



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

Breast Cancer Incidence & Prevalence in Orange County

IV MONOGRAPH IV of IV

IV 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**

Monograph IV

Planning for Breast Cancer in Orange County

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

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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.

Planning for the Future

As the 'baby boomers' enter retirement, the U.S. faces one of the largest demographic shifts in its history. The aging of the population will have implications on health care costs and capacities, public policy, social security, retirement, and economic productivity. In this our fourth monograph we examine the future of breast cancer in Orange County. The aim is to predict the future burden of breast cancer in order to help plan the provision of breast health and breast cancer treatment services. We estimated the number of women who will be using local screening and breast health services in 2010 and 2020, comparing with actual numbers for 2005, and we predicted the economic demands of increasing provision to meet these needs.

Methods

Population projections for 2010 and 2020 were prepared by the State of California Department of Finance. Race/ethnic and age specific incidence rates of breast cancer for Orange County 1991-2005 were calculated using California Cancer Registry and Census population estimates. We used the population projections and recent trends in breast cancer incidence to predict demand for breast health and breast cancer treatment services. Current costs were inflation-adjusted and applied to estimates of demand to calculate future financial burden.

Local Population is Aging and Becoming More Diverse

The adult female population of Orange County is projected to rise 25% from 974,643 in 2005 to over 1.2 million in 2020. Increases will primarily occur among women aged 55-69 years (60%) and aged 70 years or older (47%). By 2020, Orange County will be more diverse, with 6% fewer non-Hispanic white women, a slight increase (5%) in the female African American population, and larger increases in Asian Pacific Islander (39%) and Hispanic (76%) populations.

Changing Rates of Breast Cancer Incidence

The age-adjusted incidence of in situ cancer has gradually increased over the past 15 years, whereas invasive breast cancer has decreased, which indicates earlier detection. This shift is evident among non-Hispanic white women, but differs for other race/ethnicities; for Hispanics and Asian Pacific Islanders, rates of both in situ and invasive breast cancer are increasing; and for African American women, in situ rates are decreasing, but invasive rates are increasing.

Increased Demand for Breast Health and Breast Cancer Treatment Services

There will be a 30% increase in demand for breast cancer screening services by 2020, compared to 2005. More than 850,000 mammograms will be performed. By 2020, 611 in situ (91% increase) and 1,980 invasive (5% increase) breast cancers will be diagnosed

By 2020, the average age of breast cancer patients will have risen from 55-59 to 60-64 years, and a much larger proportion of patients will be Hispanic or Asian Pacific Islander and a smaller proportion will be non-Hispanic white.

Predicted Costs

By 2020, we predict that the costs of breast health and breast cancer in Orange County will be;

- | | |
|---------------------------------------|---|
| a) Screening | \$213 million |
| b) Treatment | \$103 million |
| c) Lost productivity due to mortality | \$109 million & 5,779 years of lives lost |
| d) Financial support for survivors | \$420,000 |

Total costs are estimated to be \$424 million by 2020 which is an increase of 69% or \$174 million, compared to 2005.

Increased Pressure on Existing Infrastructure and Capacities

Demographic and societal changes may increase demand for public funding programs including Medicaid and Medicare, increase the number of uninsured patients, and cause a shortage of primary care physicians and other healthcare personnel, which may negatively impact the capacity of the healthcare sector to meet increased demands.

Recommendations

We recommend

The development of a systemic strategy for future provision in Orange County

- Culturally-competent breast health and treatment services
- Screening, education, and treatment programs for low income/uninsured populations
- Workforce training and education to increase healthcare personnel
- Increase of capacity in medically underserved areas
- Increased funding of public programs including Medicaid, Medicare, and Every Woman Counts

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; Jorge Castaneda, 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 fourth in a series analyzing existing cancer data collected by the California Cancer Registry.

Planning for the Future

As the 'baby boomers' enter retirement, the U.S. faces one of the largest demographic shifts in its history. The baby boom was a period between 1946 and 1960 when the fertility rate was almost double the average 20th century rate. Almost a quarter of the current population was born during that time, so their age has a strong influence on the age structure of the population. The shift towards an older population has implications for health care costs and capacities, public policy, social security, retirement, and economic productivity.

In this our fourth monograph, our aim was to predict the future burden of breast cancer in order to help plan the provision of local breast health and breast cancer treatment services, and to prepare for increased costs associated with providing those services. We used 2005 data as a reference; at this time, baby boomers were aged 45-59 years and they made up 20% of the female population in Orange County. We used population projections and recent trends in breast cancer incidence, to predict demand for breast health and breast cancer treatment and care services in;

- a). 2010, when baby boomers, aged 50-64 years, will begin to enter retirement, and
- b). 2020, when baby boomers will be 60-74 years and mostly in retirement.

Methods

Population Projections

Population projections for Orange County in 2010 and 2020 were prepared by the State of California Department of Finance (1) using a baseline cohort-component method, which traces people born in a given year through their lives. Additional changes are made to the cohorts according to assumptions based on survival tables, migration rates, and fertility rates.

Age- and Race-Specific Rates

Rates of *in situ* and invasive female breast cancer for Orange County were calculated by race-ethnicity in five-year age categories, using the number of cancers in the California Cancer Registry (CCR) as the numerator and annual population estimates from the U.S. Census (2) (3) as the denominator. The annual case counts of breast cancer among males (~10) were too small to be included in the analysis.

We calculated incidence rates for 1991-95, 1996-2000, and 2001-05 using SAS 9.1 (SAS Institute Cary, NC). The age- and race- specific rates for 2001-05 were then adjusted for 2010 and 2020 using trends in incidence over the last fifteen years (1991-2005); forecasting using linear trend was performed in Excel. In this way, predictions are based on the most recent rates but they take into account overall shifts in breast cancer diagnosis (such as the gradual shift towards more *in situ* and less invasive disease). The adjusted age- and race- specific rates were then applied to the projected population to estimate expected breast cancer cases in 2010 and 2020. Comparisons were made with 2005; this year was chosen as the reference because this is the latest year for which complete cancer incidence is available.

Type of Breast Cancer

The stage of the breast tumor at diagnosis was 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; *in situ* (non-invasive cancer that is confined to the ducts or lobules) or invasive (cancer has started to invade surrounding areas).

