



Update on breast cancer incidence patterns in Marin County and the San Francisco Bay Area, California

Christina Clarke, Ph.D
Theresa Keegan, Ph.D
Gem Le, MHS
Sally Glaser, Ph.D
Dee West, Ph.D
Northern California Cancer Center, Union City, California

SUMMARY

Previous reports have suggested elevated rates of breast cancer in Marin County, spurring community and scientific interest. This report provides updated data regarding breast cancer patterns among white, non-Hispanic women in Marin County, other parts of the San Francisco Bay Area (SFBA) and California, using the most recent information available from the California Cancer Registry, the California Office of Vital Statistics, and the California Department of Finance (DOF). This information updates prior reports by incorporating newly released DOF population data in all calculations and presenting rates for the years 2000 and 2001.

Main findings from this report include:

Revisions in population estimates impacted breast cancer rates

Compared to those previously reported, rates incorporating the revised population estimates were lower for Marin County but higher for some other regions, including San Francisco County.

San Francisco Bay Area breast cancer incidence elevated above other parts of California

Averaged across the most recent five years for which we have data (1997-2001), the rate of invasive breast cancer in the SFBA was 9% higher than that for the rest of California. Rates in each of the six SFBA counties were significantly elevated above other parts of California.

San Francisco County rate comparable to Marin County rate

The 1997-2001 rate of invasive breast cancer in San Francisco County (178.9 per 100,000) was similar to that for Marin County (176.6 per 100,000).

Marin County rate elevated, but not as high as previously reported

The 1997-2001 rate for Marin County was 6% higher than the rest of the SFBA and 15% higher than the rest of California. These elevations were statistically significant.

Rates for 2000, 2001 lower than 1999

In all regions studied, invasive breast cancer rates for the years 2000 and 2001 were lower than the rate for 1999. Additional years of observation are needed to assess whether these changes represent a downturn or random variation. Compared to the 1988-89 rate, the 2000-01 rate was 12.4% higher in Marin County, the same in San Francisco County, 5.9% higher in other parts of the SFBA and 6.5% higher in the rest of California.

Breast cancer mortality rates comparable and decreasing

Mortality rates in Marin County and San Francisco County were not significantly different than other regions. In all regions, breast cancer mortality rates decreased between 1988 and 2001.

Excess incidence rates specific to certain types of breast cancers

Among white women in San Francisco and Marin Counties, the pattern of excess breast cancer occurrence can be characterized as most concentrated in women aged 40-69 years at diagnosis, limited to early stage cancers, and more pronounced for lobular than other histologic subtypes.

Rate excesses also observed in Hispanic women, but not other racial/ethnic groups

Excess rates of invasive breast cancer were observed for Hispanic women living in Marin and most other SFBA counties, but were not observed for Asian/Pacific Islander or African-American women living in any part of the SFBA.

Prostate and uterine cancer also higher in Marin county, lung and cervical cancer lower

Previous reports have suggested elevated rates in Marin County of cancers other than female breast cancer. 1997-2001 data indicate that prostate cancer and uterine cancer in females were significantly higher and lung and cervical cancer significantly lower in Marin County as compared to other parts of California.

Cancer registry data alone cannot speak to reasons for the elevated incidence of breast cancer among white women in San Francisco, Marin and other SFBA counties. However, previous studies examining regional variation in breast cancer incidence point to a major role of sociodemographic factors. The higher average socioeconomic status of SFBA women may correspond to higher proportions of women with known risk factors for breast cancer diagnosis, including reproductive characteristics like parity and age at first birth, and utilization of mammographic screening programs. A new study suggesting that living in affluent communities impacts breast cancer risk above and beyond the risk conferred by individual risk factors underscores the importance of ongoing research to understand the factors underlying geographic variation in breast cancer and in turn, how these factors might inform breast cancer causation.

PURPOSE

This scientific report updates breast cancer patterns in Marin County and the San Francisco Bay Area using the most up-to-date cancer registry and population information as of September, 2004. Detailed study of breast cancer incidence patterns among white, non-Hispanic women in Marin County and the San Francisco Bay Area are warranted by previous observations of higher-than-average breast cancer incidence rates¹⁻⁴, as well as by community and scientific interest and concern.

METHODS

Cancer incidence and mortality data were obtained from the California Cancer Registry (CCR) and the California Office of Vital Statistics, respectively. CCR data were based on the August 2004 submission. Breast cancer analyses were based on incident cases (International Classification of Diseases-Oncology, 3rd edition⁵ (ICD-O-3) site codes 54.0-54.9) and deaths (International Classification of Disease, 10th edition codes C50.0-C50.9) occurring in the period January 1, 1988 through December 31, 2001, the most recent year for which cancer data are complete. Because of the marked variation in breast cancer incidence by race/ethnicity, with rates in the highest-risk group, white, non-Hispanic women, nearly 75% higher than the lowest-risk group, Asian/Pacific Islander women,⁶ analyses were conducted separately by race/ethnicity and focused primarily on white, non-Hispanic (hereafter called white) women.

Population estimates from the California Department of Finance (DOF)⁷, revised to incorporate Census 2000 information, were used to calculate incidence and mortality rates for the individual years 1988-2001 and for the most recent five-year period 1997-2001 for four geographic areas: Marin County, San Francisco County, the rest of the San Francisco Bay Area (SFBA) (Alameda, Contra Costa, San Mateo, and Santa Clara counties) and all other counties in California. SEER*Stat software⁸ was used to compute all cancer rates, age-adjust them to the 2000 US standard population, produce standard errors and 95% confidence intervals (95% CI), and conduct weighted linear regression. Age-adjusted rates were compared statistically by calculating the difference between two rates, dividing it by the standard error of the difference, and testing this score for statistical significance from zero using the standard normal distribution⁹. All tests of statistical significance assumed a two-sided P-value of 0.05. Percent changes over the period 1988-2001 were made by comparing rates for end points of the study period (1988-1989 vs. 2000-2001). For calculation of stage-specific rates, stage was determined using AJCC stage (3rd edition). ICD-O-3 histology codes were used to distinguish the lobular (8520) histologic subtype from other subtypes.

RESULTS

Changes in population estimates

Accurate cancer rates require accurate estimates of the population at risk for denominators. In California, these estimates are produced by the demography unit at the DOF. Following a decennial census year (e.g., 1990), estimates of counts in subsequent years are based on sophisticated extrapolations using those Census data as a base; the further these extrapolated counts are in time (e.g., 1998, 1999) from the census data on which they are based, the less certain they tend to be. When new census data are released after the next decennial census (e.g., 2000), demographers can use the newer information to revise population projections based on the prior census by interpolating between the two census years. Because these

interpolated estimates are based on data from two censuses, they are more accurate than the extrapolated estimates, which project forward from one census.

For interpolations based on Census data from 1990 and 2000, the estimation process was complicated because the 1990 census asked respondents to choose only one race and ethnicity, while the 2000 census allowed multiple races to be selected. Thus, to maintain comparability in population estimates over the period 1990-1999, persons reporting two or more race/ethnicities in the 2000 Census had to be allocated to a single race/ethnicity. Using this method, the DOF revised estimates of population for the period 1991-1999 by single race, age, sex, county, and year and released these estimates in June, 2004. Figures 1a and 1b compare the original (1990-based) population projections (1996-99) to the revised estimates for white women living in Marin and San Francisco counties at the end of the decade. These figures show that for Marin County, original population projections overestimated the numbers of women aged 10-40, and underestimated the numbers aged 45-70. For San Francisco County, original population projections sharply underestimated numbers of women aged 10-30 and overestimated numbers aged 35-60.

