality, among women younger than 40, California, 1991-2005.

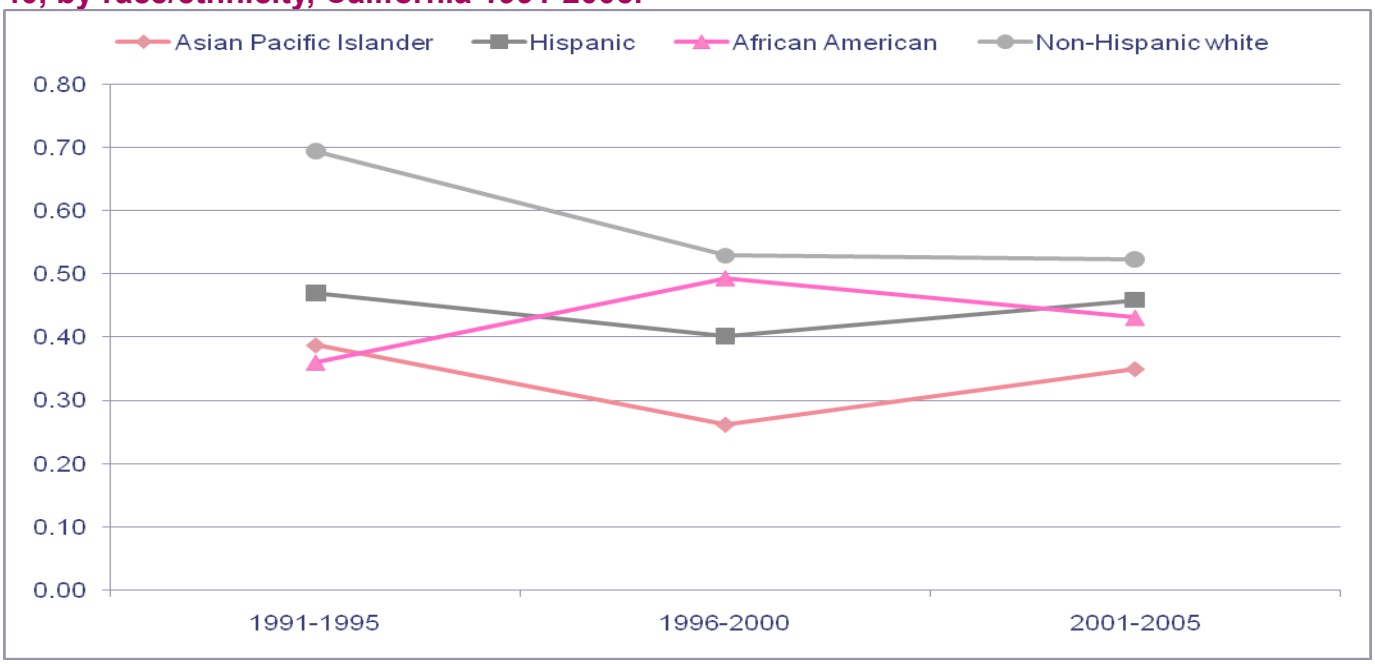
	Race/Ethnicity			
California	Non-Hispanic white	African American	Hispanic	Asian Pacific Islander
Number of breast cancer deaths	254	28	124	38
Age-adjusted mortality*	0.6 (0.5, 0.7)	0.4 (0.3, 0.6)	0.4 (0.4, 0.5)	0.3 (0.2, 0.4)

*Mortality per 100,000 women (95% confidence intervals).
Excludes women of other or unknown race/ethnicity.

Change in Mortality

Non-Hispanic white women had the highest age-adjusted breast cancer mortality rate during 1991-1995 in California (Figure 5) however it has since declined significantly, whereas the mortality rate for other racial/ethnic groups has not significantly changed. By 2001-2005 breast cancer mortality was fairly similar across all racial/ethnic groups in California.

FIGURE 5. Annual age-adjusted breast cancer mortality rates per 100,000 women younger than 40, by race/ethnicity, California 1991-2005.