Patient Characteristics

Age at diagnosis and race/ethnicity were ascertained from specific statements in medical records (5) and recorded by the CCR. 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/ Indian 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.

Estimates of Cost

The cost of a mammogram in 2002 was taken from Hendrick et al 2005 (6) and then inflation-adjusted for 2005, 2010 and 2020. The total number of women to be screened combines the total number of women aged 40 or older (recommended age for screening) and the number of mammograms currently estimated to be provided to women aged 30-39 years.

Lifetime treatment costs per patient in 2008 were taken from Max et al. (7) and then inflation-adjusted for 2005, 2010 and 2020. Cost range shown is the average cost of treating *in situ* to distant disease; costs were calculated for each stage and then summed. Lifetime costs include the cost of inpatient, outpatient, nursing home, and home health services, office-based provider visits and prescription medications. Costs were calculated for total breast cancer patients (combined total number of primary and secondary breast cancers).

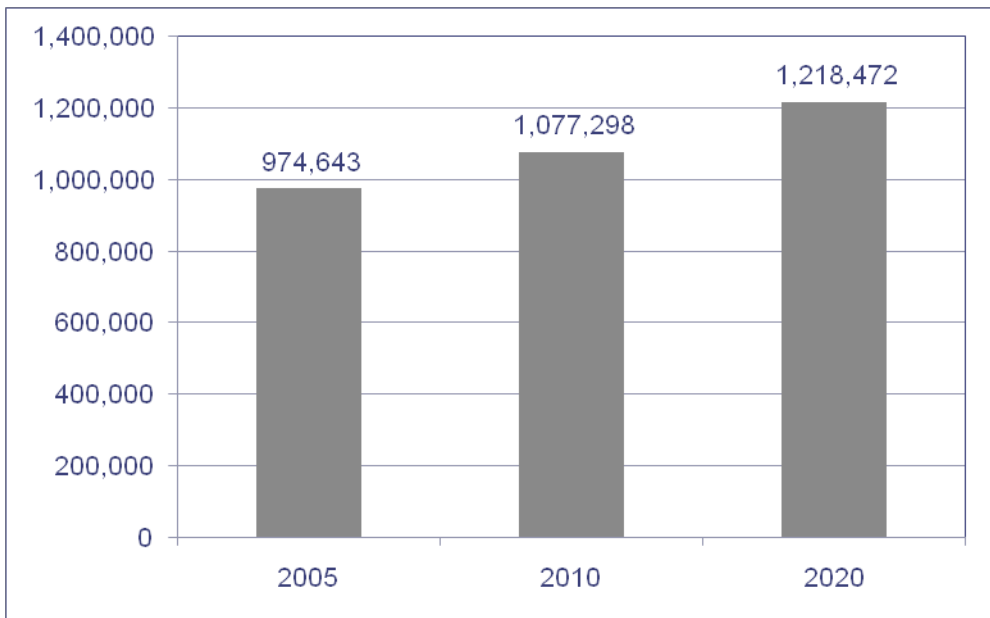
Breast cancer deaths for 2005 are from the California state mortality file. Estimated breast cancer deaths for 2010 and 2020 were calculated using age-specific rates of mortality for 2001-05, adjusted for predicted future declines in breast cancer mortality, and applied to projected age-specific population. Life years lost per breast cancer death are from Max et al. (7). Present Value of Lifetime Earnings (PVLE) per breast cancer death in 2001 are from Max et al. (7) and then inflation-adjusted for 2005, 2010, and 2020.

Financial support provided to survivors is estimated from the numbers of women helped by two local non-profit organizations; Orange County Affiliate for Susan G. Komen for the Cure and Breast Cancer Survivors (8).

Population Change in Orange County

The female population of Orange County is expected to increase every year over the next 12 years (Figure 1). This growth includes natural increase (births minus deaths) as well as migration into the county. According to the Orange County 2008 Community Indicators report, natural increase, rather than in-migration, has become, and will continue to be, the principal source of population growth (9). The adult female population is predicted to rise 10.5% from 974,643 in 2005 to over 1 million in 2010, and then by a further 13.1% to over 1.2 million in 2020.

FIGURE 1. Actual and projected female population aged 25 years or older, Orange County 2005-2020.



Changing Age Structure

The increase in the female population over the next 12 years will primarily occur among women over 55, with the highest percentage increase among women aged 60-64 years (69.6% increase), 65-69 years (80.3% increase) and 70-74 years (79.0% increase) (Table 1). Since 2005, according to Department of Finance Demographic Research Unit data, out-migration has surpassed migration into the County (9; 10) which accounts for the projected decrease in the number of women aged 35-39 years (2.4% decrease) and 40-44 years (9.3% decrease).

TABLE 1. Actual and projected female population in five-year age groups, Orange County 2005-2020.

Age group	2005	2010	2020	2005 to 2020 percent change
25-29	92,827	107,739	127,314	37.2%
30-34	108,593	106,923	122,875	13.2%
35-39	117,585	118,768	114,777	-2.4%
40-44	119,450	124,029	108,283	-9.3%
45-49	112,606	123,887	117,503	4.3%
50-54	95,709	114,030	120,995	26.4%
55-59	83,925	96,388	118,433	41.1%
60-64	62,562	83,383	106,086	69.6%
65-69	48,119	61,157	86,742	80.3%
70-74	40,396	44,618	72,311	79.0%
75-79	35,372	35,038	50,342	42.3%
80-84	29,071	28,654	33,526	15.3%
85+	28,428	32,684	39,285	38.2%

Figure 2 shows the projected population change between 2005 and 2020 by broader age categories. The number of women aged 55-69 years and 70 or older is projected to increase by 60% and 47% respectively. Population growth is more modest for younger women; 14% among women aged 25-39 years and 6% among women aged 40-54 years.

