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Greater Bay Area
CANCER REGISTRY

The Greater Bay Area Cancer Registry
Incidence and Mortality Annual Review, 1988-2017
30 Years of Cancer Surveillance

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SPECIAL HIGHLIGHT:

RACIAL/ETHNIC DISPARITIES IN CANCER INCIDENCE AND MORTALITY IN THE GREATER BAY AREA, 2013-2017

The nine-county Greater Bay Area has one of the most racially/ethnically diverse populations in the nation, with 28.8% Asian/Pacific Islander, 25.8% Hispanic, 6.9% non-Hispanic Black (NH Black), and 38.4% NH White males and females.

There are long-standing and persistent racial/ethnic disparities in cancer incidence (new cases) and mortality (deaths). In the Greater Bay Area, NH Black males had the highest incidence and mortality rates for all cancers combined of any racial/ethnic group (40% higher than NH White males) with similar patterns seen nationally across the U.S.[1] NH White females had the highest incidence rate of all cancers combined, but NH Black females had the highest mortality rate (34% higher than NH White females) **(Figure A)**.

Other noteworthy disparities include the significantly higher prostate cancer incidence and mortality rates among NH Black males compared to other racial/ethnic groups **(Figure B)**. NH Black males and females also had the highest incidence rates for cancers of the lung, colon and rectum, liver, pancreas, stomach and myeloma, compared to males of other racial/ethnic groups. NH White females had the highest incidence rate of breast cancer **(Figure B)**, while NH Black females had the highest mortality rate of breast cancer. For several other cancers, including lung, colorectal, pancreatic, stomach, uterine and myeloma, NH Black females had the highest incidence rates. NH Black females also had the highest mortality rates for lung, colorectal, uterine, pancreatic, stomach and myeloma. Liver cancer incidence and mortality was highest among NH Black males and Hispanic females. Cervical cancer incidence and mortality were highest among Hispanic females.

The causes of these disparities in cancer incidence rates and mortality rates reflect social and economic inequities rooted in structural factors such as racism, poverty, and unequal access to healthcare. For example, structural racism resulting in redlining and racial residential segregation exposes certain communities to toxic physical and social environments. Medical mistrust and discrimination experiences among communities of color may deter participation in clinical trials and access to cutting-edge treatments such as precision medicine. Social determinants such as housing and food insecurity may impact delays in early diagnosis and receipt of guideline treatments in addition to survivorship care. Social determinants at the contextual level, such as the social and built environments, can present barriers for communities to engage in healthy behaviors to prevent cancer and its progression.

This **special highlight** of the Greater Bay Area Cancer Registry's Annual Report draws attention to the racial/ethnic disparities in cancer incidence and mortality in the region. Investments in policies that address social determinants of health, including the structural factors, are needed to mitigate these persistent racial/ethnic disparities. Continuing cancer surveillance by race/ethnicity and other social status indicators coupled with research on the contextual to biological multilevel contributors to cancer health disparities is essential to informing the most effective intervention and policies.

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Figure A. All Cancer Incidence and Mortality Rates, 2013-2017, GBACR

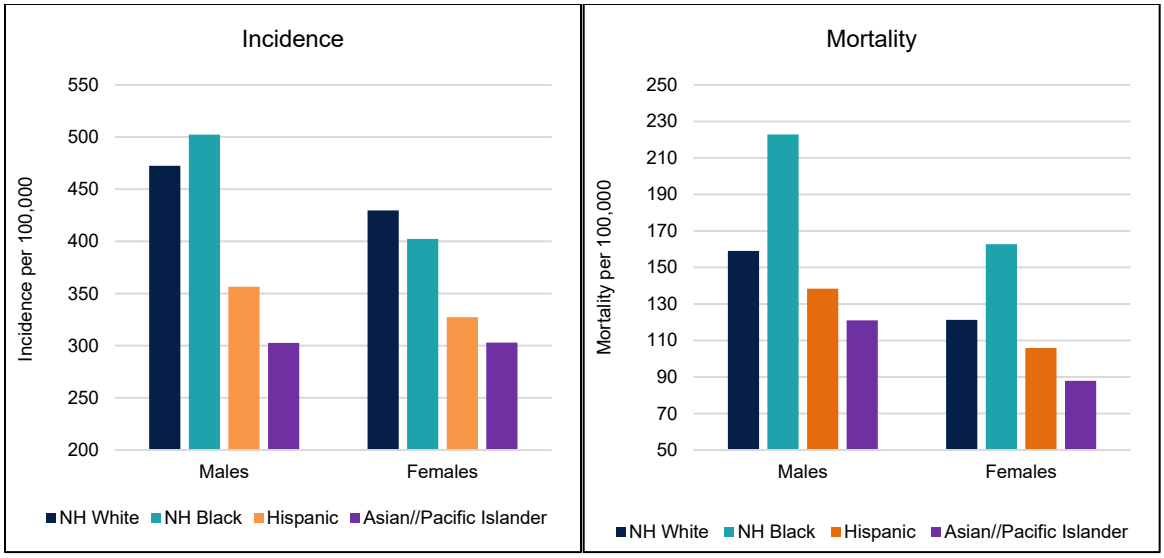
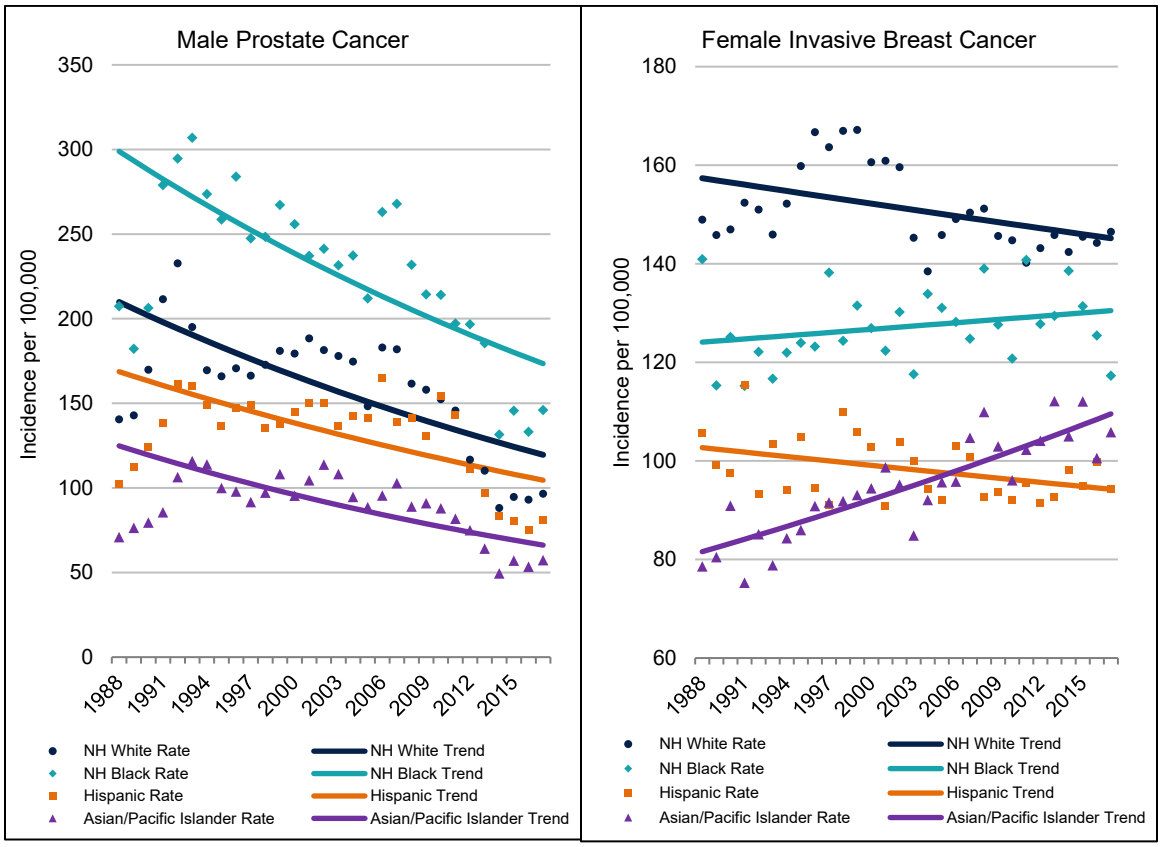


Figure B: Age-Adjusted Incidence Rates and Trends for Male Prostate Cancer and Female Invasive Breast Cancer in the Greater Bay Area by Race/Ethnicity, 1988-2017



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This report highlights the most current cancer statistics for the Greater Bay Area and includes data on new cases of cancer and cancer deaths for the 30-year period from 1988 through 2017. The report focuses on the incidence and mortality of invasive cancers[1] and examines trends, highlighting the latest available data from 2013-2017 for the nine Greater Bay Area counties. For cancer sites of the breast, skin, and colon/rectum, incidence rates are also provided for *in situ* tumors[2]. Because cancers vary considerably by age, all incidence and mortality rates have been age-adjusted to the 2000 U.S. Standard Population to allow for the comparison of rates across groups, without the confounding effects of age. Please refer to the **Appendix** at the end of this report for definitions of the technical terms used throughout this report.

As part of the California Cancer Registry (CCR), the Greater Bay Area Cancer Registry (GBACR), operated by the University of California at San Francisco (UCSF), collects information on all newly diagnosed cancers occurring in residents of nine Greater Bay Area counties: Alameda, Contra Costa, Marin, Monterey, San Benito, San Francisco, San Mateo, Santa Clara, and Santa Cruz. Statewide cancer reporting in California began in 1988. At present, the most recent year of complete case ascertainment and follow-up for deaths is 2017 [2, 3]. Cancer rates from the entire state are also included for comparison. California mortality rates are calculated from vital status data obtained from the California Department of Public Health, Center for Health Statistics (www.cdph.ca.gov).