Influence of revised population estimates on previously reported rates and trends

We compared our previously calculated breast cancer incidence rates and trends for the 1990's to revised statistics incorporating the revised population estimates. Revised rates for Marin County (Figure 1c) were lower and those for San Francisco County (Figure 1d) were higher than those previously reported, with deviations generally increasing with time since the 1990 census. Additional analyses using the revised population estimates (data not shown) show that the incidence of invasive breast cancer in Marin County was significantly elevated above California averages throughout most of the 1990's, as indicated in prior reports, but that the magnitude of this elevation was not as extreme as suggested previously. These analyses also confirmed previous findings of more rapid increases in incidence for Marin County than other SFBA counties and the rest of California for the period 1990-99, as reported previously, although regional differences in trends were not statistically significant. Unlike prior reports, breast cancer mortality rates and trends in Marin County women were shown to be comparable to those for other regions. Furthermore, analyses using the revised population estimates show that in the 1990's, San Francisco County had comparable breast cancer incidence patterns to Marin County. These patterns are discussed in detail below.

Recent breast cancer rates among white women in the San Francisco Bay Area

Averaged over the years 1997-2001, the annual rate of invasive breast cancer for white women in the six SFBA counties combined was 167.8 per 100,000 (95% CI: 165.1-170.6). This rate was significantly higher (RR=1.09) than the rate for other parts of California (154.3 per 100,000; 95%CI: 153.1-155.5). Figure 2 shows that within the SFBA, rates for San Francisco County and Marin County were similar and higher than rates for Alameda, Contra Costa, San Mateo and Santa Clara counties. Examining breast cancer mortality (Figure 3), rates in all counties, including San Francisco and Marin, were comparable to averages for the rest of California. On the basis of these patterns, further analyses focused on Marin and San Francisco counties, and combined data for the other four SFBA counties (Alameda, Contra Costa, San Mateo and Santa Clara).

Detailed breast cancer rates and trends including data for the years 2000 and 2001

Invasive breast cancer incidence

Table 1 presents yearly counts and incidence rates for invasive breast cancer in white women in Marin and San Francisco counties, and incidence rates for comparison regions. In both counties, rates for the years 2000 and 2001 were lower than the 1999 rate. In other regions, rates also were lower after peaking in 1998 or 1999. Additional years of observation will be needed to assess whether these changes represent true reversals of increasing incidence trends, random variation, or a temporary downturn. Figure 4a shows trends in invasive breast cancer incidence between 1988 and 2001 by region. Comparing the average rates between 1988-1989 and 2000-2001, rates of invasive breast cancer were virtually the same in San Francisco County, but increased 12.4% in Marin County, 5.9% in other parts of the SFBA, and 6.5% in other parts of California.

Averaged over the years 1997-2001, 243 white women were diagnosed with breast cancer each year in Marin County. For San Francisco County, this number was 320. Table 2 shows that incidence rates in Marin County and San Francisco County were 6-8% higher than the rate for other SFBA counties and 15-16% higher than that for the rest of California. All of these differences were significant at the $p < 0.05$ level. To quantify the excess number of breast cancer cases in Marin and San Francisco counties as compared to the rest of California, average age-specific incidence rates for the rest of California from 1997-2001 were applied to the populations of Marin and San Francisco County separately. Over this time period, Marin had an additional 31 cases and San Francisco had an additional 40 cases per year of breast cancer than would be expected if these two counties had the same incidence rates as white women living in the rest of California.

In situ breast cancer incidence

Table 2 also shows that rates of breast cancer *in situ* (breast cancer that has not invaded surrounding tissue) in white women were significantly higher in San Francisco County than in Marin County and in the rest of the SFBA which in turn, had rates significantly higher than the rest of California. The rate of *in situ* breast cancer in Marin County was not statistically different from the rate in the rest of the SFBA ($p = 0.71$). Figure 4b shows time trends for the incidence of *in situ* breast cancer. Comparing the average rates for 1988-1989 and 2000-2001, the incidence of breast cancer *in situ* increased 60.9% in San Francisco County as compared to an increase of 64.7% in the other SFBA and 72.7% in the rest of California, while Marin County increased 34.2% over this time period.

Breast cancer mortality

Averaged over the years 1997 to 2001, 42 and 63 white women died of breast cancer per year in Marin and San Francisco counties, respectively. Table 2 shows that the breast cancer death rates for white women in Marin County and San Francisco County were comparable to rates in other counties in the SFBA and in other parts of California. Figure 4c shows that between 1988 and 2001, breast cancer mortality rates decreased in all regions, with the rates of decrease in Marin and San Francisco similar to those in other parts of the SFBA and California.

Rates in patient subgroups

Age at diagnosis

Figure 5 shows incidence rates of invasive breast cancer by age at diagnosis by region for the five-year period 1997-2001. This graph suggests that rate excesses in San Francisco and Marin are limited to women over 40 years of age. To better understand age-specific patterns, especially as they might relate to screening influences, we examined data separately for three age groups--under 40 years, 40-69 years, and 70+ years at diagnosis (Table 3). For women aged 40-69, rates were significantly elevated in San Francisco County compared to similarly aged women in other parts of the SFBA (RR=1.11) and other parts of California (RR=1.25); for Marin County women, rates of invasive breast cancer were also significantly elevated as compared to other parts of California (RR=1.18) and the SFBA (RR=1.08), although the latter comparison was of borderline significance ($p=0.06$). For women aged 70 and over at diagnosis, rates in both Marin and San Francisco counties were higher than those for other regions, but differences were not statistically significant. As shown in Figure 6, which graphs time trends in invasive breast cancer incidence by region and age group, more substantial excesses among women aged 70 and over were observed in both Marin and San Francisco counties between 1993 and 1998. The downturn in recent years in rates for this age group suggests that the decreases in overall incidence rates for the years 2000 and 2001 occurred primarily in women ages 70 and over.

Stage and histology

We examined breast cancer incidence rates by stage of disease at diagnosis and by histologic subtype for 1997-2001. For early stage at diagnosis (AJCC stages I and II), significant rate excesses were observed for Marin (156.3 per 100,000 women) and San Francisco (156.0 per 100,000) as compared to other parts of the SFBA (144.3 per 100,000) and California (128.7 per 100,000). In contrast, for late stage cancers, which constituted 8-10% of all invasive breast cancers in these counties, incidence rates were slightly higher in San Francisco County (16.6 per 100,000) than Marin County (13.8 per 100,000) but were statistically comparable to rates for other SFBA and California (other SFBA: 14.4 per 100,000; other California: 14.6 per 100,000). Rates of lobular cancer were significantly greater in Marin (21.0 per 100,000) and San Francisco (16.9 per 100,000) than in other parts of California (13.5 per 100,000), but only the Marin County rate was significantly higher than the rate for the SFBA (15.9 per 100,000). This observation is in accordance with previous data⁴ showing that the Marin County rate of lobular breast cancer was substantially higher (RR=1.55) than that for other regions.