Risk of Five-Year Breast Cancer Mortality

In a previous monograph we reported that in Orange County (1991-2000) women who were younger than 40 years when they were diagnosed with primary breast cancer had more than double the increased risk of breast cancer mortality within five-years of diagnosis (relative risk = 2.74, 95% CI = 1.31, 5.73), compared with women who were 70 years or older at diagnosis, after adjustment for year of diagnosis, race/ethnicity, and tumor characteristics (2). The relative risk is statistically significant but we were unsure of the exact degree of extra risk as indicated by the wide confidence intervals.

Using California data, we are able to focus on just breast cancer patients that were diagnosed more recently (1996-2000) (Table 13). Furthermore we were able to further subdivide the young women by age at diagnosis. The results confirm what we reported from Orange County, that relative risk of breast cancer mortality within five-years of diagnosis is more than two and a half times higher for those diagnosed before age 35, and more than one and a half times higher for those diagnosed between the ages of 35 and 39, in comparison with women diagnosed in their forties. This is after adjustment for the characteristics that we have identified as differing according to age of diagnosis such as race/ethnicity, tumor characteristics (including stage), socioeconomic status, health insurance status, and first line of treatment.

Similar results were reported a few years ago for women younger than 35 years at diagnosis in the San Francisco Bay Area (21) and Chung et al reported that mortality for women with breast cancer aged 40 and younger was worse than other age groups even when they compared women with the same stage of disease (12). It is not exactly clear why there is this disparity in mortality for younger breast cancer patients.

TABLE 13. Adjusted relative risk of five-year breast cancer mortality among breast cancer patients diagnosed in California, 1996-2000 (n=21,305), by age at diagnosis.

Age at diagnosis	Total diagnosed		5 yr breast cancer mortality
	n	%	Adjusted RR (95% CI)*,†
40-49	16,036	75.3	1.0
35-39	3,415	16.0	1.62 (1.35, 1.93)
<35	1,854	8.7	2.85 (2.12, 3.83)

*RR, relative risk; CI, confidence interval.
†Adjusted for year of diagnosis, race/ethnicity, tumor characteristics, socioeconomic status, health insurance and treatment

Factors Associated with Five-Year Breast Cancer Mortality Among Younger Patients: Multivariate Analysis

Of the 10,576 breast cancer patients who were diagnosed before they were aged 40 years in California between 1991 to 2000, 2,038 (19.3%) of them died of breast cancer within five-years of their diagnosis. In order to identify which younger breast cancer patients are at most risk of breast cancer mortality, we conducted a multivariate model including all the characteristics described within this report. We used a stepwise technique to select the most important factors and these are presented in order of significance in Table 14. Six of the tumor characteristics including stage were selected for the model; they are not presented in the table but they are adjusted for in the multivariate analysis.

Race/ethnicity was selected as the most significant determinant of risk of five-year mortality among young breast cancer patients. Without taking into account tumor characteristics or the other variables in the table there was an increased risk of mortality for African Americans and Hispanics, and a reduced risk for Chinese women. However after adjusting for tumor characteristics, socioeconomic status, insurance and so on, young African American patients had 60% increased risk and young Vietnamese patients had 75% increased risk (although the confidence intervals were wide) of dying from their disease compared to non-Hispanic white women.

Treatment was unsurprisingly highly associated with outcome. Of course, the type of tumor determines the treatment options, and therefore, only the relative risks that adjust for tumor characteristics can be interpreted meaningfully. In the multivariate model, we found that breast conserving surgery with radiation was the optimum first line of treatment; all the other combinations examined were associated with increased risk of mortality. Breast conserving surgery without radiation was associated with a 20% increased risk compared to having the same surgery with radiation. After adjustment for the type of tumor, race/ethnicity and the other variables in the model, young breast cancer patients who were Christian were at a slightly increased risk (13%) and those who were members of a Christian sect were at over 50% increased risk of mortality relative to patients who were not religious.

Lastly, young patients who lived in a neighborhood where more than 20% of the adults aged 16 years or older have a blue collar job had 28% increased risk compared to other patients, and being covered by Medicaid (30% increase) or Medicare (90% increase) or not having health insurance (45% increase) had an increased risk of five-year breast cancer mortality relative to patients covered by managed care, HMO or PPO. Note that to be eligible for Medicare before you reach the age of 65 years you must be receiving disability payments and therefore this group of patients will have other co-morbidities which may limit treatment options.