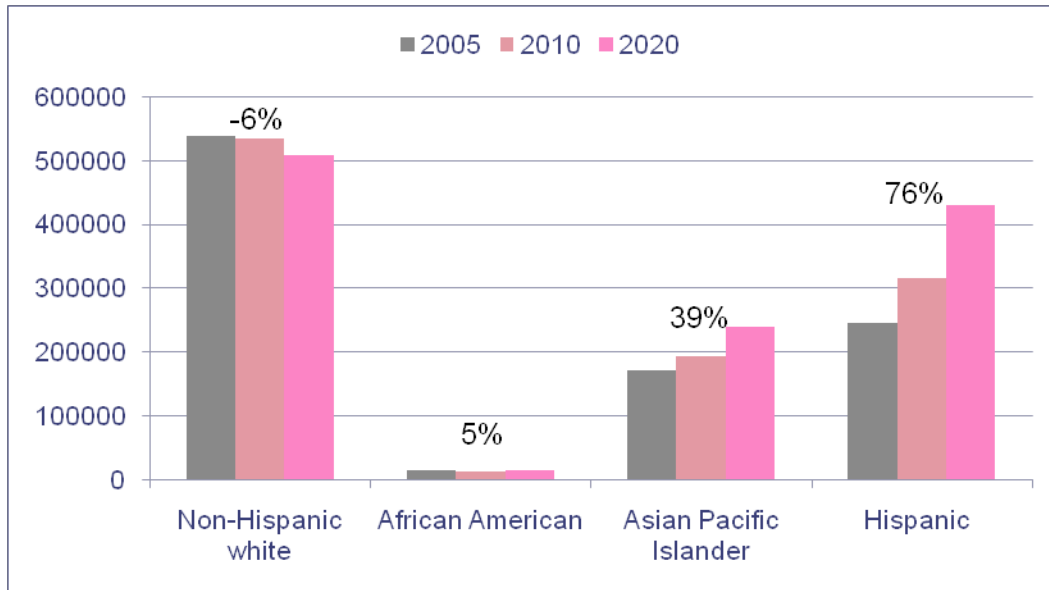
FIGURE 2. Actual and projected female population in age groups, Orange County 2005-2020.



Changing Racial/Ethnic Composition

Figure 2 shows the projected population change by race/ethnicity in Orange County from 2005 until 2020. Orange County will become more diverse, with 6% fewer non-Hispanic white women, a slight increase (5%) in the female African American population, and a large increase in the Asian Pacific Islander and Hispanic populations (by 39% and 76% respectively).

FIGURE 3. Actual and projected female population, by race/ethnicity, Orange County 2005-2020.



Recent Trends in Incidence

Among all women in Orange County, over the past 15 years, the age-adjusted incidence of *in situ* breast cancer has gradually increased (Figure 4), whereas incidence of invasive breast cancer has decreased (Figure 5). *In situ* cancers are a form of early stage breast cancer so rising rates indicate improved screening and earlier detection (11). This shift is evident among non-Hispanic whites; *in situ* cancer increased by 31.3% over 15 years and invasive cancer decreased by 5.8%. Among Hispanics and Asian Pacific Islanders, the incidence of *in situ* and invasive breast cancer are lower than for other race/ethnicities, but they are both now increasing; *in situ* rates have increased 59.0% for Hispanic women and 43.5% for Asian Pacific Islanders; invasive rates have increased 1.6% for Hispanics and 13.1% for Asian Pacific Islanders. Among African American women, *in situ* rates have decreased by 26.8%, but invasive rates have increased 14.4%.

FIGURE 4. Age-adjusted incidence of *in situ* breast cancer per 100,000 women, by race/ethnicity, Orange County 1991-2005.

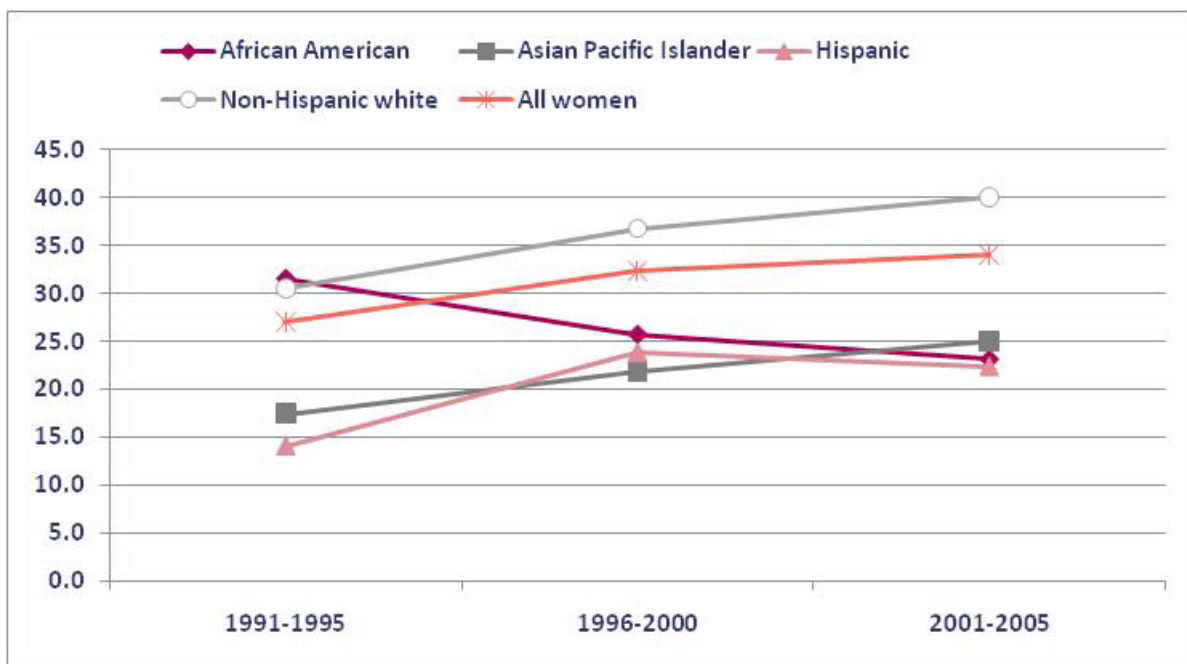
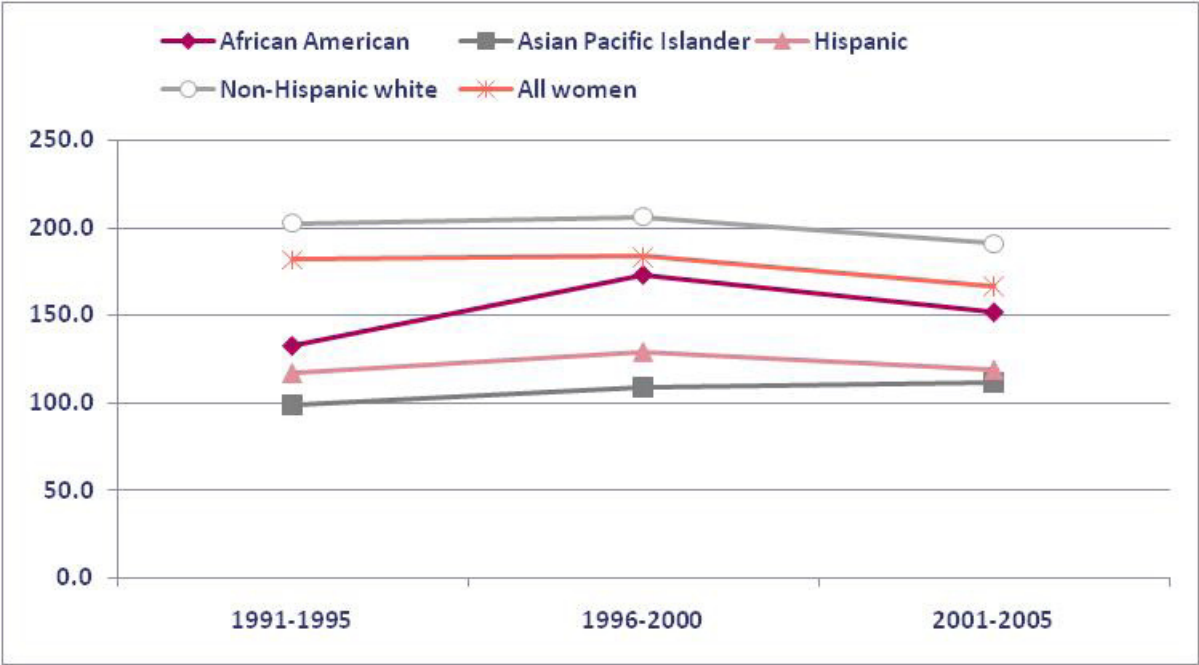