Rates for non-white racial/ethnic groups

Table 4 shows 1997-2001 breast cancer rates for African-American, Hispanic, and Asian/Pacific Islander women by region. Because Marin County had small populations of these groups, with correspondingly small average yearly case counts of invasive breast cancer (African-American: 2, Hispanic: 9, Asian/Pacific Islander: 7) and thus unstable yearly rates, Marin County rates for these groups were calculated from all years for which data were available (1988-2001). Over the 14-year period, the rate of invasive breast cancer in Hispanic Marin County women (based on 112 diagnoses) was significantly higher than that for other parts of the SFBA (RR=1.30) and the rest of California (RR=1.50). The rate in Asian/Pacific Islander Marin County women (based on 82 diagnoses) was also higher than rates other parts of the SFBA (RR=1.18) and the rest of California (RR=1.22), but these differences were not statistically significant. The rate among African-American Marin County women (based on 26 diagnoses) was lower as compared to

rates other regions, although the differences were not statistically significant. Rates of *in situ* breast cancer were based on very small case counts but suggested no difference from SFBA or California averages.

In San Francisco County, rates of invasive breast cancer for African-American, Hispanic and Asian/Pacific Islander women were statistically comparable to those observed for women in other parts of the SFBA (African-American: RR=1.05, Hispanic: RR=0.87, Asian/Pacific Islander: RR=0.96) and other parts of California (African-American: RR=1.01, Hispanic: RR=1.01, Asian/Pacific Islander: RR=0.99). However, in all San Francisco County groups, rates of *in situ* breast cancer were significantly elevated above rates for other parts of California.

Interpretation of patterns

Rates of invasive breast cancer in SFBA white women generally have been higher than state and national averages since the inception of ongoing cancer surveillance in 1973. These findings for the time period 1997-2001 continue to show statistically significant excesses of invasive breast cancer among white women in all SFBA counties as compared to other parts of California. Among SFBA white women, the highest rates were observed in San Francisco and Marin Counties. Rates of *in situ* breast cancer were elevated in San Francisco but not in other SFBA counties, including Marin County. Breast cancer mortality rates did not vary substantially among SFBA counties and were comparable to statewide rates. Prior to the availability of the revised DOF denominators, rates of both *in situ* and invasive breast cancer among white women in San Francisco County were underestimated in the 1990's because the earlier government projections overestimated the size of the white female population aged 35-60 years living there. The most recent data, incorporating the newest population estimates, suggest that among white women in San Francisco and Marin Counties, the pattern of excess breast cancer occurrence can be characterized as most concentrated in women aged 40-69 years at diagnosis, limited to early stage cancers, and more pronounced for lobular than other histologic subtypes.

Excess rates of breast cancer incidence were observed for Hispanic women living in Marin and most other SFBA counties, but were not observed for Asian/Pacific Islander or African-American women living in any part of the SFBA. However, the heterogeneity of Asian/Pacific Islander and Hispanic groups with respect to birthplace and acculturation may obscure meaningful differences in breast cancer incidence patterns for subgroups within these larger racial/ethnic groupings. These kinds of differences have been difficult to study in cancer registry data for lack of appropriate population denominators. In particular, rates should be examined for Asian/Pacific Islander subgroups, because in Los Angeles County, rates of breast cancer in Japanese and Filipino women have been shown to be twice those of Korean and Chinese women, with rates in Japanese women comparable to those in white women¹⁰. Future research should examine geographic and other variation in rates among nonwhite women with attention to acculturation, socioeconomic status, and other factors influencing breast cancer risk.

These analyses were carried out using the most updated cancer registry and population information. It is unlikely that these findings are strongly biased by inaccurate breast cancer counts, given standardized CCR protocols to ensure complete case reporting. Accuracy of population denominators are difficult to assess, especially between census years. For these analyses, we used the recently released California DOF estimates that incorporated both 1990 and 2000 Census data to estimate population between census years, although estimates for the year 2001 represent extrapolations from the 2000 Census. To the extent that these estimates are sensitive to methods for allocating multi-race individuals to single race groups, the observed

patterns may have been influenced in some part by systematic differences in population interpolation or projection.

These data cannot speak to reasons for the elevated incidence of breast cancer among white women in San Francisco, Marin and other SFBA counties. However, previous studies examining regional variation in breast cancer incidence point to a major role of sociodemographic factors. Regional distributions of sociodemographic factors, particularly race/ethnicity and socioeconomic status (SES), may influence breast cancer incidence rates through their correlation with known risk factors for breast cancer diagnosis, including reproductive characteristics like parity and age at first birth, and utilization of mammographic screening programs. Most white populations in the SFBA have higher average measures of education, income, and other measures of SES as compared to statewide averages. For example, Census 2000 data show that the proportions of white women aged 25 and over with at least a bachelors' degree were substantially higher in San Francisco County (62%) and Marin County (54%) than the statewide average (30%)¹¹. Only one published study has examined the role of sociodemographic factors in explaining the elevated rates for specific SFBA counties. Prehn and West (1997) used 1990 census data and 1988-92 cancer registry data to calculate breast cancer incidence rates for Marin County and aggregations of Northern California census block groups matched to Marin County on characteristics associated with breast cancer risk (% white population, urban status, average parity, median household income, % persons with college degree, % persons with working class occupation, and % households living below poverty), and found rates in the matched areas comparable to those in Marin County¹. Robbins et al. (1997) showed that compared to other parts of the US, the SFBA overall had a higher prevalence of women with established risk factors for breast cancer, including low or nulli-parity, later age at first full-term pregnancy, or higher consumption of alcohol; and that adjustment for these factors fully explained higher breast cancer incidence rates in SFBA white and black women in 1978-82¹². On the other hand, Laden et al. (1997) found that excess breast cancer risk among nurses living in the state of California, as compared to those living in the Northeast, Midwest or South, was not entirely explained by risk factors (age, age at menarche, parity, age at first birth, use of oral contraceptives, age at menopause, use and duration of postmenopausal hormones, family history of breast cancer, history of benign breast disease, and body mass index)¹³.

The higher average SES of white residents of Marin and San Francisco Counties may also correspond to better access to breast cancer screening programs. Screening mammography has been linked previously to increasing breast cancer incidence in the US, most notably the 4% yearly increase after its widespread adoption in the 1980's¹⁴. In Hawaii in 1992-93, Maskarinec et al. found that differences in mammography utilization explained 23% of the geographic variation in overall breast cancer incidence, and 36% of incidence variation among women aged 50-64 years old after adjustment for age and education¹⁵. Our observations that incidence excesses were limited to early-stage cancers and that mortality rates were comparable to other regions suggest some relation of the Marin and San Francisco rate excesses to regional differences in screening. For San Francisco County, this possibility is consistent with the higher rates of breast cancer *in situ*, a form of cancer generally diagnosed exclusively by mammography, observed among women of all race/ethnicities. Rates of *in situ* cancer in Marin County were comparable to other regions. An influence of screening in explaining the geographic variation is also suggested by the observation of age-specific rate excesses limited to ages targeted by screening programs (ages 40+). Recent data from Norway and Sweden show increases in breast cancer incidence of 45-54% among women aged 50-69 and no corresponding decline in women aged 70 and older, a pattern attributed to the introduction of national screening programs¹⁶. Our data suggest that in Marin and San Francisco

Counties, rates increased during the 1990's in all women over age 40, although data from the end of the decade (i.e., 1999-2001) show a leveling off of incidence among women aged 70 and over. However, inconsistent with a major role of screening are the lack of deficits in late stage cancers observed in both counties and no evidence of substantially elevated rates of mammography utilization, at least in Marin County in 2002¹⁷. The possibility that early-stage cancers are increasing independently of diagnostic trends is underscored by recent Australian reports of significant increases in small breast cancers among women who did not participate in screening programs¹⁸. Thus, further research is needed to understand how differential screening (perhaps utilization of MRI or other screening modalities), temporal changes in screening practices, or other screening characteristics have impacted breast cancer incidence rates and trends in California.