Marital status, neighborhood education, and neighborhood poverty did not remain significant after adjustment for other factors and were not selected for the final model.

TABLE 14. Factors associated with risk of five-year mortality among breast cancer patients diagnosed before age 40, in California (n=10,576), 1991-2000.

Characteristic in order of significance	Total n	5 yr breast cancer mortality RR (95% CI)* adjusted for age and date of diagnosis	5 yr breast cancer mortality RR (95% CI)* adjusted for all variables†
Race/Ethnicity			
Non-Hispanic White	5789	1.0	1.0
African American	1017	1.96 (1.73, 2.23)	1.60 (1.40, 1.83)
Asian Pacific Islander	1206	0.90 (0.77, 1.05)	0.91 (0.77, 1.07)
Chinese	282	0.62 (0.43, 0.89)	0.69 (0.48, 1.00)
Filipino	351	0.81 (0.60, 1.08)	0.80 (0.59, 1.07)
Japanese	118	0.90 (0.56, 1.46)	1.07 (0.66, 1.75)
Korean	80	1.10 (0.65, 1.86)	0.97 (0.57, 1.65)
Vietnamese	114	1.32 (0.88, 1.96)	1.75 (1.16, 2.64)
Pacific Islander	33	1.56 (0.78, 3.13)	1.16 (0.57, 2.34)
S Asian/Indian	80	1.39 (0.87, 2.21)	1.35 (0.83, 2.21)
Other	148	0.84 (0.54, 1.31)	0.72 (0.46, 1.14)
Hispanic	2509	1.40 (1.26, 1.56)	1.04 (0.93, 1.17)
Caribbean	436	1.27 (1.02, 1.58)	1.15 (0.92, 1.43)
Mexican	984	1.65 (1.44, 1.90)	1.07 (0.91, 1.25)
South & Central American	220	1.22 (0.90, 1.66)	0.87 (0.64, 1.19)
Other	869	1.25 (1.06, 1.46)	1.02 (0.86, 1.20)
Other/Unknown	55		
P value		<.0001	<.0001
First Line of Treatment			
Breast conserving surgery, radiation	3244	1.0	1.0
Breast conserving surgery, no radiation	1119	1.64 (1.37, 1.96)	1.29 (1.08, 1.54)
Mastectomy, radiation	1521	3.15 (2.74, 3.61)	1.20 (1.03, 1.40)
Mastectomy, no radiation	4360	1.81 (1.60, 2.05)	1.31 (1.15, 1.49)
No surgery, radiation	122	14.3 (11.2, 18.1)	2.22 (1.67, 2.94)
No surgery, no radiation	210	10.3 (8.34, 12.7)	2.18 (1.69, 2.82)
P value		<.0001	<.0001
Religion			
None	4416	1.0	1.0
Catholic	2837	1.21 (1.09, 1.35)	1.01 (0.89, 1.14)
Christian	2563	1.36 (1.22, 1.52)	1.13 (1.01, 1.27)
Christian sects	329	1.98 (1.60, 2.44)	1.55 (1.25, 1.92)
Eastern religions	169	0.81 (0.54, 1.23)	0.77 (0.49, 1.19)
Jewish	240	0.68 (0.47, 0.99)	0.69 (0.48, 1.01)
Other religion	22		
P value		<.0001	0.002

*RR, relative risk; CI, confidence interval.
†Adjusted for all other covariates in the table as well as age, year of diagnosis and tumor characteristics (stage at diagnosis, number of positive lymph nodes, estrogen receptor status, tumor size, tumor grade/differentiation and histological type)

