

## YEAR 2000 POPULATION STANDARD

Age-adjusted rates in this report are directly standardized to the age distribution of the United States projected population in 2000, referred to as the Year 2000 Population Standard. In previous California Cancer Registry (CCR) annual reports, rates were standardized to the age distribution of the United States population in 1970. Because of this change, age-adjusted rates presented in this report cannot be meaningfully compared to those in earlier CCR reports, or to rates from other geographic areas that are not also standardized to the Year 2000 Standard. The exceptions are rates in Tables 6 and 7. These rates are standardized to the World Standard Population, which has not changed. This section summarizes why rates are age-adjusted, why a new U.S. standard was adopted, and the impact of this change on California cancer rates.

### AGE-ADJUSTMENT

Age-adjustment is a statistical technique that produces a summary measure of a population's risk of developing or dying from cancer that is not biased by how old or young the population is. This is particularly important when comparing cancer rates between groups of people or time periods. Cancer risk increases with age, and the age distribution of populations can vary considerably by sex, race/ethnicity, geographic area, and time. Without age-adjustment, one cannot tell whether differences in rates are the result of differences in the age distribution of the populations being compared, or due to differences in cancer risk other than age. Because the increase in cancer risk with age is generally well established and because one's age cannot be modified, comparisons in which the effect of age differences have been eliminated are often more useful when evaluating issues related to cancer etiology, surveillance, and control.

The calculations involved in direct standardization to produce an age-adjusted rate are described in detail in the article "Age adjustment using the 2000 projected U.S. population," by Klein and Schoenborn, published in *Healthy People 2010 Statistical Notes*, January 2001 (see Additional Information, below).

An age-adjusted rate reflects what the overall rate would be in a population if that population had the same age distribution as the standard population. The age-adjusted rate will be higher or lower than the unadjusted, or crude, rate depending on whether the standard population is younger or older than the population being studied, and on the relationship between age and the disease being examined. If the standard population is older and the disease increases with age, the age-adjusted rate will be

higher than the crude rate. Similarly, if a new standard population is older than the original standard population and the disease increases with age, the new age-adjusted rate will be higher than the original age-adjusted rate. The numeric value or magnitude of the age-adjusted rate can therefore change simply by the choice of the standard population, without any change in the true risk of developing disease. Although this may seem to be an undesirable characteristic of a summary statistic, and other methods have been developed, the age-adjusted rate is useful in comparing cancer rates between groups and over time, and remains one of the most commonly cited cancer statistics. One way to avoid this difficulty is to rely on age-specific rates when comparing cancer risk in two populations, and in fact, this is often the most informative approach. The difficulty is that multiple comparisons must then be made (cancer rates are typically reported using 18 five-year age categories), which can make generalization difficult.

### ADOPTION OF THE YEAR 2000 POPULATION STANDARD

CCR is one of many organizations that has recently started using the Year 2000 Standard for calculating age-adjusted rates. This change was adopted by state and federal agencies reporting health-related data starting with the 1999 data year. Prior to this, data users were sometimes confused because agencies used different standards when reporting mortality statistics. The common use of a new standard promotes uniformity and comparability of data from many organizations. Starting with the 1999 data year, age-adjusted cancer incidence and mortality rates standardized to the Year 2000 Standard will be reported by the Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute, by California regional cancer registries, and by the North American Association of Central Cancer Registries.

### CHARACTERISTICS OF THE YEAR 2000 POPULATION STANDARD

Figure 1 shows the age distributions of the U.S. population in 1970 and 2000. In general, the 2000 population is older; a smaller proportion are younger than 25 years of age, a much larger proportion are ages 30 to 54, and a somewhat larger proportion are 70 years of age and older.

### IMPACT OF THE YEAR 2000 STANDARD ON CALIFORNIA CANCER RATES

To evaluate the impact of the Year 2000 Standard on California cancer rates, the same data (i.e., age-specific numerators and denominators) were used to calculate rates,

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age-adjusting to both the 1970 U.S. population and the new Year 2000 Standard. Any differences in the value of the rates are therefore due solely to the choice of standard.