Breast cancer incidence changes in the SFBA may reflect recent migration patterns that may have changed the regional distributions of education or established breast cancer risk factors. In theory, regional increases in the cost of housing in the 1990's could have encouraged lower-risk women to move out of the region, increasing the concentration of women at higher risk. It is possible that because of the soaring cost of living in most SFBA counties, women who were professional and did not have children or delayed childbearing could afford to stay in or move to these counties, while women who had many children at an earlier age might have been economically compelled to leave. Similarly, economic recessions and job losses may also differentially have influenced the out-migration of women with differing risk profiles for breast cancer. Efforts are ongoing among demographers, economists, and others to inform the influence of population changes related to a boom-and-bust economy on the prevalence of established risk factors for breast cancer and breast cancer incidence rates in SFBA populations.

There has been public concern regarding the possible role of unique, localized environmental toxins in causing the excess rate of breast cancer, particularly in Marin County. This possibility is inconsistent with the accumulated range of research findings, namely ecologic- and individual-level assessments confirming higher distributions of known risk factors^{1, 19}, racial/ethnic variation in rates within Marin County, the uniform distribution of breast cancer within Marin County as determined by mapping efforts¹⁷, the lack of association in a recent case-control study of breast cancer risk with length of residence in Marin County¹⁹, and comparable rates in sociodemographically similar populations^{6, 20}. These observations do not address the potential involvement of environmental toxins in breast carcinogenesis, but do provide strong evidence in support of efforts to identify novel breast cancer causes associated with residence in all areas of higher average SES.

Understanding the basis of regional variation in breast cancer incidence has implications for understanding breast cancer etiology. A recent Wisconsin study²¹ examined separately the influences on breast cancer risk of individual-level measures of education and established risk factors and community-level measures of socioeconomic status and urbanicity, obtained from the 1990 Census. This study found that breast cancer risk was associated with high community socioeconomic status after adjustment for individual-level education and other established risk factors, suggesting that living in affluent communities impacts breast cancer risk above and beyond the risk conferred by individual risk factors. In this vein, Marin, San Francisco, and other SFBA communities are important settings for investigating the potential roles of community-level factors common to affluent regions. Before considering factors of uncertain relevance to breast cancer, community-level factors that should be ruled out include mammographic screening behaviors (e.g., availability of screening, type of screening technologies), physical activity resources (e.g., availability of walking trails or other places to

exercise), practices for prescribing hormone replacement therapy, and alcohol consumption norms.

Updated statistics for other types of cancer in Marin County

Previous reports have suggested elevated rates of cancers in Marin County other than female breast cancer. The appendix shows updated incidence statistics (1997-2001) for selected cancers for Marin County, other parts of the SFBA (other five counties including San Francisco County) and other parts of California. Among these cancers, incidence rates were significantly elevated only for prostate cancer in males (RR =1.26 vs. California) and uterine cancer in females (RR=1.17 vs. California). However, mortality rates for prostate cancer and uterine cancer in Marin County were comparable to those for other regions. Rates of two cancers, lung and cervix, were significantly lower in Marin County than in other parts of California (male lung cancer incidence: RR=0.65; female lung cancer incidence: RR=0.83, female cervical cancer incidence RR=0.65). For all invasive cancers combined, Marin County had comparable incidence rates and significantly lower mortality rates than the rest of California (male all cancer mortality: RR=0.83, female all cancer mortality: RR=0.92).

TABLES AND FIGURES

Table 1:

Counts and incidence rates of invasive breast cancer for white, non-Hispanic women in Marin county, San Francisco County, other San Francisco Bay Area counties, and other parts of California, 1995-2001

Year of diagnosis	Marin County		San Francisco County		Other SFBA*	Other California**	US***
	N	Rate	N	Rate	Rate	Rate	Rate
1995	205	162.1	344	189.7	163.0	145.9	138.6
1996	237	187.8	346	195.3	167.8	149.4	138.7
1997	230	176.6	321	176.7	169.5	150.9	145.6
1998	234	176.6	366	207.0	173.3	155.9	149.3
1999	261	190.7	332	187.7	171.1	157.8	149.2
2000	226	157.5	275	153.1	163.3	153.9	144.7
2001	264	184.7	306	167.9	157.3	152.9	146.3
Average 1997-2001	243	176.6	320	178.9	165.7	154.2	147.0

All rates per 100,000 and age-adjusted to the 2000 US age standard

* Alameda, Contra Costa, San Mateo, and Santa Clara counties

** Other counties in California excluding the Bay Area

*** US includes the metropolitan areas of Los Angeles, San Jose-Monterey, Seattle-Puget Sound, Detroit, Atlanta, and the states of Connecticut, Hawaii, New Mexico, Utah, and Iowa

Table 2:

Five-year average annual breast cancer incidence and mortality rates per 100,000 white, non-Hispanic women in Marin County, San Francisco County, other San Francisco Bay Area (SFBA) counties, and other California counties, 1997-2001

	<i>In situ</i> incidence Rate (95% CI)	Invasive incidence Rate (95% CI)	Mortality Rate (95% CI)
Marin county	36.2 (31.8-41.4)	176.6 (166.1-186.6)	29.8 (25.9-34.5)
San Francisco county	44.9 (40.4-50.2)	178.9 (170.0-188.6)	31.9 (28.3-36.2)
Other SFBA *	35.3 (33.9-36.8)	165.7 (162.7-168.8)	28.5 (27.3-29.7)
Other California**	29.3 (28.7-29.8)	154.2 (153.0-155.5)	28.4 (27.9-28.9)

All rates age-adjusted to the 2000 US age standard

* Alameda, Contra Costa, San Mateo, and Santa Clara counties

** Other counties in California excluding the Bay Area

Table 3:

Five-year average annual breast cancer incidence and mortality rates per 100,000 white, non-Hispanic women in Marin County, San Francisco County, other San Francisco Bay Area (SFBA) counties, and other California counties, 1997-2001, by age at diagnosis

	<i>In situ</i> incidence Rate (95% CI)	Invasive incidence Rate (95% CI)	Mortality Rate (95% CI)
Ages 0-39			
Marin county	0.7 (0.1-3.7)	13.7 (9.8-19.4)	0.3 (0.0-3.3)
San Francisco county	2.6 (1.4-5.7)	13.2 (10.3-17.6)	0.9 (0.3-3.7)
Other SFBA	2.5 (2.0-3.1)	13.8 (12.6-15.1)	1.3 (1.0-1.8)
Other California	2.0 (1.8-2.2)	13.7 (13.1-14.2)	1.7 (1.5-1.9)
Ages 40-69			
Marin county	82.0 (70.7-94.6)	340.7 (317.3-365.5)	44.9 (36.7-54.5)
San Francisco county	98.1 (86.3-111.1)	352.3 (329.6-376.2)	54.6 (45.9-64.5)
Other SFBA	76.5 (73.0-80.2)	316.9 (309.6-324.4)	44.0 (41.3-46.8)
Other California	61.6 (60.2-62.9)	288.1 (285.1-291.0)	44.4 (43.2-45.5)
Ages 70+			
Marin county	88.0 (66.4-114.6)	581.2 (524.0-643.1)	156.5 (127.9-189.9)
San Francisco county	111.8 (91.9-134.8)	567.3 (522.5-615.2)	140.3 (119.4-164.2)
Other SFBA	87.2 (80.5-94.4)	550.4 (533.5-567.6)	139.3 (131.0-148.0)
Other California	79.3 (76.8-82.0)	532.4 (525.7-539.1)	135.5 (132.2-138.9)