Table 11. Continued

Characteristic in order of significance	Total	5 yr breast cancer mortality	
	n	RR (95% CI)* adjusted for age and date of diagnosis	RR (95% CI)* adjusted for all variables†
Neighborhood Blue Collar Status a			
No	4717	1.0	1.0
Yes	5838	1.58 (1.33, 1.89)	1.28 (1.06, 1.53)
Unknown	21		
P value		<.0001	0.033
Insurance Status b			
Managed care, HMO, PPO	3218	1.0	1.0
Not insured (including self-pay)	158	1.84 (1.34, 2.53)	1.45 (1.03, 2.04)
Medicaid	612	1.98 (1.67, 2.35)	1.30 (1.08, 1.56)
Medicare	68	2.21 (1.44, 3.39)	1.90 (1.22, 2.97)
Military or other public funding	131	1.08 (0.70, 1.66)	1.16 (0.75, 1.79)
Insured, but unknown type	675	0.96 (0.78, 1.18)	0.95 (0.76, 1.18)
Unknown if insured	407		
P value		<.0001	0.005

*RR, relative risk; CI, confidence interval.
†Adjusted for all other covariates in the table as well as age, year of diagnosis and tumor characteristics (stage at diagnosis, number of positive lymph nodes, estrogen receptor status, tumor size, tumor grade/differentiation and histological type)
a ≥20% of adults aged 16 years or older have a blue collar job.
b Presented for diagnoses 1996-2000 only

Summary and Recommendations

Young women have low incidence of breast cancer in comparison to older women, but their cancers tend to be diagnosed at a later stage, and their tumors are larger, higher grade and with poorer prognostic characteristics, resulting in more radical treatment (mastectomy and mastectomy with radiation rather than breast conserving surgery) and higher rates of breast cancer mortality. The unique characteristics of the tumors diagnosed in young women, and the distinct types of women susceptible to early-onset breast cancer, suggest that breast cancer in young women is a different disease with different risk factors (22), and possibly an increased genetic component (23). Little is known about young women with breast cancer; they may be under-represented in research studies and not separately identified in regular cancer-monitoring statistics.

The key to detecting cancer early in young women is being able to identify women at high risk and then targeting them for diagnostic services. It is known that women with a family history (a close relative with the disease) of early-onset breast or ovarian cancer (gene mutations associated with ovarian cancer are also associated with breast cancer) are at higher risk, but many young women may not be fully aware of their own family history of breast and ovarian cancer (24), and this may vary by race/ethnicity (14; 24).

Recommendations

We recommend:

- Research to identify young women at high risk for breast cancer.
- Educating women about talking to their families about cancer to learn their own risk.
- Encouraging doctors to ask young women about their family history of breast and ovarian cancer.
- Making screening and diagnostic services available for women who are at high risk (such as women with a family history of early-onset breast or ovarian cancer); most high-risk women should begin getting screening “at age 30” (25).
- Routine clinical breast examinations at least every three years for women younger than 40 years.
- Regular monitoring of incidence rates among women younger than 40 years as part of national and statewide breast cancer surveillance.
- Focusing interventions on young breast cancer patients who are most at risk of 5 year mortality (women who are African American, Vietnamese, Christian sect or Christian religion, women who have Medicaid, Medicare, or no health insurance coverage, and women who live in neighborhoods with low socioeconomic status).

Cautions on Interpretation and Limitations

The validity and reliability of our analyses depend on the accuracy of patients' medical records from which the cancer registrars abstract information. Although the California Cancer Registry is a tremendously useful and complete register, numerous different institutions contribute data and so some inconsistencies, errors, and missing data are to be expected.

It is known, for instance, that there are some misclassifications in patient characteristics. 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. Stewart et al. report that the CCR's method of classifying race/ethnicity may underestimate the number of Hispanic cases (26). Another example is the cancer registry health insurance information, which does not always accurately reflect the payer on the date of diagnosis; this has been shown to result in an underestimation in Medicaid enrollment (27).

Statistically significant variation can occur by chance alone (especially when we are dealing with small numbers in certain sub-populations), 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. Small numbers in some sub-populations may also mean we miss some disparity. Lastly, we had limited ability to explain the observations we made.

Glossary

Breast conserving surgery
Common surgical treatment for breast cancer allowing the conservation of the breasts. Various surgeries are considered breast conserving, but the principal types are lumpectomy and axillary dissection. Lumpectomy is considered breast conserving because only the lump (the part of the breast that has cancer) and part of the breast tissue around the lump are removed.

Confidence interval (CI) of an incidence rate
A range of values that has a specified probability of containing the rate or trend. The 95% (p-value = .05) confidence intervals are the most commonly used. For 95% confidence intervals, it can be stated that, 95% of the time the true rate will lie within these limits.