FIGURE 5. Age-adjusted incidence of invasive breast cancer per 100,000 women, by race/ethnicity, Orange County 1991-2005.

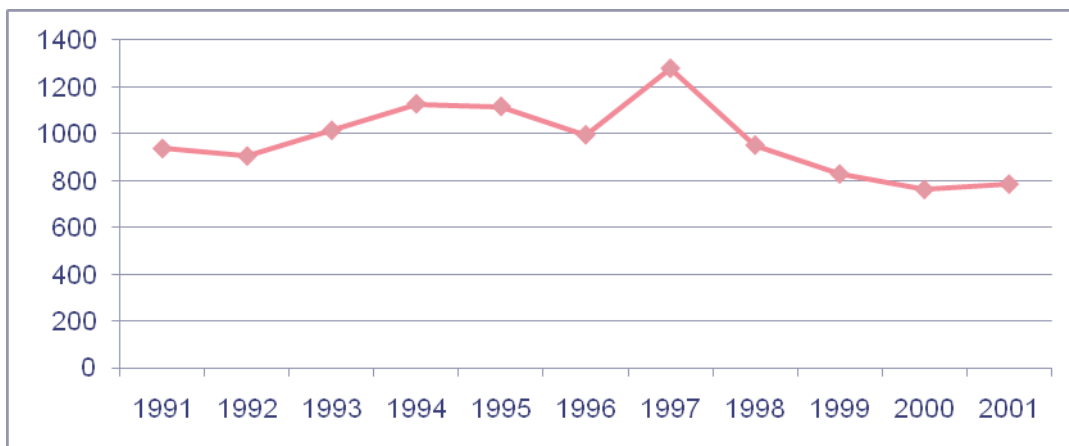


Incidence of Secondary Breast Cancers

Rising incidence and improved survival after breast cancer diagnosis may place an increased number of women at risk for a second primary breast cancer. It is known that risk of a second malignancy in the contralateral breast is higher for breast cancer survivors than the overall risk in the general population (12) although it is unclear on the reasons for this; genetic or lifestyle factors that increase a woman's risk will be shared to both tumors, but it is also possible that treatments such as radiotherapy or chemotherapy may put breast cancer survivors at increased risk.

In Orange County, the incidence of a secondary breast cancer rose from 1991 to 1997, but has since declined (Figure 6). On average 57 women per year are diagnosed with a second primary breast cancer within four years of their first diagnosis. Although we do not know why this is, it may be due to advances in treatment including newly available drugs specifically intended to reduce the risk of a second malignancy. A recent study found that chemotherapy treatment was associated with a 43% reduced risk for developing cancer in the opposite breast, and that Tamoxifen use was associated with a 34% reduced risk of a second breast cancer (13).

FIGURE 6. Annual risk of a subsequent primary breast cancer per 100,000 person years, within 4 years of first diagnosis.



Increased Demand for Breast Health Services

The current Susan G. Komen for the Cure screening recommendation is for women to begin annual mammography at age 40 and there is no upper age limit when regular screening should stop. The U.S. Preventive Services Task Force, the American Medical Association (14), the American College of Obstetricians and Gynecologists (15), and the American College of Radiology (16), all support screening with mammography beginning at age 40. Medicare covers annual mammography for women older than age 40 (17). However, the American Academy of Family Physicians (17), and the American College of Preventive Medicine (18) recommend beginning mammography for average-risk women at age 50.

To predict demand for screening services we can look at the estimated change in the female population who are of recommended screening age (Table 2). The female population aged 40 or older is projected to grow from 655,638 women in 2005 to 853,506 women in 2020. That is an increase of 197,868 women or 30%. Much of the increase will be among women aged 60-74 years as we noted previously (Table 1). The female population aged 50 or older is projected to grow by 204,138 women or 48% over the 15 years.

TABLE 2. Actual and projected total female population recommended to be screened for breast cancer, Orange County 2005-2020.