More information about the GBACR can be found on our website at https://cancerregistry.ucsf.edu/greater-bay-area-cancer-registry. Furthermore, cancer statistics for the Greater Bay Area region are available upon request by emailing GBACR@ucsf.edu. Customizable cancer statistics for all counties in California are available from the CCR interactive cancer incidence and mortality mapping tool https://www.cancer-rates.info/ca/. This website allows users to create and view custom tables and maps of the most current cancer incidence and mortality data by cancer site, year of diagnosis, sex, race/ethnicity, and county. Incidence rates for additional geographies (e.g., sub-county zones, medical service study areas, census designated places, and legislative districts) are available at: https://www.californiahealthmaps.org/

Nine Counties Included in the GBACR

[1] Tumors that have invaded surrounding tissue or other parts of the body.

[2] Tumors that stay in the site of origin and do not invade neighboring tissues or other parts of the body.

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I. TRENDS IN INVASIVE CANCER INCIDENCE AND MORTALITY IN THE GREATER BAY AREA

Cancer incidence and mortality have decreased significantly during the 30-year period from 1988 through 2017 in the Greater Bay Area. For each cancer site, there are notable differences by sex and race/ethnicity, but overall, there are promising patterns of decreasing incidence and mortality for most cancer sites. The report focuses on sex- and race/ethnicity-specific cancer rates and trends as well as notable trends seen among all populations combined. Since 1988, the incidence and mortality rates of cancer (calculated as number of new cases and deaths per 100,000 individuals, respectively) have greatly decreased in the Greater Bay Area, with distinct declines seen in the latest 10-year period of available data from 2008 through 2017 **(Figures 1-4)**.

Incidence

Decreasing incidence of many cancers, as evident from the average annual percent changes, is due in part to changes in cancer screening and the reduction in smoking prevalence. For all invasive cancers combined, the average annual percent decrease in males from 1988 through 2017 was -1.2%, and for females was -0.4%.

In the past 10 years alone (2008-2017), cancer incidence rates declined annually for several cancers including colorectal (males: -3.1%, females: -3.5%), lung (males: -3.1%, females: -2.4%), bladder (males: -1.8%, females: -3.4%), and stomach cancers (males: -1.7%, -0.5%). Additionally, males experienced significant average annual decreases in the incidence of prostate cancer (-6.7%), which may be attributable to changes in prostate cancer screening guidelines during this time frame that limited the ages of males recommended for routine screening by prostate-specific antigen or PSA. Only thyroid cancer (3.8%) and malignant melanoma (2.5%) increased significantly on an annual basis during this period among males **(Figure 1)**. For females, annual incidence rates increased significantly for malignant melanoma (2.2%), thyroid (1.4%), and uterine cancers (1.0%) **(Figure 2)**.

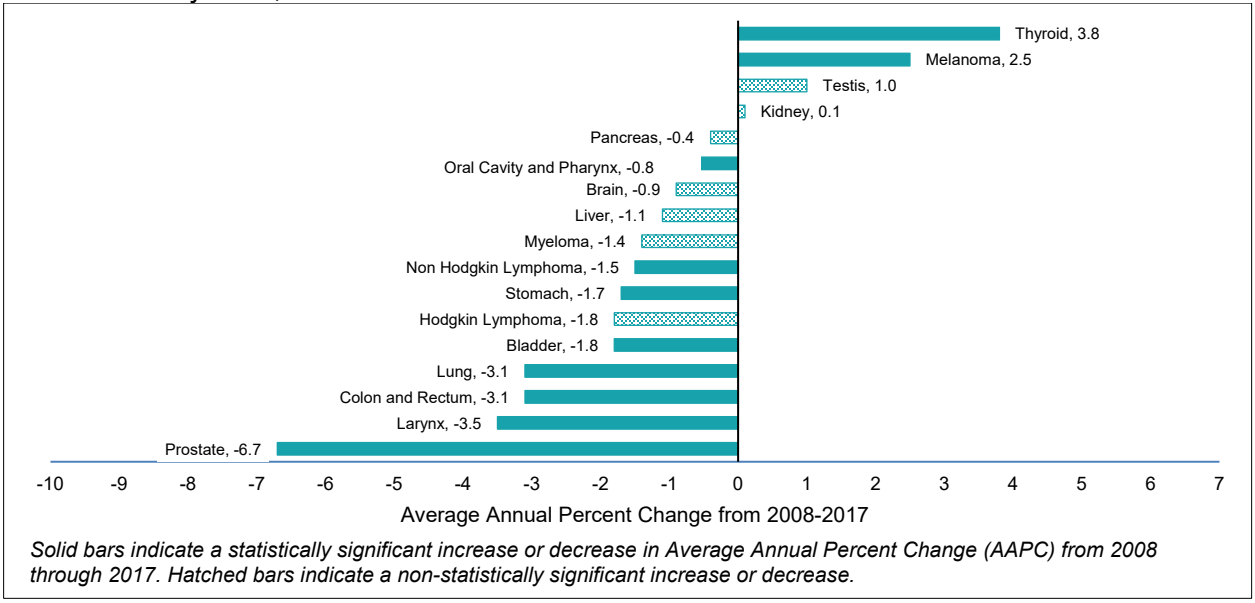
Mortality

Cancer mortality rates for the Greater Bay Area have also declined since 1988, by an average annual percent of -2.0% for males, and -1.6% for females. However, during the the most recent five years of data (2013 to 2017), there was a greater decline in cancer mortality among males (-2.8% per year). Among females, cancer mortality decreased by -1.6% per year during this same time. Significant decreases in cancer deaths were also noted nationwide in the Annual Report to the Nation [4].

During the most recent 10-year period, mortality in the GBACR declined by an average of -2.3% per year in males, and -2.2% in females. More specifically, cancer mortality rates declined for several of the most common cancers such as lung cancer (males: -3.8%, females: -4.2%), colorectal cancer (males: -3.8%, females: -3.2%), and Non-Hodgkin lymphoma (males: -2.8%, females: -2.3%) **(Figures 3, 4)**. Males experienced significant annual declines in mortality rates of prostate (-2.1%), stomach (-2.4%), Non-Hodgkin lymphoma (-2.8), colorectal, (3.8%), lung (4.2%), malignant melanoma (-4.3%) and laryngeal cancers (-8.3%). Females experienced significant annual declines in mortality rates of melanoma (-6.7%), oral

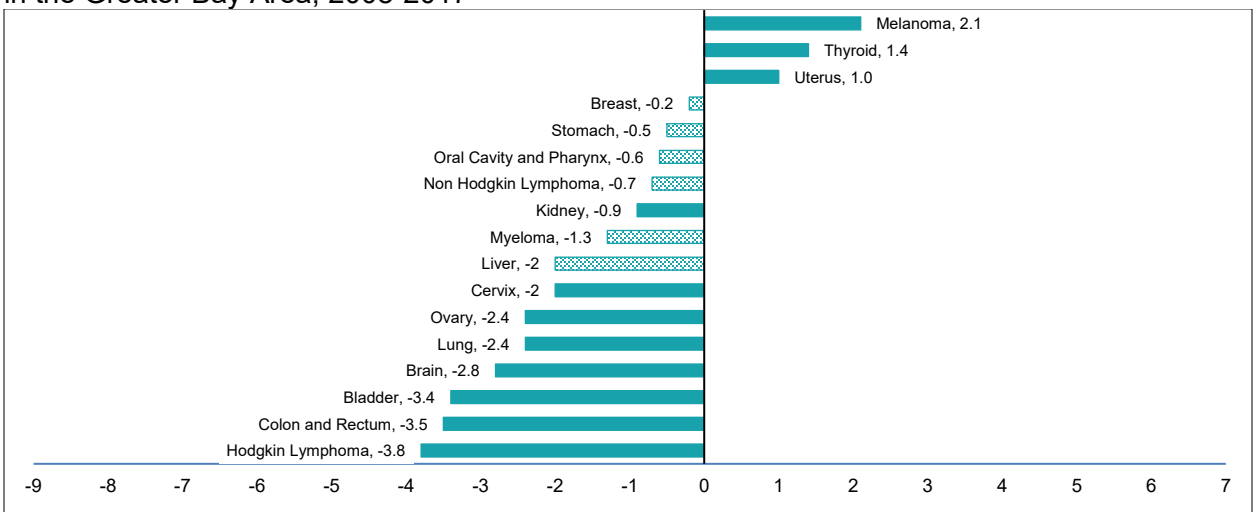
cavity/ pharynx cancer (-4.1%), lung cancer, (-3.8%), colorectal (-3.2%), kidney (-2.7%), ovary (-2.5%), and breast cancer (-2.2%). The only cancer site with a significance increase in mortality rate was female uterine cancer (3.2%), and there were no significantly increased mortality rates for males for any cancer from 2008 through 2017.