All rates per 100,000 and age-adjusted to the 2000 US age standard

* Alameda, Contra Costa, San Mateo, and Santa Clara counties

** Other counties in California excluding the Bay Area

Table 4:

Five-year average annual breast cancer incidence and mortality rates for African-American, Hispanic, and Asian/Pacific Islander women in Marin County, San Francisco County, other San Francisco Bay Area (SFBA) counties, and other California counties, 1997-2001

	<i>In situ</i> incidence Rate (95% CI)	Invasive incidence Rate (95% CI)	Mortality Rate (95% CI)
White			
Marin county	36.2 (31.8-41.4)	176.6 (166.1-186.6)	29.8 (25.9-34.5)
San Francisco county	44.9 (40.4-50.2)	178.9 (170.0-188.6)	31.9 (28.3-36.2)
Other SFBA *	35.3 (33.9-36.8)	165.7 (162.7-168.8)	28.5 (27.3-29.7)
Other California**	29.3 (28.7-29.8)	154.2 (153.0-155.5)	28.4 (27.9-28.9)
African-American			
Marin county (1988-2001)	21.9 (7.8-56.9)	97.1 (62.4-150.0)	37.6 (17.1-78.2)
San Francisco county	34.6 (26.3-44.9)	129.4 (112.7-148.1)	42.9 (33.6-54.2)
Other SFBA	21.6 (18.6-25.0)	123.1 (115.8-130.7)	34.4 (30.6-38.5)
Other California	22.5 (21.0-24.1)	128.1 (124.5-131.9)	36.1 (34.1-38.1)
Hispanic			
Marin county (1988-2001)	22.7 (13.1-38.0)	139.1 (113.0-170.3)	15.7 (8.1-29.0)
San Francisco county	30.4 (23.4-39.0)	93.3 (80.8-107.2)	16.0 (11.2-22.3)
Other SFBA	20.5 (18.0-23.2)	107.7 (102.0-113.6)	20.8 (18.3-23.7)
Other California	15.7 (15.0-16.5)	92.2 (90.5-94.0)	18.5 (17.7-19.3)
Asian/Pacific Islander			
Marin county (1988-2001)	26.6 (16.1-46.4)	108.5 (84.7-140.5)	16.4 (7.3-35.9)
San Francisco county	26.0 (22.4-30.1)	88.2 (81.4-95.5)	12.2 (9.7-15.2)
Other SFBA	25.0 (22.9-27.2)	91.8 (87.7-96.0)	13.9 (12.3-15.7)
Other California	19.1 (18.0-20.2)	89.2 (86.8-92.6)	14.7 (13.7-15.8)

White, Black and Asian/Pacific Islander groups exclude Hispanics
 To maximize rate precision, rates for Marin County non-whites include data from all years available (1988-2001)

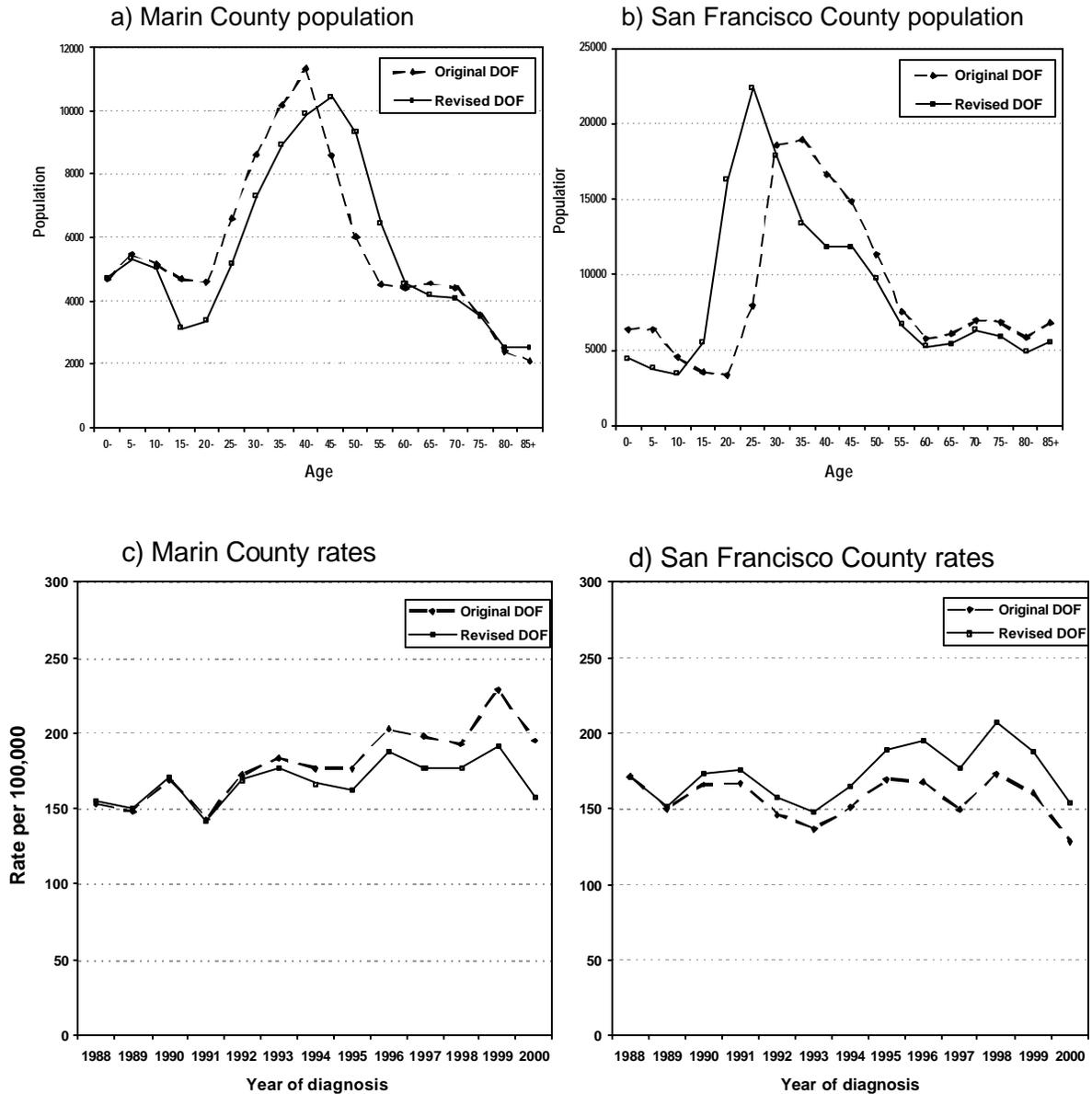
All rates per 100,000 and age-adjusted to the 2000 US age standard

* Alameda, Contra Costa, San Mateo, and Santa Clara counties

** Other counties in California excluding the Bay Area

Figure 1:

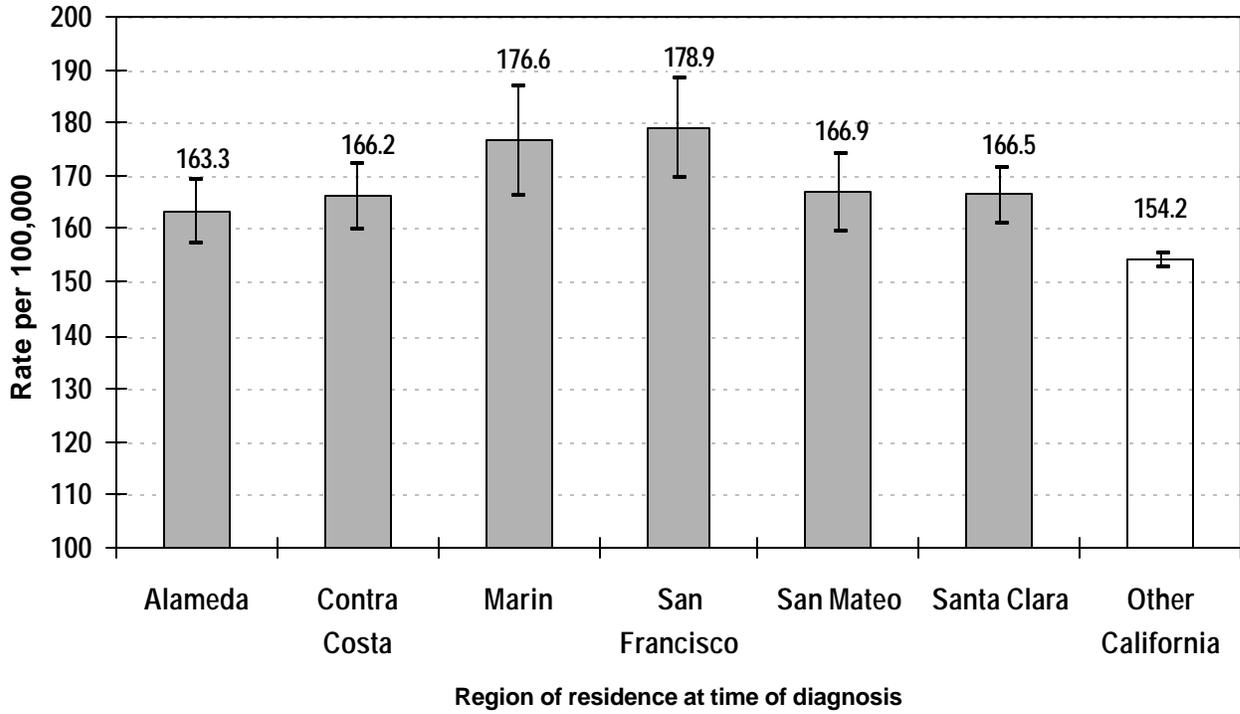
Original and revised population estimates for non-Hispanic white females by age for Marin and San Francisco Counties, California Department of Finance (DOF), 1996-99 (panels a, b); and breast cancer incidence rates utilizing original and revised population estimates, Marin and San Francisco Counties, 1988-2000 (panels c, d)



Incidence rates for invasive breast cancer only. All rates age-adjusted to the 2000 US age standard.

Figure 2:

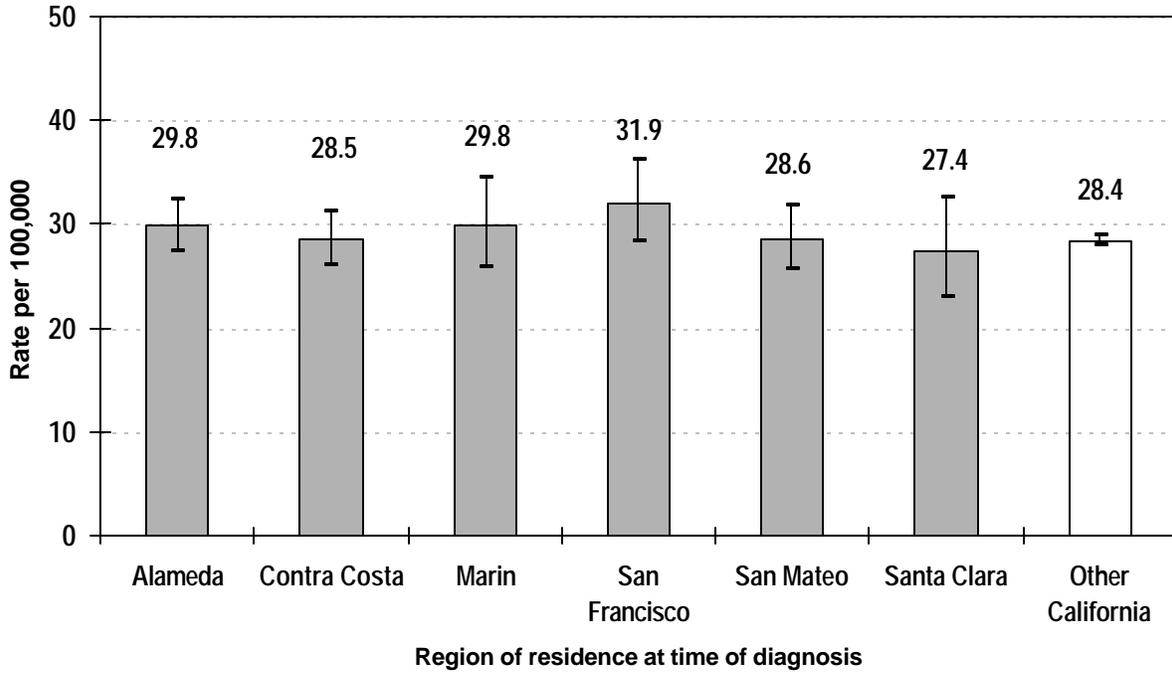
Incidence rates of invasive breast cancer for non-Hispanic white females by region of residence at time of diagnosis, San Francisco Bay Area vs. other California, 1997-2001.



All rates age-adjusted to the 2000 US age standard.

Figure 3:

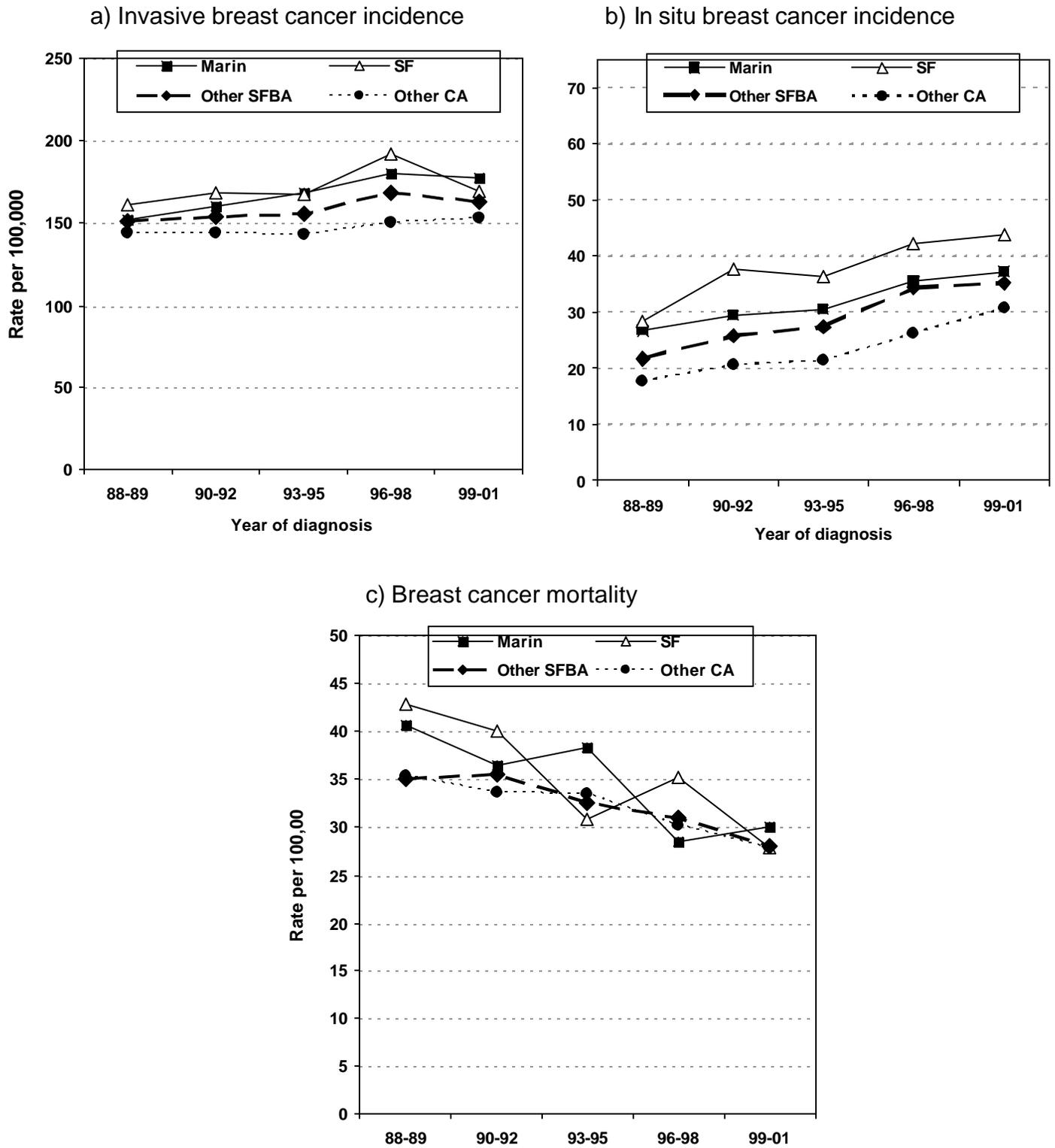
Breast cancer mortality rates for non-Hispanic white females by region of residence at time of diagnosis, San Francisco Bay Area vs. other California, 1997-2001.



All rates age-adjusted to the 2000 US age standard.

Figure 4:

Trends in age-adjusted breast cancer incidence (panels a, b) and mortality (panel c) rates among non-Hispanic white females by region, 1988-2001



Note: Incidence rates presented separately for invasive and in situ breast cancer. All rates age-adjusted to the 2000 US age standard.

Figure 5:

Age-specific incidence rates of invasive breast cancer in non-Hispanic white females by region, 1997-2001

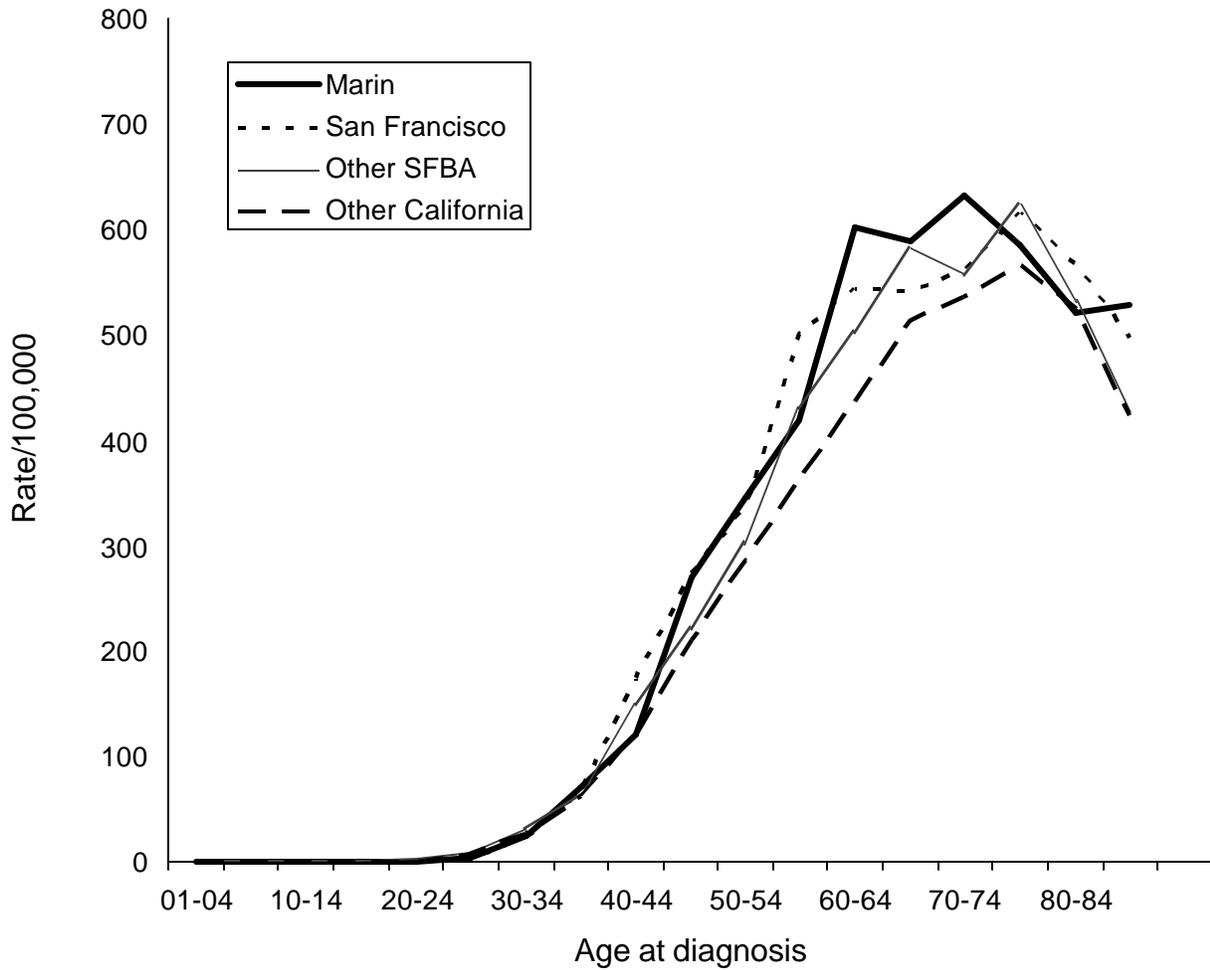
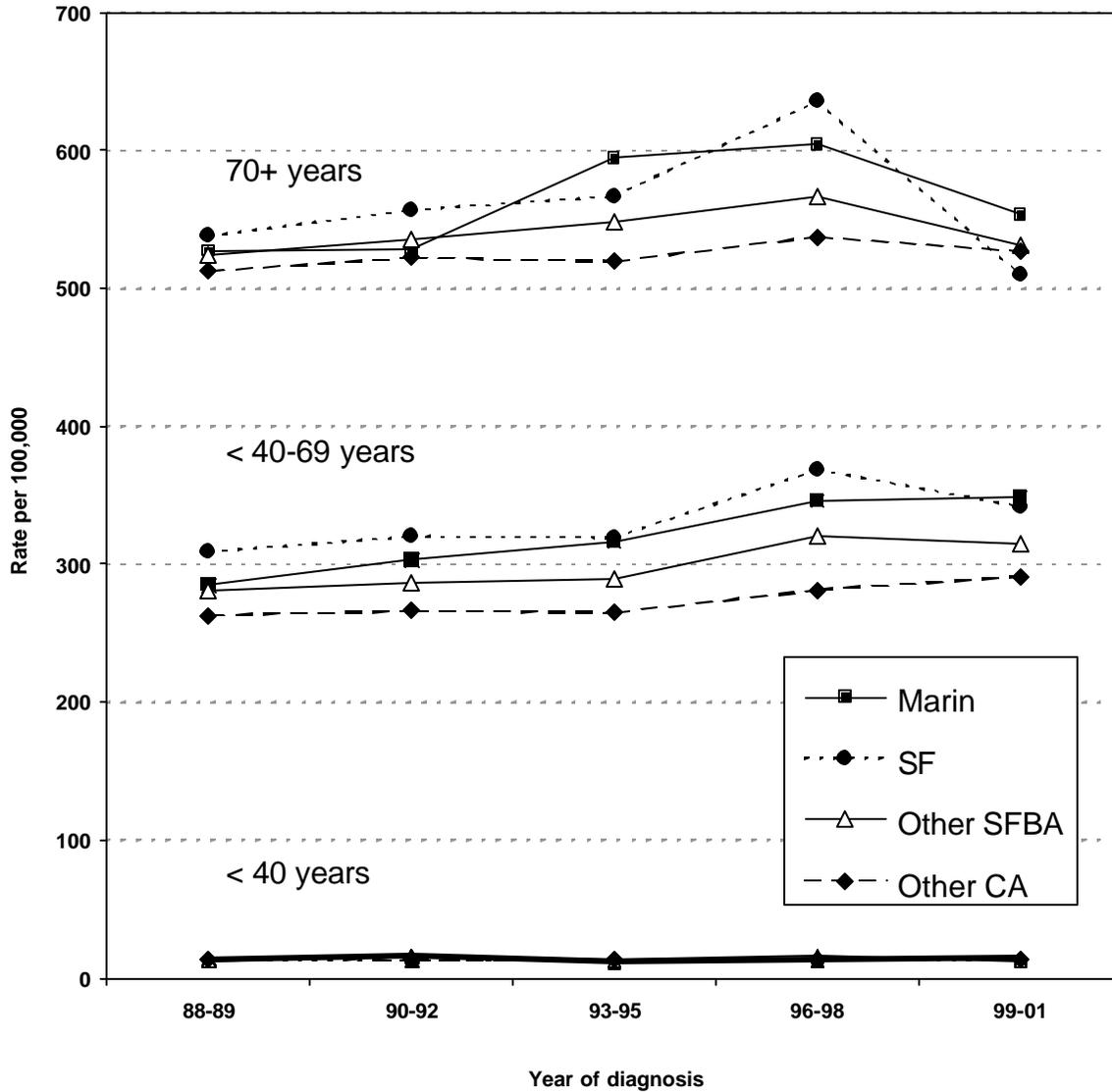