Because the 2000 Standard Population is older and cancer risk tends to increase with age, rates that are age-adjusted to the 2000 Standard are higher than those that are age-adjusted to the 1970 Standard. For example, the overall average annual age-adjusted cancer incidence rate in California over the five-year period 1995-1999 is 372.8 per 100,000 persons when standardized to the 1970 U.S. population, but 446.7 per 100,000 when standardized to the 2000 Standard. This represents an apparent relative increase in the cancer incidence rate in California of 19.8 percent, due solely to the change in standard population. Figure 2 shows the percentage by which incidence and mortality rates increased for common cancer sites due to the adoption of the new standard.

The magnitude and degree of the increase is not the same for every cancer because the relative increase depends on the specific relationship between age and cancer risk. In general, the older the average age at diagnosis, the larger the proportional increase in the age-adjusted rate using the 2000 standard. The age-adjusted incidence rate for brain and central nervous system cancer, with an average age at diagnosis of 55, increases by 10.7 percent using the new standard, while colon and rectum cancer, which has an average age at diagnosis of 72, increases by 26.1 percent.

Because people tend to die from cancer at an older age than they are diagnosed, the proportional increase due to the new standard is greater for age-adjusted mortality rates than for incidence rates. The overall average annual age-adjusted cancer mortality rate in California over the five-year period 1995-1999 is 145.9 per 100,000 persons when standardized to the 1970 U.S. population, and 184.0 per 100,000 when standardized to the 2000 Standard, a relative increase of 26.1 percent for cancer mortality, compared to 19.8 percent for incidence. The mortality rate for brain and central nervous system cancer, with an average age at death of 63, increases by 15.0 percent using the new standard, while colon and rectum cancer, which has an average age at death of 74, increases by 32.4 percent. Again, these increases are due solely to the choice of a new standard.

The proportional increase in age-adjusted rates also varies by sex and race/ethnicity, but usually not to a great extent. For example, the age-adjusted incidence rate for all cancer sites combined increased by 21.2 percent for males, and 19.6 percent for females. Among women, the relative increase varied from 19.1 percent among non-Hispanic white women to 19.4 percent among Asian/Pacific Islander women. Among men, the relative increase varied from 21.1

percent among non-Hispanic white men to 21.6 percent among Asian/Pacific Islanders. There are, however, some exceptions to this generalization. The age-adjusted prostate cancer incidence rate increased by 11.8 percent among non-Hispanic white males, 14.5 percent among Hispanics, and 15.9 percent among African Americans, but by 21.7 percent among Asian/Pacific Islander males, due to the new standard.

In general, cancer trends in California were only minimally affected by the change in standard. The impact of the new standard on cancer trends will depend not only on the relationship between age and cancer risk, but also on the specific ages in which cancer trends are predominantly occurring. The relationship is complex and should be studied on a case by case basis. The new standard will have a greater effect on cancer trends if the trends are primarily limited to certain age groups, and the proportion of the population in these age groups changed considerably between 1970 and 2000.

Figures 3 and 4 show annual breast cancer rates in California over the twelve-year period 1988-1999, age-adjusted to the 1970 and to the 2000 U.S. population standards. Age-adjusted incidence rates are approximately 18 percent higher using the 2000 Standard compared to the 1970 Standard, and mortality rates are about 22 percent higher. Because the impact of the new standard is fairly consistent over time, the trends are not significantly affected. Using the 1970 Standard, the average percent change in the rate over the twelve-year period is 0.0 percent per year for breast cancer incidence, and -2.7 percent for mortality. Using the 2000 Standard, the average percent change is 0.0 percent per year for breast cancer incidence, and -2.5 percent for mortality. The new standard may also differentially affect cancer rates in a geographic area, especially if rates are based on relatively small numbers, or are clustered in certain age categories.

## ADDITIONAL INFORMATION

The following articles provide more detailed information on the rationale for adopting and the impact of the Year 2000 Standard.