Figure 1: Average Annual Percent Change of Invasive Cancer Incidence Rates among Males in the Greater Bay Area, 2008-2017



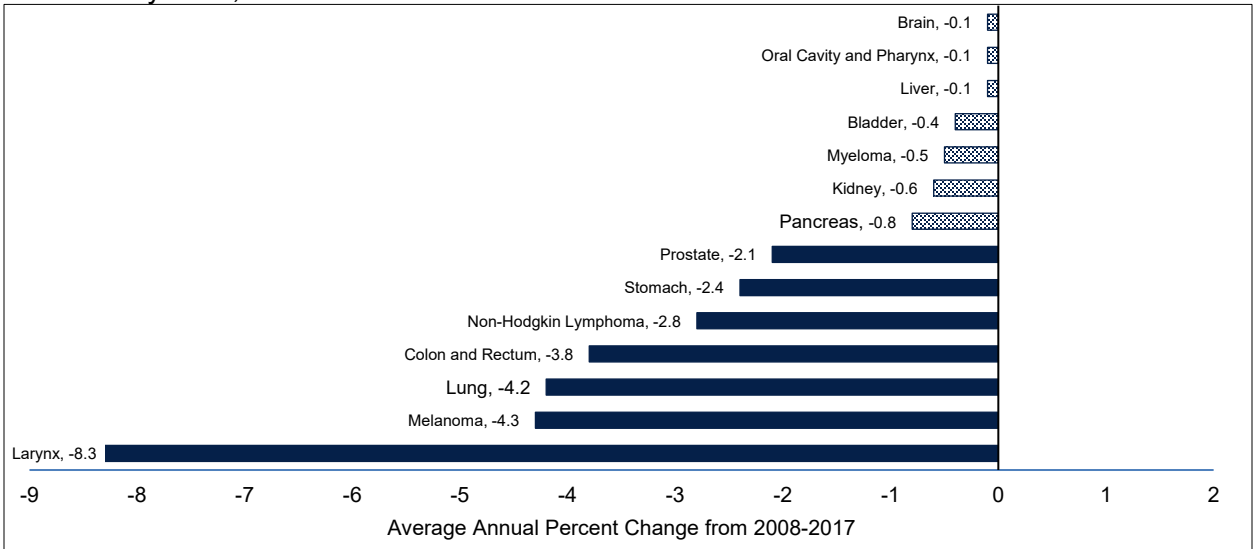
Solid bars indicate a statistically significant increase or decrease in Average Annual Percent Change (AAPC) from 2008 through 2017. Hatched bars indicate a non-statistically significant increase or decrease.

Figure 2: Average Annual Percent Change of Invasive Cancer Incidence Rates among Females in the Greater Bay Area, 2008-2017



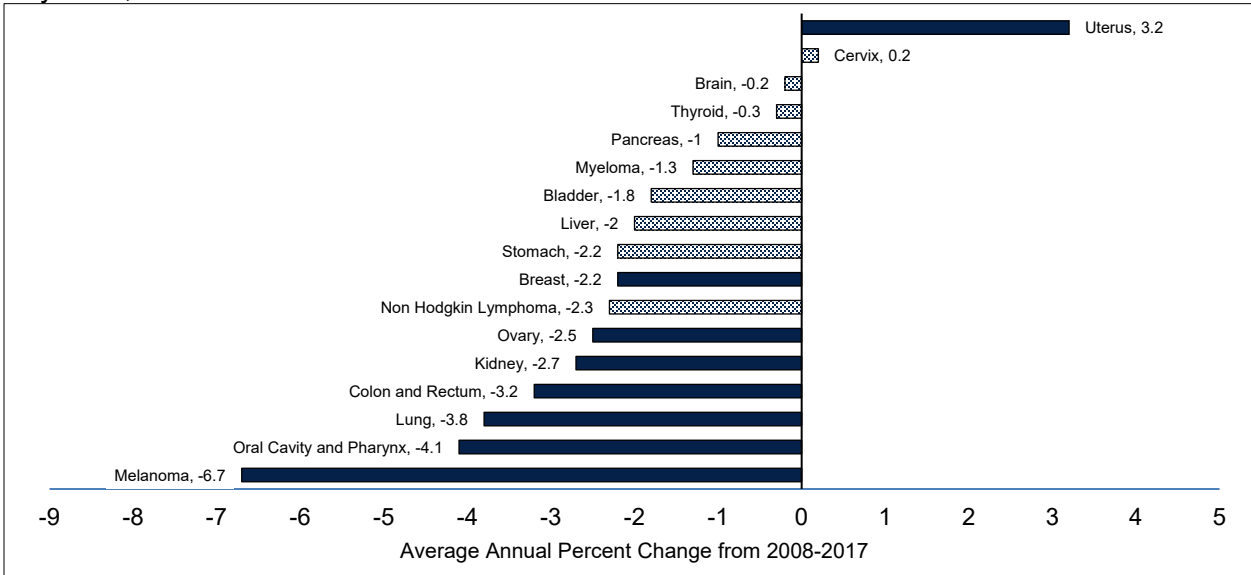
Solid bars indicate a statistically significant increase or decrease in Average Annual Percent Change (AAPC) from 2008 through 2017. Hatched bars indicate a non-statistically significant increase or decrease.

Figure 3: Average Annual Percent Change of Cancer Mortality Rates among Males in the Greater Bay Area, 2008-2017



Solid bars indicate a statistically significant increase or decrease in Average Annual Percent Change (AAPC) from 2008 through 2017. Hatched bars indicate a non-statistically significant increase or decrease.

Figure 4: Average Annual Percent Change of Cancer Mortality Rates among Females in the Greater Bay Area, 2008-2017



Solid bars indicate a statistically significant increase or decrease in Average Annual Percent Change (AAPC) from 2008 through 2017. Hatched bars indicate a non-statistically significant increase or decrease.

II. ALL INVASIVE CANCERS IN THE GREATER BAY AREA, 1988-2017

Overall Invasive Cancer Incidence Rates

From 1988 through 2017, incidence rates of all invasive cancers (i.e., rate of newly diagnosed cancers of any site) declined substantially in the Greater Bay Area **(Figure 5)**. Invasive cancers are those determined by a pathologist to have spread beyond the tissue of origin and invaded the surrounding tissue (i.e., not *in situ* or benign cancers). The annual percent decrease in incidence rates from 1988 through 2017 was substantially greater for males than females (-1.2% vs. -0.4%, respectively), driven largely by declines in the incidence rates of smoking-related cancers and prostate cancer in males (data not shown). During the recent 5-year period of 2013-2017, 161,620 new cases of invasive cancer were diagnosed in the Greater Bay Area. In 2017 alone, 33,098 new cases of cancer were diagnosed.

The five most common invasive cancers—breast, prostate, lung and bronchus, colorectal, and melanoma—accounted for over half (53.0%) of all newly diagnosed cancers. The incidence rate of all invasive cancers from 2013-2017 was higher in males (421.7 per 100,000) than in females (380.3 per 100,000) **(Table 1)**. In the Greater Bay Area, non-Hispanic (NH) Black males had the highest incidence rate (502.3 per 100,000), while Asian/Pacific Islander males) had the lowest incidence rate (302.6 per 100,000). NH White females had the highest incidence rate (429.7 per 100,000) and Asian/Pacific Islander females had the lowest rate (302.9 per 100,000). Incidence rates of all invasive cancers among males and females in the Greater Bay Area were almost identical to the rates in California. However, the rates for NH Black and Asian/Pacific Islander males and females were slightly higher in the Greater Bay Area.

Figure 5: Age-Adjusted Incidence Rates and Trends for All Invasive Cancers in the Greater Bay Area by Race/Ethnicity, 1988-2017

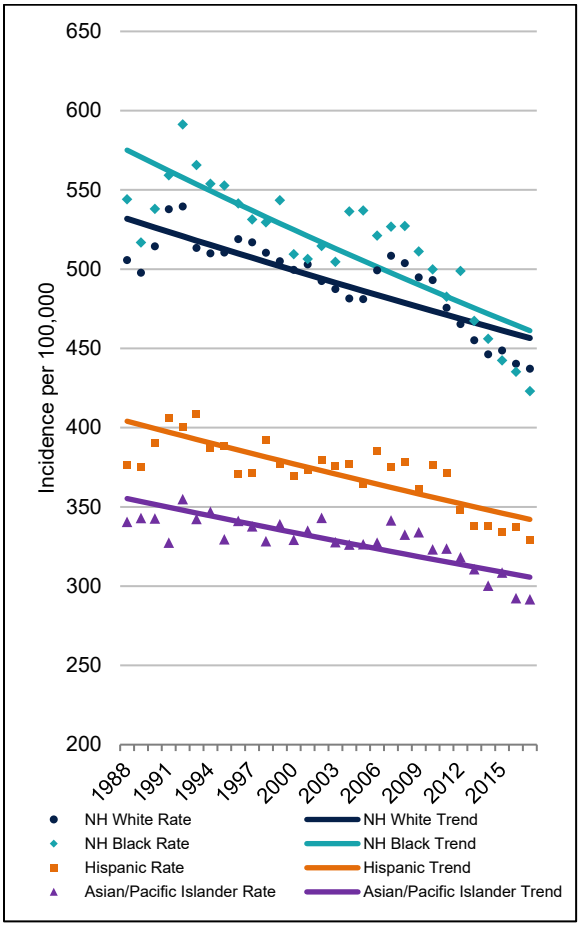


Table 1: Age-Adjusted Incidence Rates for All Invasive Cancers per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2013-2017

Race/Ethnicity	**Greater Bay Area**		**California**	
	Males	Females	Males	Females
All Races/Ethnicities	421.7	380.3	424.6	381.8
Non-Hispanic White	472.4	429.7	470.4	427.0
Non-Hispanic Black	502.3	402.3	469.9	388.4
Hispanic	356.5	327.4	341.9	317.4
Asian/Pacific Islander	302.6	302.9	290.6	301.4

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

Overall Cancer Mortality Rates

As with overall cancer incidence, deaths due to cancer also declined dramatically from 1988 through 2017 in the Greater Bay Area **(Figure 6)**. In general, a more substantial decline in cancer mortality occurred for males than females over the 30 year period. Among males, the annual percent decline in mortality was -2.0%, compared to females, (-1.6%) (data not shown). Cancer mortality rates fell from 564.6 to 413.28 per 100,000 among males, and 426.2 to 369.4 per 100,000 among females. During this 30 year period, cancer mortality declined across all racial/ethnic groups, particularly among NH Black males and females. Deaths due to cancer declined -2.2% per year among NH Black males, and -1.6% for NH Black females, with similar patterns observed in California [3]. From 2013 through 2017, the overall cancer mortality rate in the Greater Bay Area was significantly lower than the mortality rate for California. This was driven by the lower NH White mortality rate among males and females, compared to the statewide rate for these groups **(Table 2)**. Overall, males had a substantially higher mortality rate than females (151.3 vs. 113.53 per 100,000, respectively), with the highest mortality rate observed in NH Black males (222.9 per 100,000) and lowest mortality rate observed in Asian/Pacific Islander females (87.9 per 100,000). In just 2017, breast, prostate, lung, colorectal, and melanoma were the most common cancer sites, and lung, breast, prostate, colorectal, and pancreatic cancer were the most common cause of cancer deaths, collectively accounting for half of all cancer deaths in the Greater Bay Area **(Figure 7)**.