Age	2005	2010	2020	2005 to 2020 difference	2005 to 2020 percent change
≥40 years	655,638	743,868	853,506	197,868	+30%
≥50 years	423,582	495,952	627,720	204,138	+48%

Although mammography is not routinely provided for women younger than 40, there are times when they are screened, for example if they are at high risk or when a clinical breast exam is suspicious. According to the California Health Interview Survey (19), 13.9% (95% confidence intervals = 9.0, 18.9) of women aged 30-39 years in Orange County had a mammogram within the last two years. If mammography of young women remains at current levels, we predict a 5% increase in the number of mammograms based on demographic changes (Table 3).

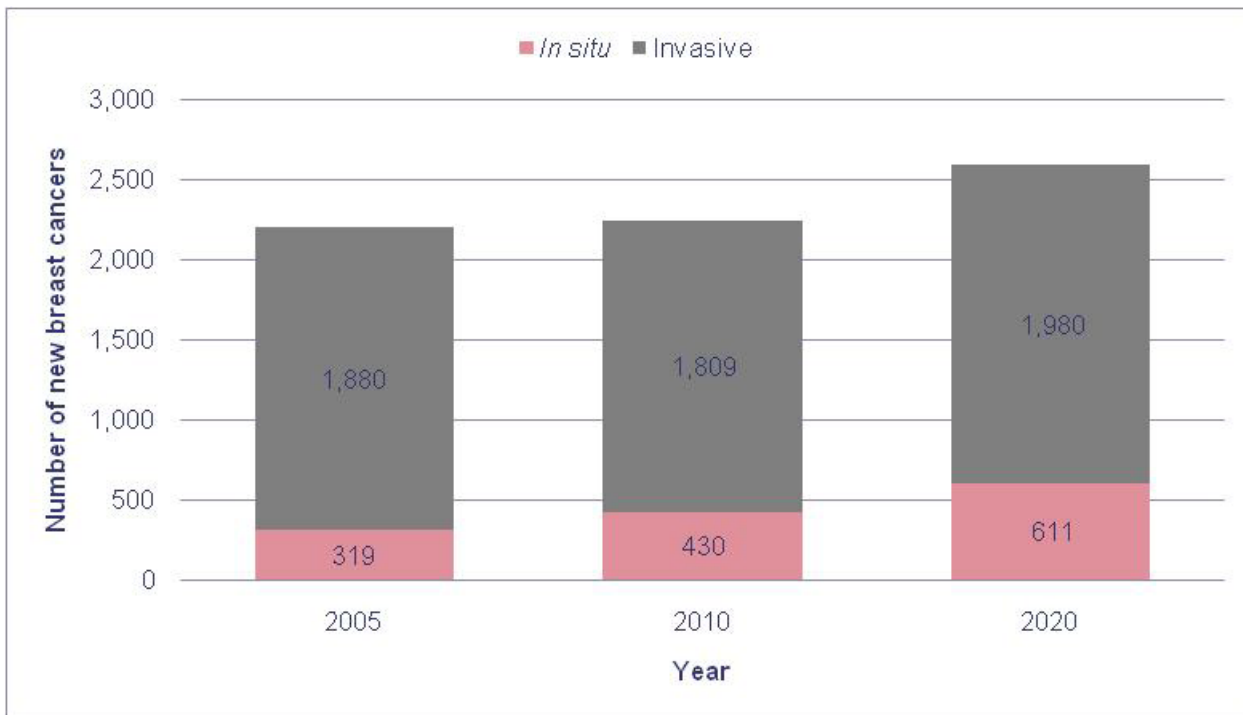
TABLE 3. Actual and projected number of mammograms provided to women aged 30-39 years, Orange County 2005-2020.

Age	2005	2010	2020	2005 to 2020 difference	2005 to 2020 percent change
30-39	31,439	31,371	33,034	1,595	+5%

Increased Demand for Breast Cancer Treatment Services

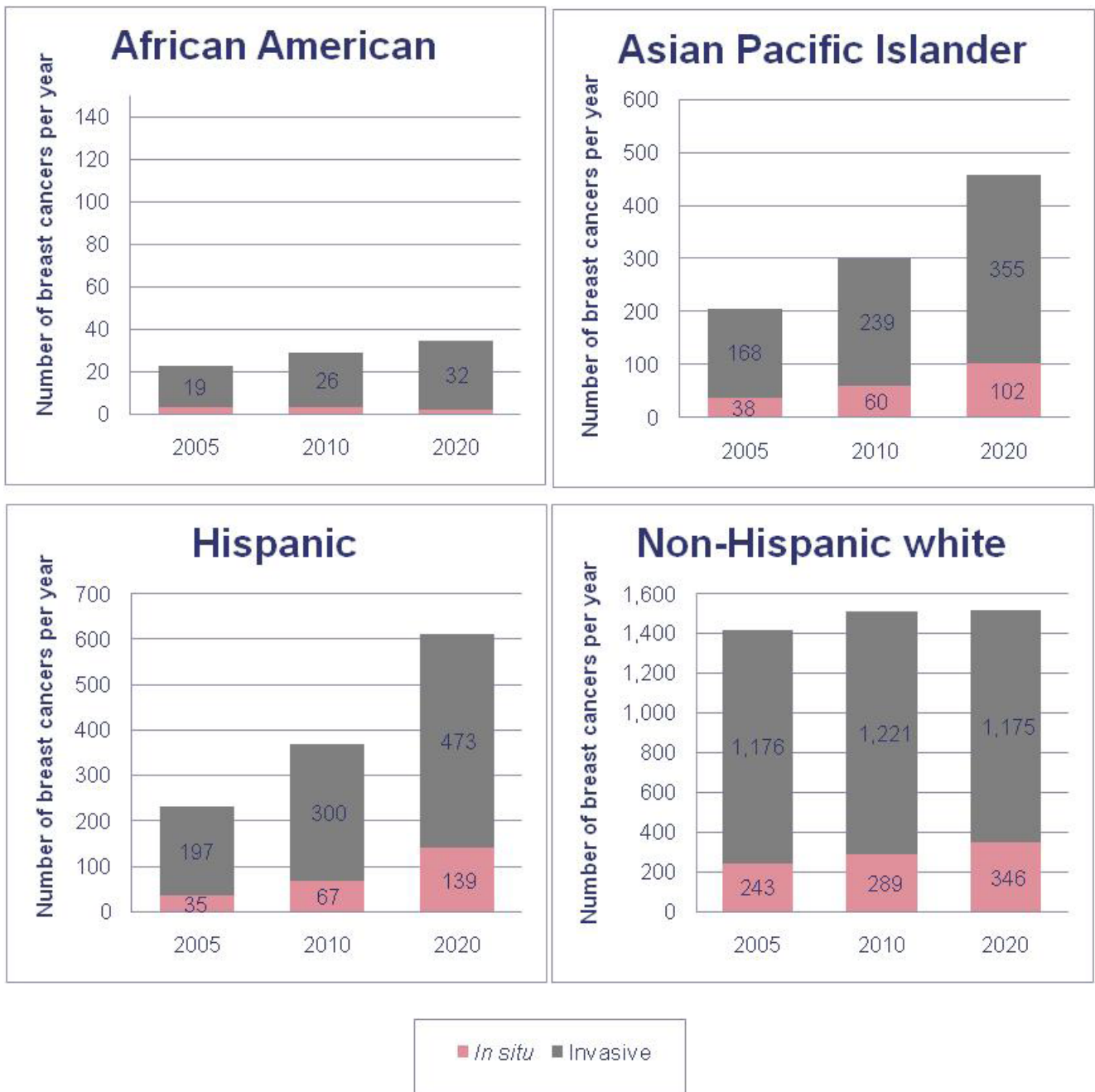
Orange County can expect an 18% increase in the total number of breast cancers diagnosed between 2005 and 2020 (Figure 7). The total will rise from 2,199 in 2005 to 2,591 in 2020; and additional 391 diagnoses. Although the majority of cancers will still be invasive, the increase will be higher for *in situ* breast cancer; we expect the number to almost double (91% increase) from 319 in 2005 to 611 in 2020. Invasive breast cancers will increase by 5% or 100 cases from 1,880 in 2005 to 1,980 in 2020.