Hoyert DL, Anderson RN. Age-adjusted death rates: trend data based on the Year 2000 Standard population. National Vital Statistics Reports, September 21, 2001; Volume 49, number 9. Hyattsville, MD: National Center for Health Statistics. Available on [http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49\\_09.pdf](http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_09.pdf).

Year 2000 population standard for age-adjusted death rates in the United States: information on the adoption, implementation and impact, plus frequently asked Q&A's. Centers

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for Disease Control and Prevention, National Center for Health Statistics. Available on <http://www.cdc.gov/nchs/data/IW134Pfct.pdf>.

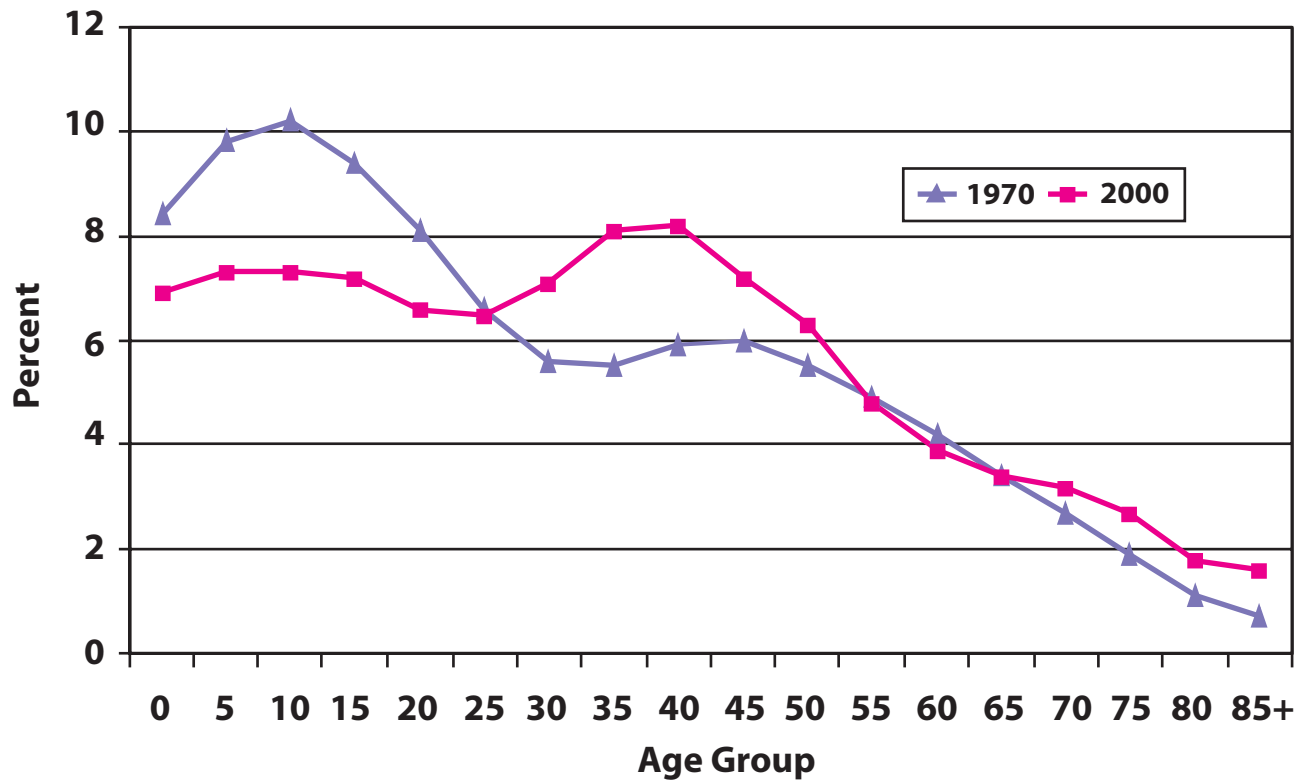
Klein RJ, Schoenborn CA. Age adjustment using the 2000 projected U.S. population. *Healthy People 2010 Statistical Notes*, January 2001; Number 20. Center for Disease Control and Prevention. Available on <http://www.cdc.gov/nchs/data/statnt/statnt20.pdf>.