Figure 6: Age-Adjusted Mortality Rates and Trends for All Invasive Cancers in the Greater Bay Area by Race/Ethnicity, 1988-2017

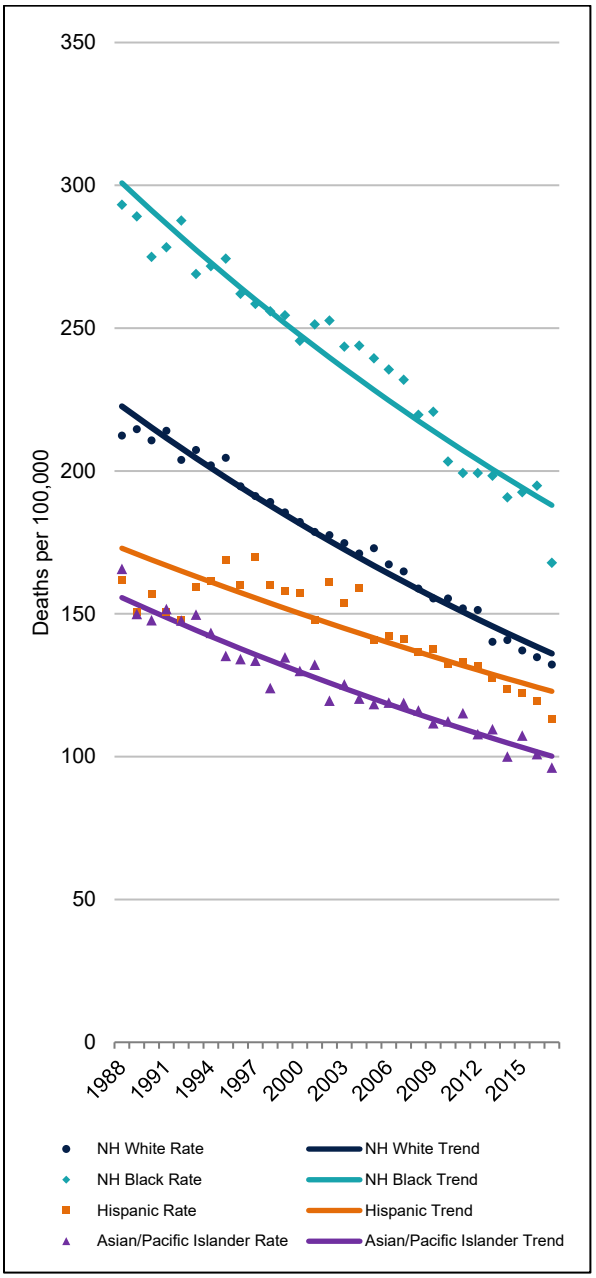
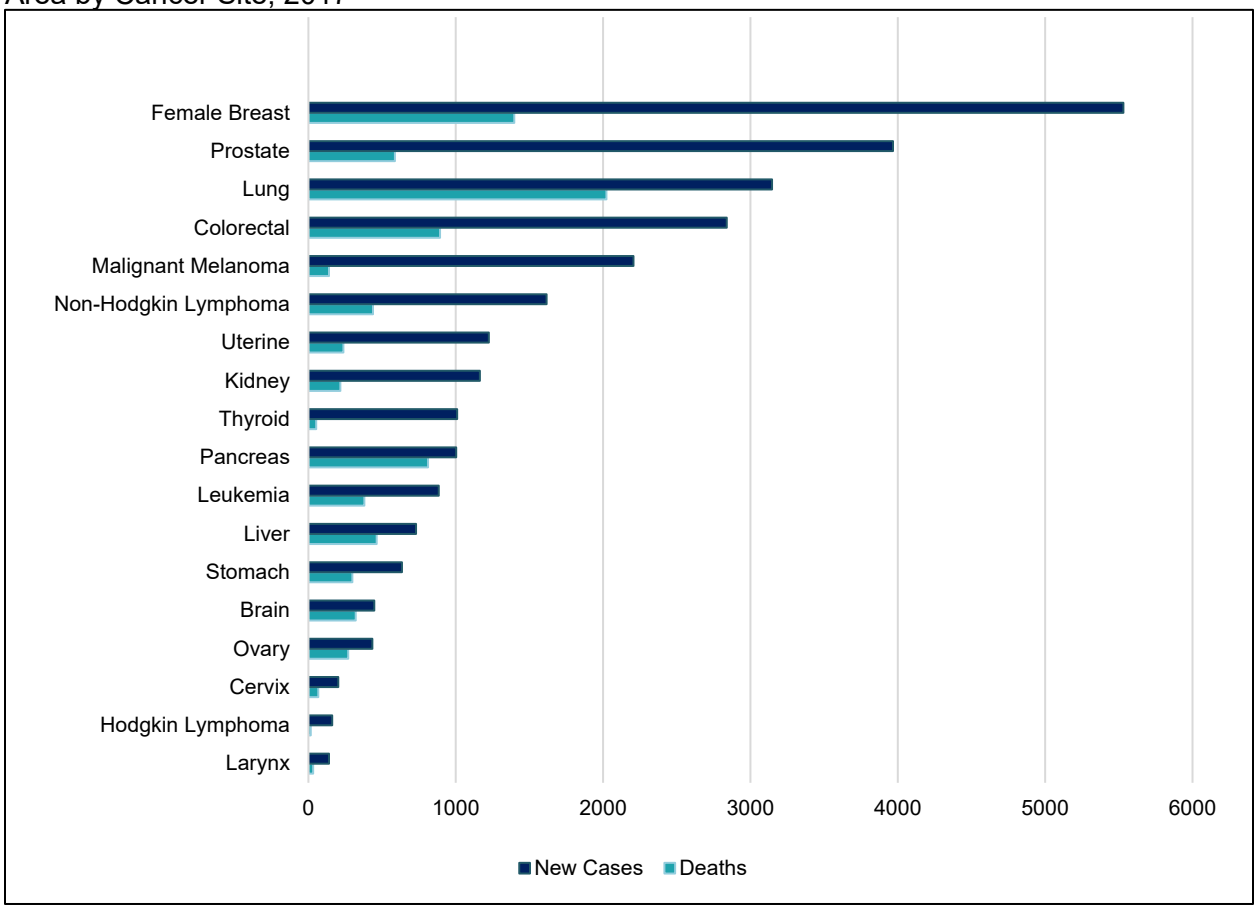


Table 2: Age-Adjusted Mortality Rates for All Invasive Cancers per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2013-2017

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	151.3	113.5	167.1	123.9
Non-Hispanic White	159.1	121.3	178.8	133.5
Non-Hispanic Black	222.9	162.7	221.2	161.3
Hispanic	138.4	105.9	143.6	107.6
Asian/Pacific Islander	121.0	87.9	127.5	93.0

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

Figure 7: Number of New Invasive Cancer Cases and Deaths from Cancer in the Greater Bay Area by Cancer Site, 2017



III. BREAST CANCER

Invasive breast cancer is the most common cancer in females, accounting for approximately a third of all invasive cancers diagnosed annually in the Greater Bay Area and in the state. From 2013 through 2017, there were 26,904 new invasive breast cancers diagnosed in females in the Greater Bay Area, and 133,272 in all of California. About one in eight females in the U.S. will develop invasive breast cancer within their lifetime. Risk factors include older age, family history of breast cancer, inherited genetic mutations (BRCA1 and BRCA2), early age of menarche, late age of menopause, no pregnancies or pregnancies later in life (i.e., first after age 30), postmenopausal hormone therapy use, obesity and excessive weight gain, physical inactivity, alcohol consumption, and dense breast tissue (as on a mammogram). However, risk factors differ across the different subtypes of breast cancer. An estimated 30% of postmenopausal breast cancers could potentially be prevented through lifestyle changes, such as maintaining a healthy weight, being physically active, and limiting alcohol intake [5-8].

Incidence trends of invasive breast cancer in the Greater Bay Area have generally paralleled those in California with overall general decline from 1988 to 2017. The well-documented decline since 2000, especially among NH White females, follows the broad cessation of hormone therapy use [9, 10] in response to the seminal report by the Women's Health Initiative of increased breast cancer risk associated with certain formulations of hormone therapy [11]. Yet, there have been striking racial/ethnic differences in breast cancer incidence rates **(Figure 8)**. For NH Black females, the annual incidence rate of invasive breast cancer has remained stable during the time period of 1988-2017. For both NH White and Hispanic females, there was an overall annual decrease in the incidence rate of invasive breast cancer by 0.3% per year. Whereas for Asian/Pacific Islander females, the rates have steadily increased since 1988, by 1.0% per year. The underlying reasons for these increasing rates in Asian/Pacific Islander females are poorly understood. Recent analyses have suggested incidence patterns may differ within the various ethnicities represented by the heterogeneous group of Asians/Pacific Islanders, population groups that are well represented in the Bay Area. The increase in incidence in Asian/Pacific Islander females may be attributable to the changing immigration patterns and/or acculturation experiences of specific Asian American ethnic groups [12-15].

For the most recent time period (2013-2017), the incidence rate of breast cancer in the Greater Bay Area (126.1 per 100,000 females) was slightly higher than that for California (121.4 per 100,000) **(Table 3)**. Rates varied across counties in the Greater Bay Area (www.cancer-rates.info/ca/). Marin County has long been recognized for having high breast cancer rates, particularly in NH White females. For NH White females, the rate in San Mateo County (158.0 per 100,000) slightly exceeded that in Marin (153.3 per 100,000), and San Francisco (151.1 per 100,000) counties during the recent 5-year period (2013-2017). Perhaps the most striking regional differences in rates were for Asian/Pacific Islander females, for whom the rates in San Mateo County (127.9 per 100,000) and Marin County (136.9 per 100,000) were significantly higher than that for Asian/Pacific Islander females in the Greater Bay Area (106.7 per 100,000) and California (103.3 per 100,000) **(Table 3)**.