FIGURE 7. Actual and projected number of new breast cancer cases (aged 25 and older), Orange County 2005-2020.



By race/ethnicity, we can expect the number of breast cancers to increase 7% among non-Hispanic white women, 53% among African American women, and to more than double among Asian Pacific Islanders (122% increase) and Hispanic women (164% increase) (Figure 8). By 2020 the number of breast cancers newly diagnosed according to race/ethnicity will be; 34 among African Americans, 457 among Asian Pacific Islanders, 612 among Hispanics and 1,521 among non-Hispanic whites.

FIGURE 8. Actual and projected number of new breast cancer cases (aged 25 and older) by race/ethnicity, Orange County 2005-2020.



New Profile of the 'Average' Breast Cancer Patient

The average age of breast cancer patients in 2005 was 55-59 years (Table 4). Given the projected population changes, the median age in 2020 will be 60-64. The average age of breast cancer patients is expected to be higher for all race/ethnicities, due to the aging population, although African American and Hispanic patients will continue to be younger than non-Hispanic white patients. In 2005 Asian Pacific Islander patients were generally younger than non-Hispanic white patients, but by 2020 the average age is expected to be the same as for non-Hispanic whites (60-64 years).

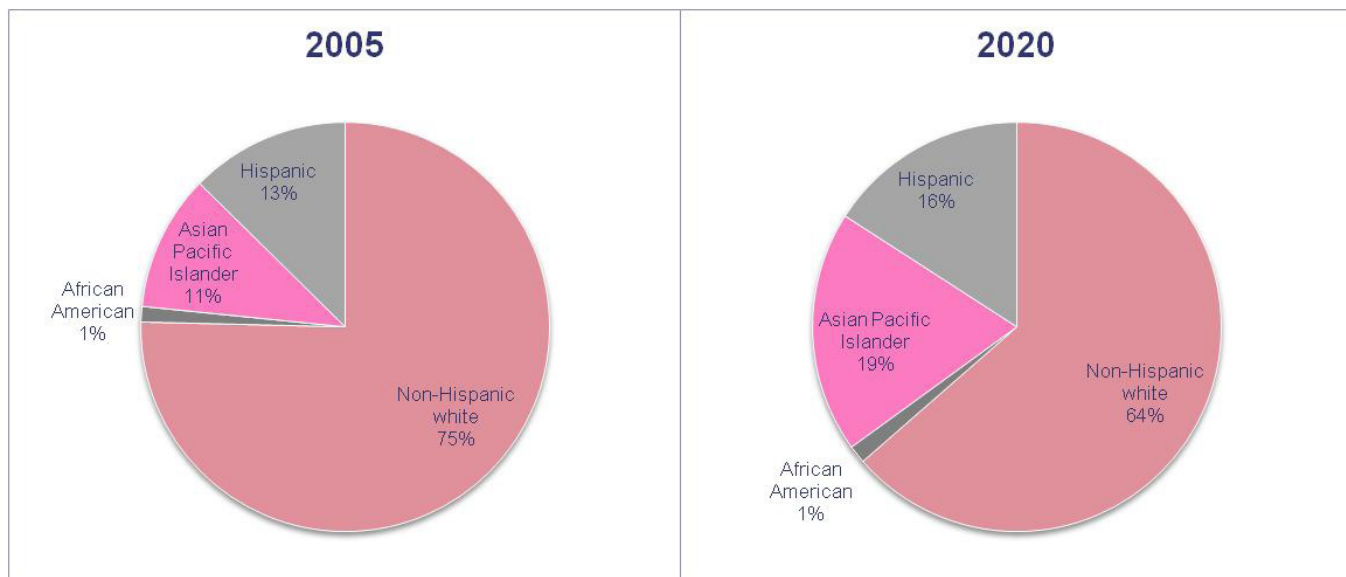
TABLE 4. Actual and projected age of breast cancer patients by race/ethnicity, Orange County 2005-2020.

Year	African American	Asian Pacific Islander	Hispanic	Non-Hispanic white	All
2005	50-54	45-49	45-49	55-59	55-59
2010	50-54	50-54 and 55-59	45-49	60-64	60-64
2020	55-59	60-64	50-54	60-64	60-64

Although the average age of breast cancer patients is expected to be higher, when young women are diagnosed they tend to have an increased risk for late stage diagnosis, as we have reported (11); so although most of the need for increased resources will be in older groups, there will continue to be a need among women younger than 40.