Anderson RN, Rosenberg HM. Report on the second workshop on age adjustment. *Vital and Health Statistics*, December 1998; Series 4, number 30. Available on [http://www.cdc.gov/nchs/data/sr4\\_30.pdf](http://www.cdc.gov/nchs/data/sr4_30.pdf).

Anderson RN, Rosenberg HM. Age standardization of death rates: implementation of the Year 2000 Standard. *National Vital Statistics Reports*, October 7, 1998; Volume 47, number 3. Hyattsville, MD: National Center for Health Statistics. Available on [http://www.cdc.gov/nchs/data/nvsr47\\_3.pdf](http://www.cdc.gov/nchs/data/nvsr47_3.pdf).

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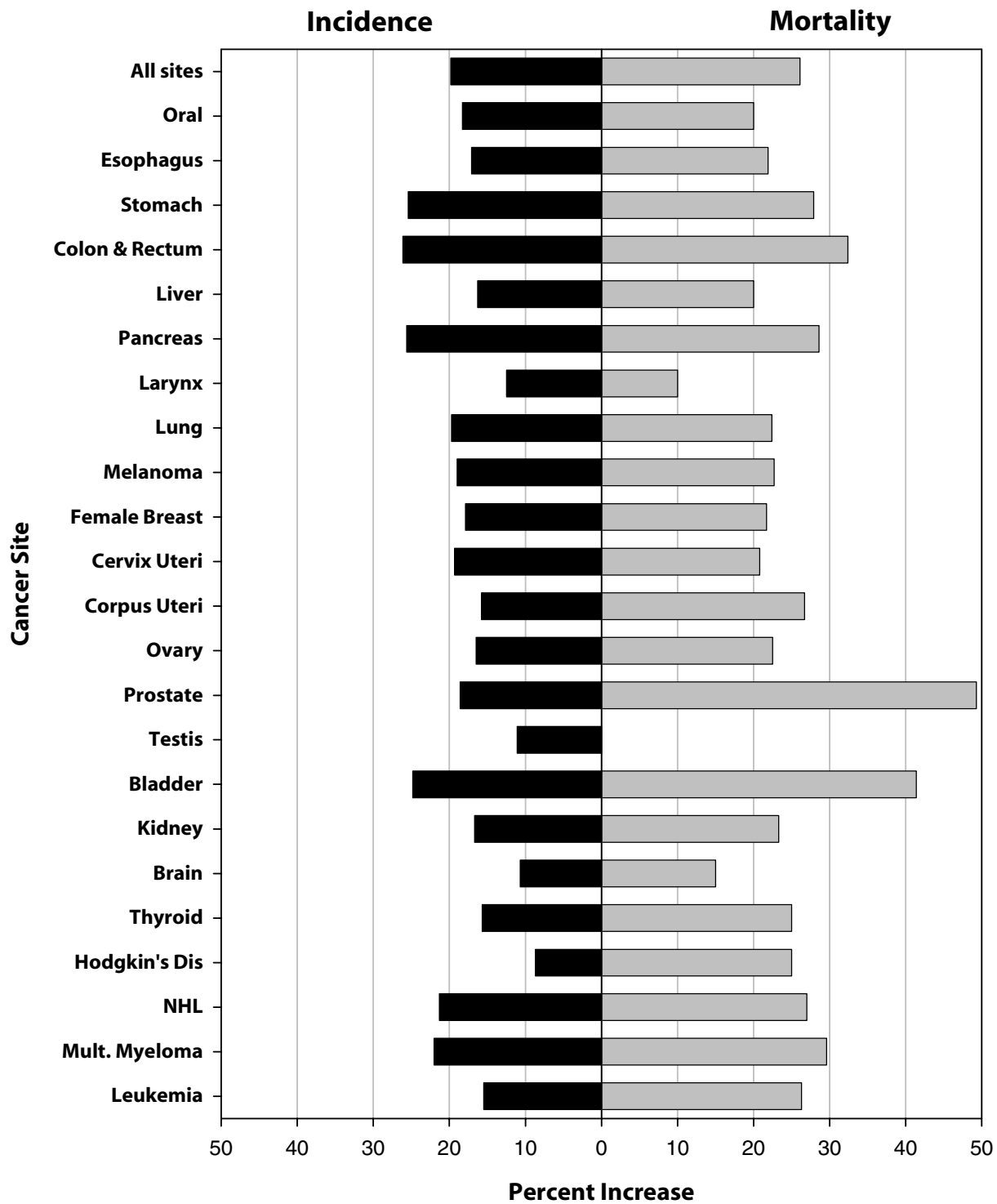
**Figure 1: Age Distribution of the U.S. Population in 1970 and 2000**