Cox regression/survival analysis
Survival analysis is a way of examining time to a particular event in a set of data. It was originally developed to study time until death as used here. The outcome of interest is time from diagnosis to death.

Ductal cancers
About 70 percent of invasive breast cancers have ductal histology. The cancer cells form in the lining of a milk duct, then break through the ductal wall and invade nearby breast tissue.

HER2/neu status
HER2-neu or human epidermal growth factor receptor 2 is a protein involved in normal cell growth that is found in high levels in some breast cancer cells. It is a relatively recent discovery. Scientists have discovered that breast cancers with this oncogene are faster growing and more likely to show resistance to chemotherapy, but it can be targeted with new treatments.

Histological grade or differentiation
Histological grade describes how similar the cancer cells are to normal cells of the same type. The degree that the cancer cells differ from normal breast cells when viewed under a microscope can be graded on a scale of histological differentiation. Low grade cancer cells (well differentiated) look most like normal cells. High grade cancer cells (undifferentiated) look least like normal cells.

Hormone receptor status
Breast cancers are tested for the presence of estrogen and progesterone receptors. A receptor is a protein on the outside of a cell that can attach to specific chemicals, hormones or drugs traveling through the bloodstream. Breast cancers can be estrogen receptor (ER) positive or negative and progesterone receptor (PR) positive or negative. With either ER positive or PR positive breast cancer, hormone-blocking medications, such as Tamoxifen, slow the cancer's growth. Hormone receptor positive cancers typically grow more slowly than do hormone receptor negative cancers.

Incidence
A cancer incidence rate is the number of newly diagnosed cancers of a specific type occurring in a specified population during a year (or group of years), usually expressed as the number of cancers per 100,000 population at risk.

In situ breast cancer
Non-invasive cancer that is confined to the ducts or lobules and do not spread to the surrounding tissues in the breast or other parts of the body.

Invasive breast cancer
Invasive (or infiltrating) cancers have started to break through normal breast tissue barriers and invade surrounding areas. Much more serious than non-invasive cancers, invasive cancers can spread cancer to other parts of the body through the bloodstream and lymphatic system.

Lobular cancer
Invasive lobular cancer is less common than ductal. The cancer starts in milk-producing lobules and then breaks into the surrounding breast tissue.

Mastectomy
Common surgical treatment method for breast cancer, involving the surgical removal of the breast or both breasts.

Positive lymph nodes
Lymph nodes are often removed to determine whether the cancer has spread; negative means that the nodes were free of cancer on examination; positive means that cancer was detected.

Prognosis
Potential for survival.

Stage of tumor
Stage describes the extent of the spread of the tumor by the time that it is detected.

Localized
Invasive tumor that is confined to breast tissue only.

Regional
Invasive tumor that has (metastasized) beyond the breast directly to the pectoral fascia, subcutaneous tissue, chest wall, ribs, skin, and/or to regional lymph nodes.

Distant
Invasive tumor that has spread beyond the breast to distant sites or further direct extension.