Figure 8: Age-Adjusted Incidence Rates and Trends for Female Invasive and *In Situ* Breast Cancer in the Greater Bay Area by Race/Ethnicity, 1988-2017

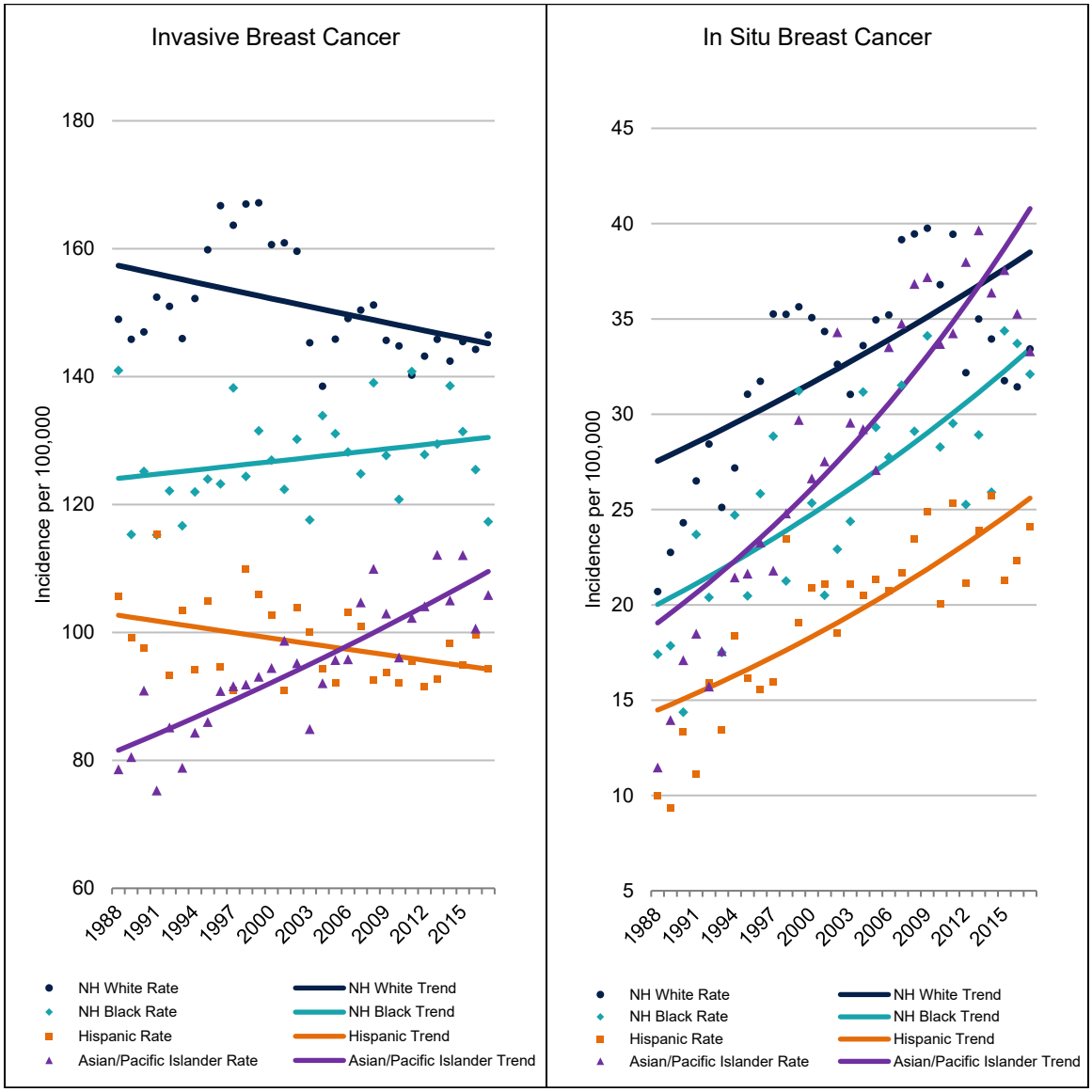
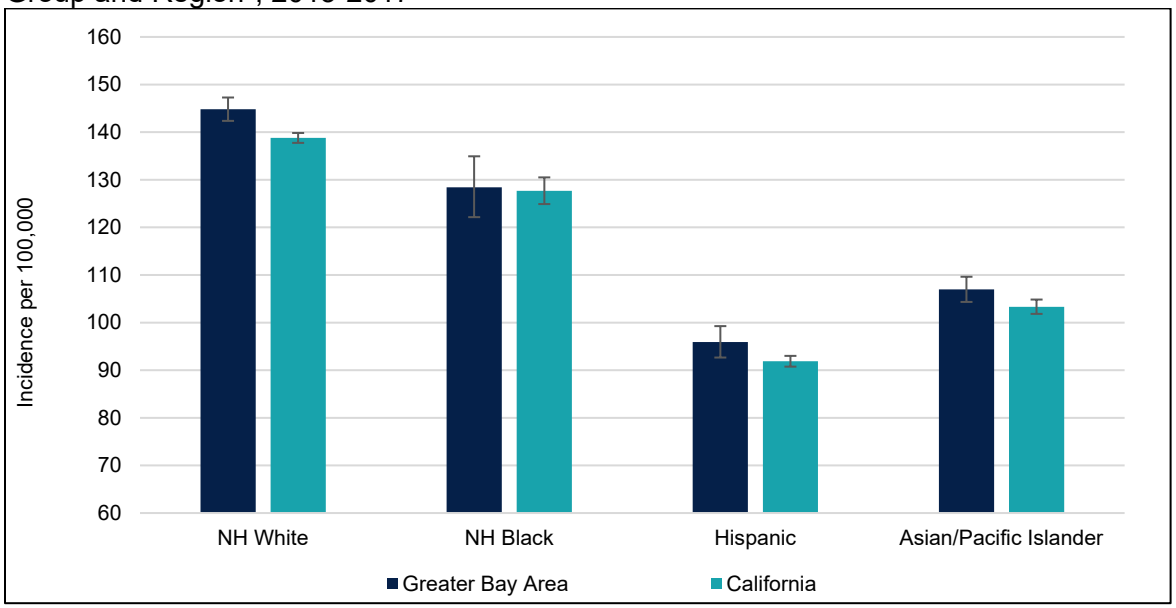


Figure 9: Female Invasive Breast Cancer Age-Adjusted Incidence Rates [1] by Racial/Ethnic Group and Region[2], 2013-2017



[1] Error bars (in black at the top of the bars) indicate 95% confidence intervals for the corresponding incidence rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

Table 3. Female Invasive Breast Cancer Age-Adjusted Incidence Rates (per 100,000 females) by Racial/Ethnic Group and County/Region, 2013-2017

Geographic Location	NH White	NH Black	Hispanic	Asian/ Pacific Islander
California	138.8	127.7	91.9	101.3
Greater Bay Area	144.8	128.4	95.9	106.7
Alameda County	143.0	126.5	89.8	103.5
Contra Costa County	140.2	128.8	99.6	115.0
Marin County	153.3	146.4	104.5	136.9
San Francisco County	151.0	135.1	92.8	108.3
San Mateo County	158.0	130.6	93.7	127.8
Santa Clara County	142.6	133.8	103.5	97.2
Monterey County	133.2	102.6	89.5	118.3
San Benito County	103.4	^	99.1	^
Santa Cruz County	144.9	^	90.7	110.0

^ Statistic not displayed due to fewer than 11 cases.

In situ carcinomas of the breast, specifically ductal carcinoma *in situ* (DCIS) and lobular carcinoma *in situ* (LCIS), reflect cancer cells of the milk ducts or milk-making glands, respectively, that do not spread to surrounding healthy breast tissue. DCIS, the most common, is thought to have the potential to progress to invasive breast cancer [16] and is captured by cancer registries as a reportable cancer. Incidence rates of *in situ* breast carcinomas in the Greater Bay Area increased significantly from 1988 through 2017 by an average of 1.3% per year. Incidence rates for *in situ* breast cancer have increased significantly from 1988 through 2017 for all racial/ethnic groups with the largest average increase per year seen in Asian/Pacific Islander females (2.7%), followed by Hispanic females (2.0%), NH Black females (1.8%), and NH White females (1.2%; **Figure 8)**. The incidence rate of *in situ* carcinomas for the Greater Bay Area (32.4 per 100,000) was significantly higher than the rate for California (27.9 per 100,000).

Mortality rates for invasive breast cancer declined significantly in all racial/ethnic groups from 1988 through 2017, with the largest average declines per year seen in NH White females (-2.2% per year), followed by Hispanics (-1.8%), NH Blacks (-1.6%), and Asians/Pacific Islanders (-0.9%; **Figure 10)**. From 2013 through 2017, breast cancer mortality rates varied by race/ethnicity, with the highest rates in NH Black females (26.6 per 100,000) followed by NH White females (19.6 per 100,000), Hispanic females (14.6 per 100,000) and Asian/Pacific Islander females (11.9 per 100,000) in the Greater Bay Area **(Figure 11)**. The breast cancer mortality rate for all racial/ethnic groups together was significantly lower in the Greater Bay Area (17.3 per 100,000) than in California (19.5 per 100,000).