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

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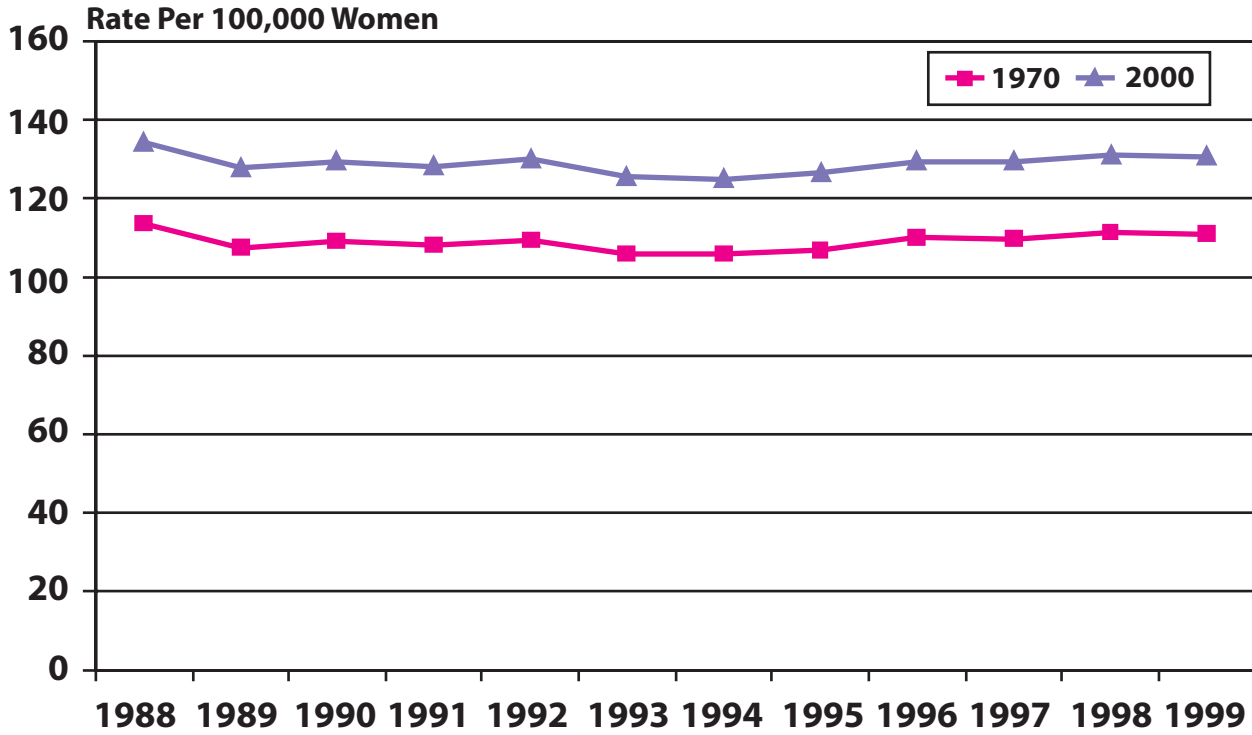
**Figure 2: Percent Increase in Age-Adjusted Cancer Rates Standardized to the U.S. Population in 2000 Versus 1970, California, 1995-1999**



Prepared by the California Department of Health Services, Cancer Surveillance Section  
 Source CCR (08/01) and Center for Health Statistics Death Master Files. Excludes *in situ* cancers except bladder.  
 NHL = non-Hodgkin's lymphoma; Brain = brain and other nervous system.