Bibliography

1. **Marshall, S F, Ziogas, A and Anton-Culver, H.** Disparities in stage at diagnosis of breast cancer in Orange County: Implications for early detection. Irvine, CA : University of California, Irvine, 2008.
2. Disparities in breast cancer mortality in Orange County. Irvine, CA : University of California, Irvine, 2008.
3. **Fairley, T L, Stewart, S and Sabatino, S.** Breast cancer in U.S. women. American Association for Cancer Research Conference. 2007.
4. **Young JL Jr, Roffers SD, Ries LAG, et al. (Eds).** SEER summary staging manual – 2000: codes and coding instructions. Bethesda, MD : National Cancer Institute, 2001. NIH Publ No. 01-4969.
5. **Fritz, A, and Ries, L, (Eds).** The SEER Program Code Manual - Third Edition. Bethesda, MD : National Cancer Institute, U.S. Department of Health and Human Services, 1998.
6. **California Cancer Registry.** Cancer Reporting in California: Data Standards for Regional Registries and California Cancer Registry. Reporting System Standards Volume III.
7. **Liu L, Deapen D, Bernstein L**. Socioeconomic status and cancer of females. Cancer Causes & Control. 1988, Vols. 9: 369-380.
8. **National Center for Health Statistics.** Estimates of the July 1, 2000-July 1, 2006, United States resident population from the Vintage 2006 postcensal series by year, county, age, sex, race, and Hispanic origin, prepared under a collaborative arrangement with the U.S. Census Bureau. August 2007.
9. Bridged-race intercensal estimates of the July 1, 1990-July 1, 1999, United States resident population by county, single-year of age, sex, race, and Hispanic origin, prepared by the U.S. Census Bureau with support from the National Cancer Institute. July 2004.
10. **Ikei R, Rowley K, Zell JA, et al.** Cancer incidence and mortality in Orange County, 2000-2004. Irvine, CA : Cancer Surveillance Program of Orange County, April 2007.
11. **Anderson, W F, et al.** Estrogen receptor breast cancer phenotypes in the Surveillance, Epidemiology, and End Results database. Br Ca Res Treat. 76;1:27-36, 2002.
12. **Chung, M, et al.** Younger women with breast cancer have poorer prognosis than older women. Cancer. 77:97-103, 1996.
13. **Gillett, D, Kennedy, C and Carmalt, H.** Breast cancer in young women. Aust NZ J Surg. 67:761-764, 1997.
14. **Shavers, V L, Harlan, L C and Stevens, J L.** Racial/Ethnic Variation in Clinical Presentation, Treatment, and Survival among Breast Cancer Patients under age 35. Cancer. 97:134-47, 2003.
15. **Gajdos, C, et al.** Stage 0 to stage III breast cancer in young women. Journal of the American College of Surgeons. 2000, Vols. 190;5:523-529.
16. **Bonnier, P, et al.** Age as a prognostic factor in breast cancer: relationship to pathologic and biologic features. Int J Cancer. 62;2:138-44, 1995.
17. **Lacey, J V, Devesa, S S and Brinton, L A.** Recent trends in breast cancer incidence and mortality. Environmental and Molecular Mutagenesis. 39:82–88, 2002.
18. **Bouchardy, C, et al.** Recent increase of breast cancer incidence among women under the age of forty. British Journal of Cancer. 96:1743-46, 2007.
19. **Farmer, T L, et al.** Early onset breast cancer genomics and tumor biology in Alabama women. American Association for Cancer Research Conference. 2007.
20. **Anderson, F W.** Perspective on the descriptive epidemiology of breast cancer as a reflection of biological heterogeneity and racial disparity. American Association for Cancer Research Conference. 2007.
21. **O' Malley, C and Le, G.** Breast Cancer Survival in San Francisco Bay Area. s.l. : State of California, Department of Health Services, 2004.
22. **Largent, J A, Ziogas, A and Anton-Culver, H.** Effect of reproductive factors on stage, grade and hormone receptor status in early-onset breast cancer. Breast Cancer Research. 7:R541-R554, 2005.
23. **John, E M, et al.** BRCA1 and BRCA2 mutation testing in minority populations enrolled in the Breast Cancer Family Registry. AACR Cancer Health Disparities Conference. November 2007.
24. **Phillips, J M, Cohen, M Z and Moses, G.** Breast cancer screening and African American women: fear, fatalism, and silence. Oncol Nurs Forum. 26:561-571, 1999.
25. **Saslow, D, et al.** American Cancer Society Guidelines for Breast Screening with MRI as an Adjunct to Mammography. CA Cancer J Clin. 57, 2007, Vols. 75-89.
26. **Stewart S, Glaser S, Horn-Ross P, et al.** SEER Study of Methods to Classify Hispanic Cancer Patients

(Final Report: Contract N01-CN-05224). Union City, CA : Northern California Cancer Center, 1993.
27. **Chan JK, Gomez SL, O'Malley CD, et al.** Validity of Cancer Registry Medicaid Status Against Enrollment Files; Implications for Population-Based Studies of Cancer Outcomes. Med Care. 44: 952–955, 2006.
28. **Weinick, R M.** Experience of primary care by racial and ethnic groups [correspondence]. Med Care. 38:447-448, 2000.