Figure 10: Age-Adjusted Mortality Rates and Trends for Female Invasive Breast Cancer in the Greater Bay Area by Race/Ethnicity, 1988-2017

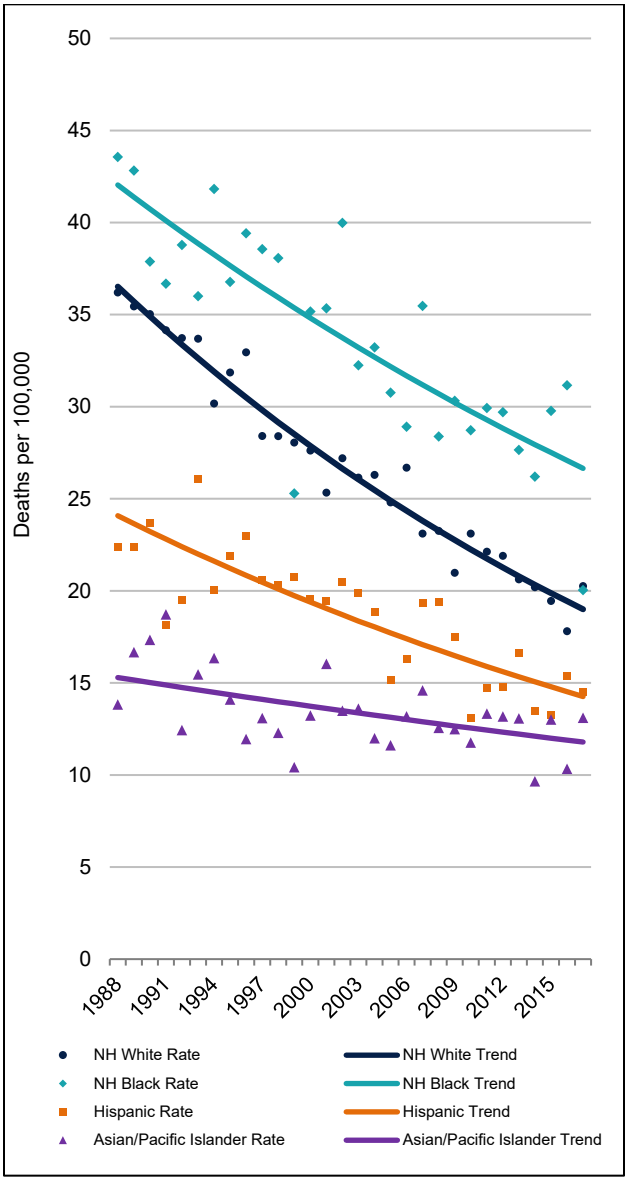
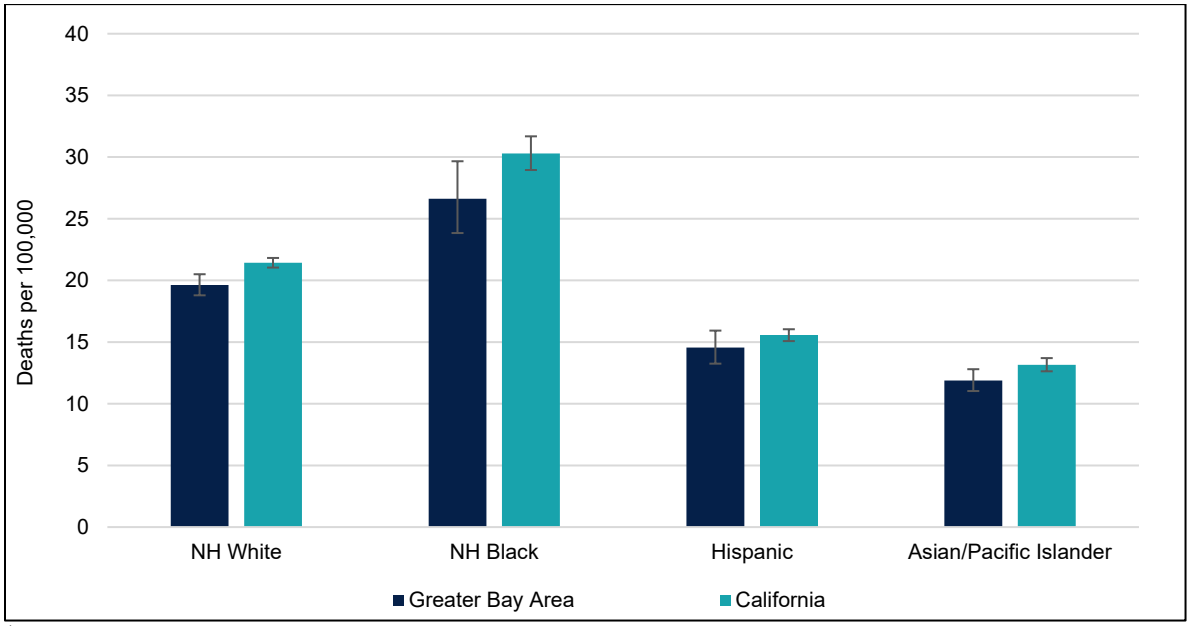


Figure 11: Female Invasive Breast Cancer Age-Adjusted Mortality Rates [1] by Racial/Ethnic Group and Region[2], 2013-2017



[1] Error bars (in black at the top of the bars) indicate 95% confidence intervals for the corresponding mortality rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

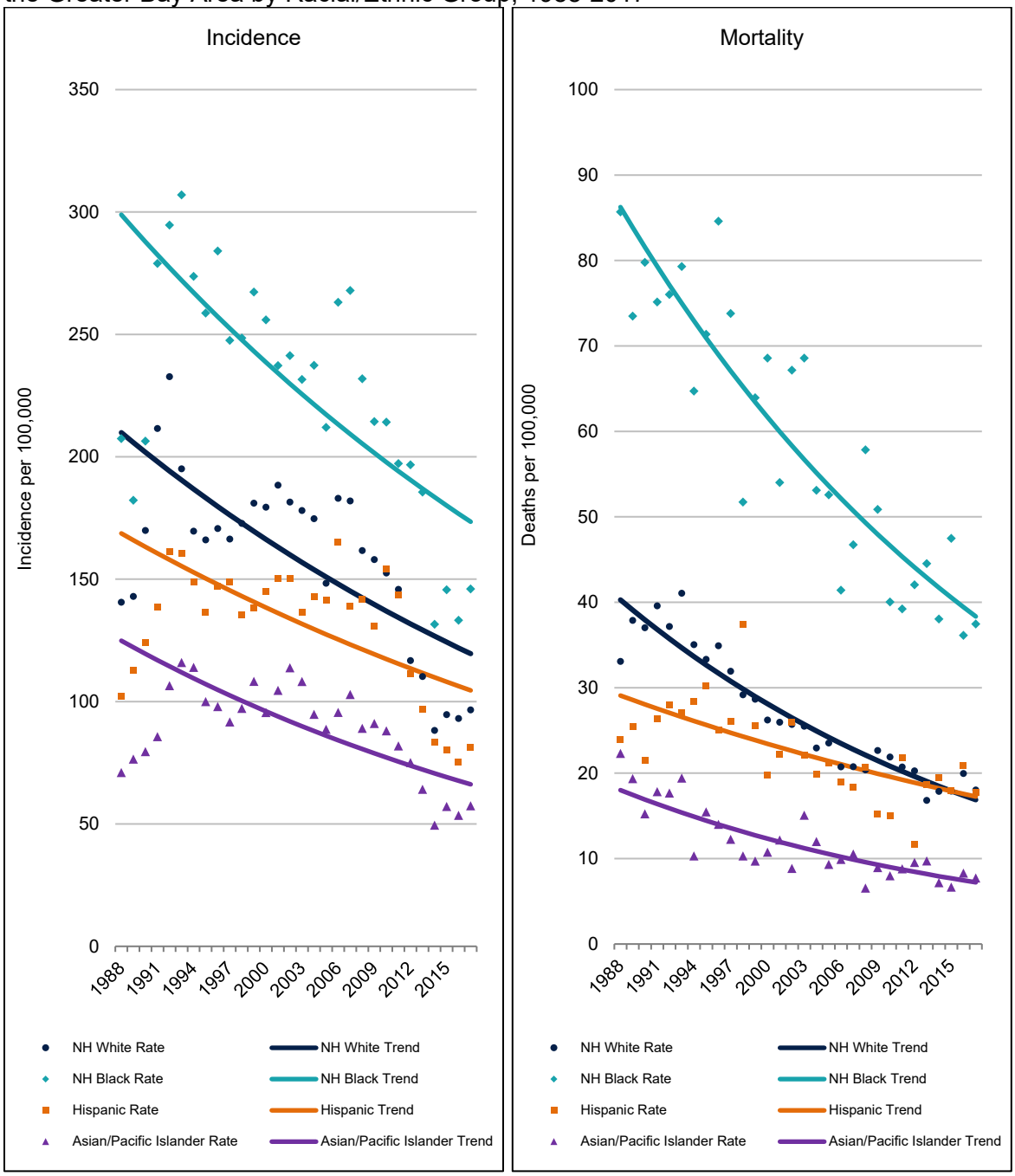
IV. PROSTATE CANCER

Prostate cancer was the most commonly diagnosed cancer in Greater Bay Area males in the years 1988 through 2017. From 2013 through 2017, NH Black males had the highest incidence rate (148.1 per 100,000 males) followed by NH White males (96.5 per 100,000), Hispanic males (83.0 per 100,000), and Asian/Pacific Islander males (56.2 per 100,000).

Prostate cancer incidence rates spiked in 1992, which has been attributed to the widespread adoption of prostate-specific antigen (PSA) screening. Incidence rates then declined with the drop in the detection of prostate cancers after the introduction of PSA screening **(Figure 12)** [17, 18]. However, as evidence that widespread screening did not improve survival among males older than 75 years of age, the U.S. Preventive Services Task Force recommended against PSA-screening in this age group in 2008 [19]. Furthermore, in 2012, the Task Force recommended against screening at all ages due to evidence that treatment for screening-detected prostate cancer resulted in more harm than benefit [20]. This recommendation and the associated decrease in screening, likely contributed to the national declines in prostate cancer diagnoses in recent years. In fact, in the Greater Bay Area, a significant decline in incidence occurred among males in all races/ethnicities between 1998 through 2017, at an average of -2.0% per year. However, it has recently been noted that after the decline of PSA screening, there has been an increase in late-stage disease at the national level [21]. The *most recent* screening recommendation (May 2018) states that for men aged 55 to 69 years, the decision to undergo periodic PSA screening for prostate cancer should be an individual one, made with each patient's clinician, including a discussion of the potential harms and benefits of such screening [22]. Furthermore, clinical practice has shifted towards more conservative management for low risk prostate cancer through active surveillance or watchful waiting [23]. The implications of this shift in clinical practice on prostate cancer mortality is unclear; the GBACR will closely monitor the trends in prostate cancer mortality.