The race/ethnicity of breast cancer patients will change over the next 15 years with fewer non-Hispanic whites, no change in the proportion of African Americans, and a higher proportion of Hispanic and Asian Pacific Islander patients (Figure 9).

FIGURE 9. Actual and projected distribution of incident invasive breast cancer cases by race/ethnicity, in Orange County, 2005 and 2020.



Estimates Of Cost

Cost of Breast Cancer Screening and Treatment

By 2020, the cost of providing breast cancer screening is expected to be \$213 million which is double the cost of mammography provision in 2005 (Table 5). If newer screening techniques such as digital mammography or magnetic resonance imaging, are more widely adopted then costs could be higher.

The cost of providing breast cancer treatment and care services by 2020 is expected to be \$103 million, compared to \$64 million in 2005. Our estimate takes into account inflation but not advances in treatment which could cost more. For example Herceptin, an antibody treatment that was first approved for use in 1998, costs around \$3,000 per month (20).

The cost of treatment varies substantially by age, race/ethnicity, exact diagnosis, and payment source (7). We reported in an earlier monograph that late stage diagnosis was more common among Hispanic patients; if this remains the case then treatment costs could be higher. However screening is associated with detection at an earlier stage, so by focusing on screening and outreach, treatment costs could be reduced.

TABLE 5. Actual and projected cost of breast cancer screening and treatment, Orange County 2005-2020.

	2005	2010	2020
<u>Screening mammogram</u>			
Cost, per mammogram	\$154	\$179	\$240
Total number	687,077	775,239	886,540
Total cost (000's)	\$105,858	\$138,465	\$212,805
<u>Cancer Treatment</u>			
Cost, per patient	\$19,458 - \$47,722	\$22,618 - \$55,472	\$30,397 - \$57,137
Total number	2,254	2,295	2,658
Total cost (000's)	\$63,564	\$74,011	\$102,583

Lost Productivity

Productivity costs are the time and economic output lost by the patient from usual activities as a result of disease and its treatment (21). These costs are typically measured by forgone earnings among the currently employed (morbidity costs) and by the present value of future output lost because of premature death (mortality costs) (21). Applying Max et al. (7) estimates to Orange County, in 2005 breast cancer deaths cost almost \$81 million in the value of lost productivity and 6,405 years of lives lost. By 2020, breast cancer deaths are estimated to cost Orange County \$109 million in the value of lost productivity and 5,779 years of lives lost.

TABLE 6. Deaths, life years lost, and Present Value of Lifetime Earnings (PVLE) attributed to breast cancer, Orange County 2005-2020.

Age	2005			2010			2020		
	Actual Deaths	Total life years lost	Total PVLE (000's)	Est. Deaths	Total life years lost	Total PVLE (000's)	Est. Deaths	Total life years lost	Total PVLE (000's)
18-44	24	1,087	\$26,222	28	1,257	\$35,158	23	1,047	\$39,349
45-64	102	3,121	\$47,839	112	3,436	\$61,046	79	2,428	\$57,967
65-74	57	1,055	\$5,906	62	1,151	\$7,475	61	1,125	\$9,818
75-84	70	826	\$828	66	782	\$909	72	848	\$1,325
85+	41	316	\$89	48	367	\$121	45	350	\$155
Total	294	6,405	\$80,885	316	6,994	\$104,711	281	5,799	\$108,617

Financial support given to breast cancer survivors by two voluntary organizations operating in Orange County gives us an indication of the financial difficulties faced by breast cancer patients (Table 7). Inflation-adjusted, the same level of support could cost \$419,801 in 2020.

TABLE 7. Financial support for survivors, Orange County 2005-2020.

	2005	2010	2020
Support per patient	\$3,545	\$4,110	\$5,524
Number supported	66	67	76
Total cost	\$234,000	\$275,380	\$419,801

Total costs are estimated to be \$424 million by 2020; this is \$174 million more than was spent in 2005 (Table 8). The largest proportion is the cost of providing screening services (50.1%), followed by the cost of lost productivity due to early mortality (25.6%).

TABLE 8. Total cost of breast cancer, Orange County 2005-2020.

	2005 (000's)	2010 (000's)	2020 (000's)	2020 (%)	Difference 2005-2020 (000's)
Screening mammogram	\$105,858	\$138,465	\$212,805	50.1%	\$106,947
Cancer Treatment	\$63,564	\$74,011	\$102,583	24.2%	\$39,019
PVLE mortality	\$80,885	\$104,712	\$108,617	25.6%	\$27,731
Survivors financial support	\$234	\$275	\$420	0.1%	\$186
Total cost	\$250,541	\$317,463	\$424,425		\$173,884

Pressure on Existing Capacities

Funding

Medicare is the universal health insurance program for older people and people with permanent disabilities. The shift of baby boomers into retirement will begin in 2011, and so by 2020 almost all of them will be covered by Medicare. In Orange County by 2020, there will be an additional 100,820 women older than 65 years, compared to 2005; that is a 56% increase in Medicare recipients.

Medicaid provides coverage for low-income Americans, however not all low-income adults are covered; adults without dependent children are typically ineligible regardless of income, and for those that are parents the income limits are typically set well below the poverty line, and so there is some shortfall and some people remain uninsured. According to the California Health Interview Survey (19; 22) in Orange County 2005, around 25% of adults were uninsured for all or part of the year, 56% had employment-based insurance, 9% were covered by Medicaid or other public programs and 5% had privately purchased health insurance. The trend however is towards less employment-based insurance; health insurance premiums have continued to rise and so employers are less willing, or able, to pay for coverage. This could mean an increased burden on state and federal programs including Medicaid and Every Woman Counts, as well as an increase in the number of uninsured women. Fewer Hispanic, African American, and Asian Pacific Islander women, compared to non-Hispanic whites, have employment-based health insurance (19) so with a more ethnically diverse population of patients, we expect increased demands on public resources and increases in the numbers of uninsured.