Figure 6:

Trends in age-specific incidence rates for invasive breast cancer in non-Hispanic white females, by region, 1988-2001



APPENDIX

Five-year average annual incidence rates of selected cancers per 100,000 white, non-Hispanic persons in Marin County, other San Francisco Bay Area (SFBA) counties, and other urban California counties, 1997-2001.

	MALES		FEMALES	
	Incidence	Mortality	Incidence	Mortality
All cancer				
Marin County	578.8 (558.6-599.9)	196.6 (184.5-209.5)	469.2 (452.8-486.3)	158.7 (149.5-168.6)
Other SFBA *	580.4 (574.6-586.3)	230.1 (226.4-234.0)	470.1 (465.4-474.9)	171.7 (168.9-174.6)
Other Calif.**	584.7 (582.2-587.3)	237.7 (236.1-239.3)	461.6 (459.6-463.7)	173.0 (171.7-174.2)
Prostate cancer				
Marin County	203.7 (191.9-216.3)	26.2 (21.7-31.6)	-	-
Other SFBA *	173.0 (169.8-176.2)	29.3 (27.9-30.8)	-	-
Other Calif.**	161.4 (160.1-162.7)	29.1 (28.5-29.7)	-	-
Breast cancer				
Marin County	1.6 (0.7-3.6)	-	176.6 (166.7-187.2)	29.8 (25.9-34.5)
Other SFBA	1.4 (1.1-1.7)	0.2 (0.1-0.3)	167.0 (164.2-169.9)	28.9 (27.7-30.0)
Other Calif.	1.3 (1.2-1.4)	0.3 (0.3-0.4)	154.2 (153.0-155.5)	28.4 (27.9-28.9)
Melanoma (skin)				
Marin County	33.3 (28.7-38.9)	6.1 (4.2-9.0)	23.4 (19.6-28.0)	2.3 (1.3-4.4)
Other SFBA	29.7 (28.4-31.0)	5.1 (4.6-5.7)	19.0 (18.0-20.0)	2.3 (2.0-2.7)
Other Calif.	33.8 (33.2-34.4)	5.6 (5.3-5.8)	21.1 (20.6-21.5)	2.4 (2.3-2.6)
Lung cancer				
Marin County	55.8 (49.6-62.9)	48.9 (43.1-55.7)	50.5 (45.3-56.5)	41.2 (36.6-46.6)
Other SFBA	75.5 (73.4-77.7)	61.8 (59.8-63.8)	57.8 (56.1-59.5)	43.9 (42.5-45.4)
Other Calif.	86.5 (85.6-87.5)	69.4 (68.5-70.2)	61.0 (60.3-61.7)	46.5 (45.9-47.2)
Colorectal cancer				
Marin County	61.5 (55.0-68.9)	20.5 (16.7-25.3)	43.9 (39.2-49.5)	14.1 (11.5-17.6)
Other SFBA	64.2 (62.3-66.2)	23.7 (22.5-25.0)	46.6 (45.1-48.0)	16.4 (15.6-17.3)
Other Calif.	63.6 (62.8-64.5)	22.6 (22.1-23.1)	45.9 (45.3-46.5)	16.2 (15.8-16.6)
Ovarian cancer				
Marin County	-	-	14.1 (11.4-17.6)	10.6 (8.3-13.7)
Other SFBA	-	-	16.1 (15.2-17.0)	10.2 (9.6-11.0)
Other Calif.	-	-	16.0 (15.6-16.4)	10.2 (9.9-10.5)
Uterine cancer				
Marin County	-	-	30.3 (26.4-35.1)	4.1 (2.8-6.4)
Other SFBA	-	-	28.9 (27.7-30.1)	4.3 (3.9-4.8)
Other Calif.	-	-	25.9 (25.4-26.4)	3.9 (3.7-4.1)
Cervical cancer				
Marin County	-	-	5.5 (3.8-8.2)	0.6 (0.2-2.4)
Other SFBA	-	-	6.6 (6.1-7.2)	1.6 (1.4-2.0)
Other Calif.	-	-	8.5 (8.2-8.8)	2.5 (2.4-2.7)

Incidence rates for invasive breast cancer only. All rates age-adjusted to the 2000 US age standard.

Rates and 95% CI based on less than 5 cases are not shown. *Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara counties, ** Other counties in California excluding the Bay Area.

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