Prostate cancer mortality rates have steadily declined in males by an average of -3.2% per year from 1988 through 2017, and declines were seen across all racial/ethnic groups **(Figure 12)**. Because most prostate cancers have a good prognosis even without treatment, the lifetime risk for dying of prostate cancer is very low (2.8%) [20]. From 2013 through 2017, the mortality rate was highest among NH Black males (41.3 per 100,000), whose rate was more than double the rates in NH White males (18.1 per 100,000) and Hispanic males (18.1 per 100,000), and almost five times the rate in Asian/Pacific Islander males (8.2 per 100,000). These rates were relatively similar or slightly lower than the mortality rates in California from 2013 through 2017.

Figure 12: Prostate Cancer Age-Adjusted Annual Incidence and Mortality Rates and Trends in the Greater Bay Area by Racial/Ethnic Group, 1988-2017



V. LUNG AND BRONCHUS CANCER

Due to aggressive anti-smoking policies and subsequent reductions in the prevalence of smoking over many years, lung and bronchus cancer incidence and mortality in the Greater Bay Area have continued to decrease through 2017 (**Figure 13**). In the most recent 10 year period (2008-2017), incidence has decreased by an average of -3.1% per year in males, and -2.4% per year in females. From 1988 through 2017, the declines in incidence rates were significant across all racial/ethnic groups, with the largest decline seen among NH White males and females (-2.0% per year) and the smallest decline seen among Asian/Pacific Islander males and females (-0.9%). Notably, among Asian/Pacific Islander females, the incidence rates of lung cancer were stable during this time in contrast to the significant declining trends across males and females of all other racial/ethnic groups.

Lung and bronchus cancer continues to be the second most common cancer diagnosis for males and females in the Greater Bay Area. From 2013 through 2017, approximately 16,000 new lung and bronchus cancers were diagnosed. The highest incidence rates of lung and bronchus cancer were observed among NH Black males and females (68.3 and 48.3 per 100,000, respectively) followed by Asian/Pacific Islander males (47.4 per 100,000) **(Table 4a)**. Hispanic females had the lowest rate (24.5 per 100,000). From 2013 through 2017, the Greater Bay Area incidence rates of lung and bronchus cancer for NH White males and females were lower than rates in California. In contrast, incidence rates for Hispanic males and females and Asian/Pacific Islander males and females in the Greater Bay Area were higher than those in California.

Despite the overall decline in incidence and mortality, from 2013 through 2017, lung and bronchus cancer continues to be the top contributor to causes of cancer deaths, representing 19.0% (975 deaths) of all cancer deaths among females and 20.0% (1,048 deaths) of all cancer deaths among males in the Greater Bay Area. The mortality rate of lung and bronchus cancer declined annually by an average of -2.5% per year from 1988 through 2017, ranging from -2.5% in NH White males and females to -1.6% in Asian/Pacific Islander males and females. From 2013 through 2017, NH Black males and females had the highest lung and bronchus cancer mortality rates (50.2 and 32.7 per 100,000, respectively), while the lowest mortality rates were observed in Hispanic and Asian/Pacific Islander females (14.2 and 17.7 per 100,000 respectively; **Table 4b**). The rates in the Greater Bay Area were substantially lower for NH White males and females in comparison to rates in California. In contrast, fairly similar mortality rates were seen for NH Black, Hispanic, and Asian/Pacific Islander males and females in the Greater Bay Area than in California.

In 2013, the U.S. Preventive Services Task Force recommended annual lung cancer screening by low-dose computed tomography (LDCT) for high risk populations (adults aged 55 to 80 years, who have a 30 pack-year smoking history and currently smoke or have quit within the past 15 years); starting in 2015, Medicare approved coverage for this screening [24, 25]. Despite this recommendation, screening uptake has been low [26].

In 2016, just 1.9% of 7.6 million estimated eligible smokers in the U.S. were screened, and rates varied across the nation from 1.0% (Western U.S.) to 3.5% (Northeastern U.S.). Awareness programs and mandated LDCT screening are recommended to prevent thousands of deaths due to lung cancer nationwide.

Table 4a and 4b: Lung and Bronchus Cancer Age-Adjusted Incidence and Mortality Rates per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2013-2017

4a: Incidence

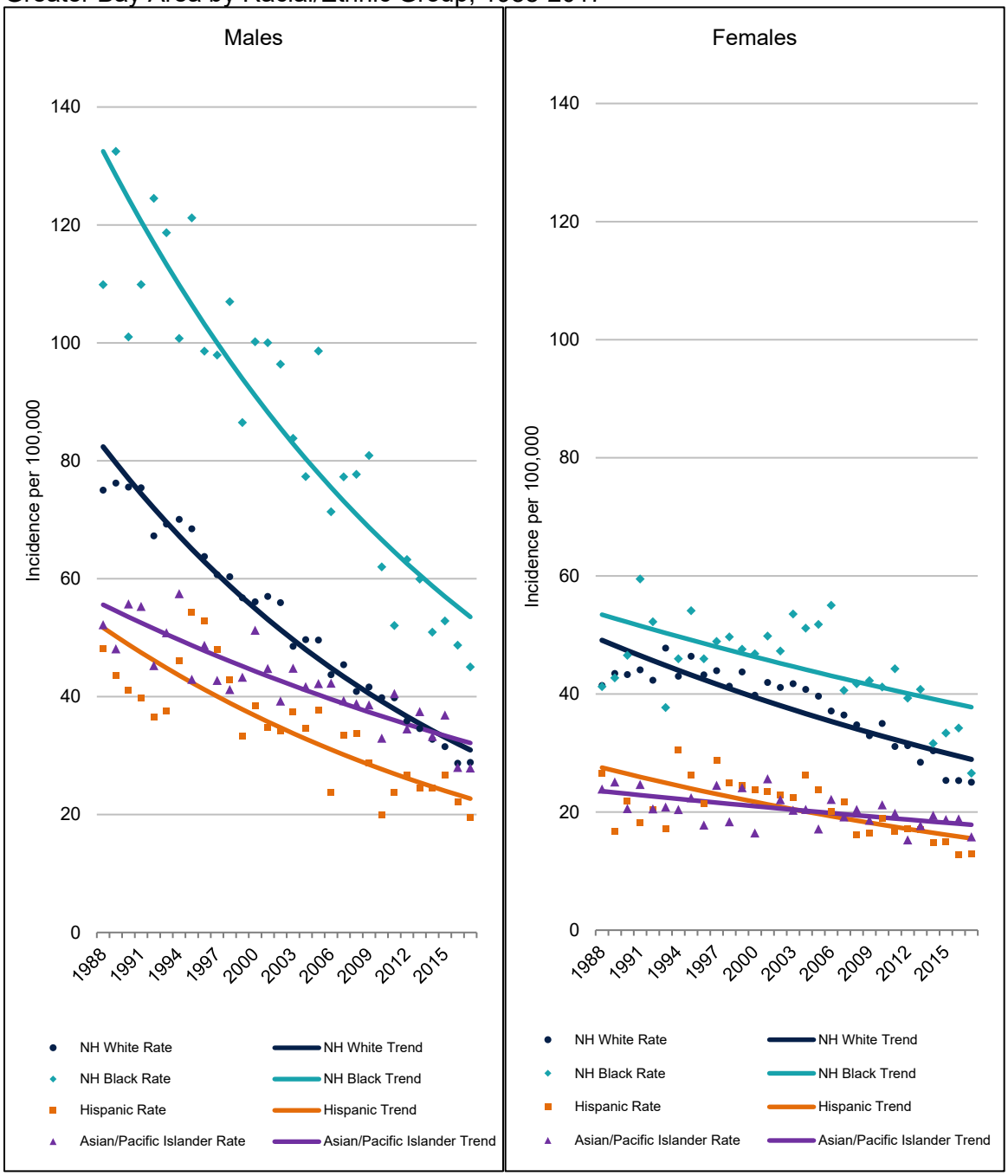
Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	44.4	36.1	46.4	37.8
Non-Hispanic White	42.8	41.5	50.9	45.9
Non-Hispanic Black	68.3	48.3	63.4	46.4
Hispanic	34.4	22.5	29.6	20.7
Asian/Pacific Islander	47.4	29.2	44.6	27.6

4b: Mortality

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	31.3	23.2	34.8	25.3
Non-Hispanic White	30.7	26.9	38.2	30.9
Non-Hispanic Black	50.2	32.7	49.7	32.5
Hispanic	23.8	14.2	22.3	13.6
Asian/Pacific Islander	31.7	17.7	32.4	17.5

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

Figure 13: Lung and Bronchus Cancer Age-Adjusted Annual Incidence Rates and Trends in the Greater Bay Area by Racial/Ethnic Group, 1988-2017