Service Capacity

The increased demands for breast health and treatment services will also put demands on local health care infrastructure. According to the Health Resources & Services Administration Shortage Designation Branch, Orange County already has two areas with a shortage of primary care health professionals and community health centers; Central Santa Ana and Anaheim Central. In addition, populations in Fullerton, Brea West/La Habra, Central Santa Ana, Dana Point, and Garden Grove South, were designated 'medically underserved' because people with low-incomes in these areas could not access the health care that they need.

Capacities could be stretched even further as more of the County's health care personnel reach retirement age and leave the workforce faster than they can be replaced (23).

Summary and Recommendations

The adult female population of Orange County is projected to rise 25.0% from 974,643 in 2005 to over 1.2 million in 2020. The increase will primarily occur among women aged 55 years or older. Orange County will become more diverse, with increases in Asian Pacific Islander and Hispanic populations.

We have discussed how these demographic changes, as well as predicted changes in incidence rates, may increase the demand for breast cancer screening by 30% and for treatment by 18%, so capacities will need to be increased. The cost of breast health and treatment in the future was estimated to be \$315 million, and the overall cost of breast cancer to Orange County by 2020 was estimated to be \$424 million. We anticipated other challenges including increased demand for publicly funded programs, more uninsured patients, and a shortage of primary care physicians and other healthcare personnel, which may negatively impact the capacity of the healthcare sector to meet increased demands.

Recommendations

We recommend;

- The development of a systemic strategy for future provision in Orange County
- Culturally-competent breast health and treatment services
- Screening, outreach, and education services targeting Asian Pacific Islander and Hispanic women
- Screening, education, and treatment programs for low income populations and the uninsured
- Workforce training and education to increase the number of physicians and other healthcare personnel
- Increase of capacity in medically underserved areas
- Increased funding of public programs including Medicaid, Medicare, and Every Woman Counts

Cautions on Interpretation and Limitations

The reliability of the projected numbers of breast cancers depends heavily on the quality, consistency and comparability of the cancer incidence rates on which they are based; however our rates were calculated using data from the California Cancer Registry, which has 99 percent coverage of new cancer diagnoses in the state (24).

In order to minimize random variation, which is greater among smaller racial/ethnic populations, we used five years of breast cancer incidence (2001-05) to make projections; this five-year average differs from 2005 rates and it could be argued that the most recent rate would be more accurate for projections.

Our projections were also highly dependent on the validity of the population projections that we used. In order to calculate future populations, major assumptions have to be made about birth rates, migration, and death rates. However for our purposes, the effects of the first two assumptions will be small as so few breast cancers occur in children, or young adults (who make up a large proportion of migrants).

The cost estimates are approximate and produced for illustrative purposes only. Accuracy of the financial figures depends on multiple sources, including population projections, breast cancer incidence, breast cancer mortality, current provision costs and inflation.

Glossary

Confidence interval (CI) of an incidence rate

a range of values that has a specified probability of containing the true 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.

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.

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.

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. **Department of Finance.** *Population Projections for California and its Counties 2000-2050, by Age, Gender and Race/Ethnicity.* Sacramento, CA : State of California, July 2007.
2. **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.
3. *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.
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. **California Cancer Registry.** *Cancer Reporting in California: Data Standards for Regional Registries and California Cancer Registry.* Reporting System Standards Volume III.
6. **Hendrick, R E, et al.** Community-based mammography practice: services, charges, and interpretation methods. *Am J Roentgenol.* 184, 2005, Vols. 433-8.
7. **Max, W, Sung, H and Stark, B.** The economic burden of breast cancer in California. *Breast Cancer Res Treat.* Published online, August 2008.
8. **Breast Cancer Survivors.** About Us. [Online] [Cited: September 30, 2008.] <http://www.bcsurvivors.org/index.php/about/>.
9. **Orange County Community Indicators Project.** Orange County 2008 Community Indicators. *County of Orange.* [Online] 2008. www.oc.ca.gov/ceocommunity.asp.
10. **California Department of Transportation Office of Transportation Economics.** Long-term Socio-economic Forecasts by County. *California Department of Transportation.* [Online] [Cited: September 24, 2008.] http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic_files/2007/Orange.pdf.
11. **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.
12. **Bernstein, J L, et al.** Risk factors predicting the incidence of second primary breast cancer among women diagnosed with a first primary breast cancer. *Am J Epidemiol.* 136:925-36, 1992.
13. **Bertelsen, L, et al.** Effects of systemic adjuvant treatment on risk for contralateral breast cancer in the Women's Environment, Cancer and Radiation Epidemiology study. *JNCI.* 100:32-40, 2008.
14. **American Medical Association.** American Medical Association (Women Physicians Congress) Policies on Breast Cancer. [Online] February 2008. <http://www.ama-assn.org/ama/pub/category/9060.html>.
15. **American College of Obstetricians and Gynecologists.** Routine Cancer Screening. *ACOG opinion .* 1997, 185.
16. **American College of Radiology.** ACR Practice Guideline for the Performance of Screening Mammography. [Online] October 2004. http://www.acr.org/SecondaryMainMenuCategories/quality_safety/guidelines/breast/screening_mammography.aspx.
17. **Zoorob, R, et al.** Cancer Screening Guidelines. *Am Fam Physician.* 63:1101-12, 2001.
18. **Ferrini, R, et al.** Screening Mammography for Breast Cancer: ACPM Practice Policy Statement. [Online] October 1996. <http://www.acpm.org/breast.htm>.
19. **California Health Interview Study.** *Public Use File.* Los Angeles (CA) : UCLA Center for Health Policy Research, 2005.
20. Herceptin: Novel therapy targets HER2-positive breast cancer. *Mayo Clinic.* [Online] October 26, 2007. [Cited: August 25, 2008.] <http://www.mayoclinic.com/health/Herceptin/BR00012>.
21. **Yabroff, K R, et al.** Burden of illness in cancer survivors: findings from a population-based national sample. *JNCI.* 96:1322-30, 2004.
22. **California Health Interview Study.** *Public Use File.* Los Angeles (CA) : UCLA Center for Health Policy Research, 2001.
23. **Cooper, R A, et al.** Economic and demographic trends signal an impending physician shortage. *Health Affairs.* 21(1): 140-154, 2002.
24. **Kwong, S L, et al.** *Cancer in California: 1988-1999.* Sacramento, CA : Cancer Surveillance Section, California Department of Health Services, 2001.