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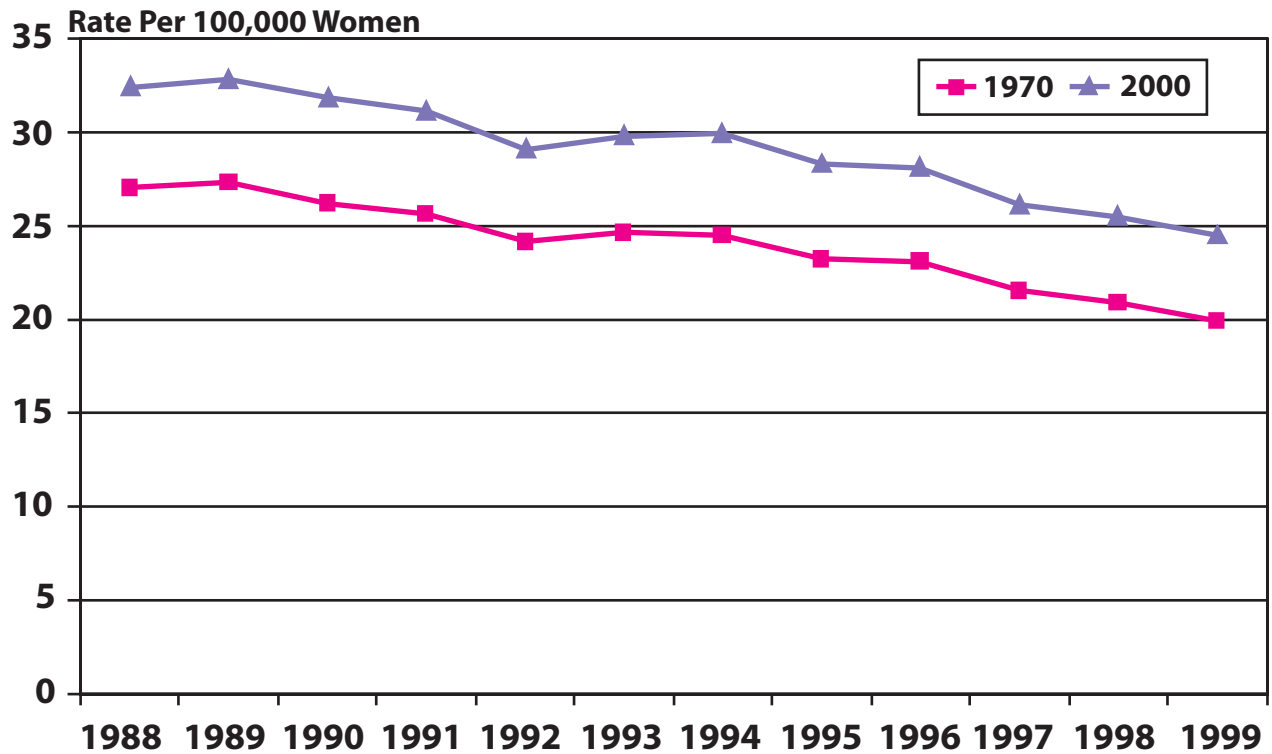
**Figure 3: Age-Adjusted Breast Cancer Incidence Rates Standardized to the U.S. Population in 1970 and 2000, California, 1988-1999**



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

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**Figure 4: Age-Adjusted Breast Cancer Mortality Rates Standardized to the U.S. Population in 1970 and 2000, California, 1988-1999**



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