VI. SMOKING-RELATED CANCERS

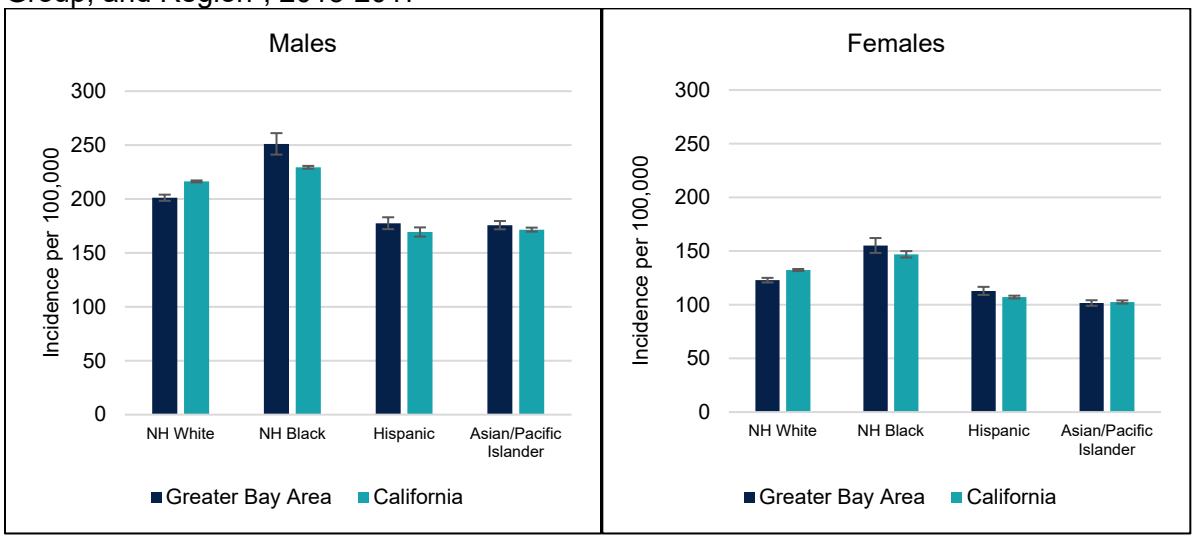
As defined by the U.S. Surgeon General, cancers known to be smoking-related include cancers of the lung, oral cavity and pharynx, esophagus, stomach, colon/rectum, liver, pancreas, larynx, bladder, kidney, and acute myeloid leukemia [27, 28]. Following national declines in smoking prevalence, incidence rates of these smoking-related cancers (combined) declined significantly from 1988 through 2017 among males and females in all racial/ethnic groups. From 1988 through 2017, the most substantial annual declines in incidence rates were observed for NH Black (-1.6%) and White (-1.4%) males. For females, incidence in NH Whites and Asian/Pacific Islanders had the steepest annual decline (1.2%), while rates among NH Black and Hispanic females declined annually by -1.1% and -0.9% per year, respectively. Historically, declines in both incidence and mortality of smoking-related cancers in the Greater Bay Area have been among the steepest in the nation, likely due to the success of California's stringent tobacco-control programs. For all smoking-related cancers combined, the incidence rates for NH Black males and females were higher than among all other racial/ethnic groups, both in the GBACR and in California. GBACR rates were higher than California rates for NH Black and Hispanic males and females, and for Asian/Pacific Islander males **(Table 5, Figure 14)**.

Table 5. Smoking-Related Cancers[1] Age-Adjusted Incidence Rates per 100,000 by Sex, Racial/Ethnic Group, and Region[2], 2013-2017

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	195.7	118.8	202.2	124.4
Non-Hispanic White	201.2	122.9	216.3	132.3
Non-Hispanic Black	251.0	155.1	229.4	146.9
Hispanic	177.5	112.9	169.4	107.2
Asian/Pacific Islander	175.7	101.6	171.6	102.5

[1] Smoking-related cancer incidence is the combined incidence of lung, oral cavity and pharynx, esophagus, stomach, colorectal, liver, pancreas, larynx, bladder, kidney cancers, and acute myeloid leukemia, as defined by the U.S. Surgeon General [27, 28].
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

Figure 14: Smoking-related Cancers Age-Adjusted Incidence Rates[1] by Sex, Racial/Ethnic Group, and Region[2], 2013-2017



[1] Error bars (in black at the top of the bars) indicate 95% confidence intervals surrounding the corresponding incidence rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county region of the Greater Bay Area).

Cigarette smoking trends in the U.S.

Among adults in the U.S., an estimated 13.7% of the population were estimated to be current smokers. There are differences by sex, race/ethnicity and by region of the U.S. [29, 30]. In the U.S. population, 15.6% of males and 12.0% of females were estimated to be current smokers. Among adults, the percentage of current smoking ranked as follows by race/ethnicity: 22% for American Indian and Alaska Native; 15% for NH White; 14.6% for African American, 9.8% for Hispanic, and 7.1% for Asian American.

The percentage of the population that is estimated to be current smokers varies significantly by region. The Midwest has the highest percentage of smokers (16.2%) followed by the South (14.8%), and the Northeast (12.5%). The Western U.S. has the lowest percentage of current smokers (10.7%). Second only to Utah (9.0%), California has the lowest percentage of smokers in the U.S. (11.2%). This is likely due to California passing the nation's earliest statewide anti-smoking legislation (1995).

Highlights of trends in specific smoking-related cancers

Cancer of the oral cavity and pharynx (oropharyngeal cancer) was more common in males than females [25, 31, 32]. Risk factors include tobacco and heavy alcohol use, as well as infection with certain cancer-causing strains of human papillomavirus (HPV) [33]. The number of oropharyngeal cancers linked to HPV infection has increased dramatically over recent decades, with approximately 70% now caused by HPV infection [34, 35]. Efforts are underway to monitor HPV-related forms of oropharyngeal cancer.

The incidence of oropharyngeal cancer in males has steadily declined by -0.9% per year from 1988-2017. In females, there has been a greater decline in incidence of -1.4% per year from 1988-2017. In 2013-2017, the incidence rate (all races/ethnicities) was 15.0 per 100,000 in males, and 5.9 per 100,000 in

females. Incidence was almost twice as high in NH White males (18.1 per 100,000) than in Hispanic males (9.0 per 100,000). Less variation in incidence occurred among females. Asian/Pacific Islander and NH White females had the highest rates (6.5 and 6.2 per 100,000, respectively) and Hispanic females had the lowest rate (4.0 per 100,000). Incidence in NH White males in the Greater Bay Area was slightly higher than in California, and rates in the Greater Bay Area were comparable to California for all other racial/ethnic groups.

There has been a consistent decline in mortality from oropharyngeal cancer since 1988 for both sexes: -2.8% per year for males, and -3.1% per year for females. This trend may be due to changes in the underlying cause of oropharyngeal cancers. As the prevalence of smoking in the U.S. has declined, so has the incidence of smoking-related oropharyngeal cancers. At the same time, the incidence of HPV-positive oropharyngeal cancer has increased, and these tumors are associated with significantly improved survival [36]. For 2013-2017, the mortality rate for NH Black males (4.7 per 100,000) was the highest of all racial/ethnic groups, followed by NH White males (3.5 per 100,000), Asian/Pacific Islander males (3.0 per 100,000), and Hispanic males (2.4 per 100,000). The mortality rates of oropharyngeal cancer in females were very low, ranging from 1.0 per 100,000 in NH White and Asian/Pacific Islander females, to 0.8 per 100,000 in Hispanic females. The mortality rate for NH White males in the Greater Bay Area (3.5 per 100,000) was slightly lower than in California (4.4 per 100,000), but rates between the Greater Bay Area and California were comparable for NH Black, Hispanic, and Asian/Pacific Islander males, and among all racial/ethnic groups for females.

Bladder cancer, both invasive and *in situ*, was the 8th most commonly diagnosed cancer in the Greater Bay Area from 2013 through 2017, and was about four times more common in males (28.5 per 100,000) than females (6.8 per 100,000). Age-adjusted incidence rates were highest in NH White males and females (20.4 and 8.5 per 100,000, respectively) and lowest in Asian/Pacific Islander males and females (8.9 and 3.9 per 100,000, respectively). Incidence of bladder cancer increases sharply with age; approximately 85% of bladder cancers were diagnosed in people aged 60 and older. Smoking increases the risk of bladder cancer two- to four-fold and approximately half of urothelial bladder cancers (the most common kind of bladder cancer) are attributed to smoking [37-40]. Other risk factors for bladder cancer include exposures to various chemicals in the dye, rubber, metal, textile, and leather industries [39].

Incidence rates of bladder cancer have been declining over time. Overall since 2006, the incidence rates for males have decreased by -2.1% per year; for females, rates have decreased by -3.6% per year since 2010. Incidence rate trends have been steady or declining in all racial/ethnic groups except for NH Black males, for whom incidence rates have been increasing by 0.8% per year. For all racial/ethnic groups combined, from 1988 through 2017 mortality rates have been decreasing at a rate of 0.6% per year in males and 1.6% per year in females. Bladder cancer incidence rates were similar in the Greater Bay Area compared to California. However, bladder cancer mortality rates were lower in the Greater Bay Area than in California (5.8 per 100,000 vs 6.8 per 100,000 for males, and 1.6 per 100,000 vs 1.9 per 100,000 for females).

VII. MELANOMA

Melanoma, a cancer of the skin's pigment cells, is substantially more common among populations with fair complexions, which generally includes NH White males and females and to some extent, Hispanic males and females. In the Greater Bay Area, among NH White males, melanoma was the second most common newly diagnosed invasive cancer, behind prostate cancer, and accounting for 12.0% (5,687 cases) of all new cancers from 2013-2017. Melanoma risk factors include fair skin complexion and exposure to sunlight over long periods of time [41]. From 2013 through 2017, the incidence rate of invasive melanoma for NH White males and females combined (46.2 per 100,000) was more than six times higher than for Hispanic males and females (7.2 per 100,000). Rates were extremely low in Asian/Pacific Islander males and females (1.2 per 100,000) and NH Black males and females (1.0 per 100,000). From 1988 through 2017, invasive melanoma incidence for NH White males and females rose rapidly in the Greater Bay Area, at an average of 3.6% per year. During this same time period, rates increased for Asian/Pacific Islander males and females by 1.3% per year, and for Hispanic males and females by 1.6% per year. Incidence rates for NH Black males and females have remained stable.

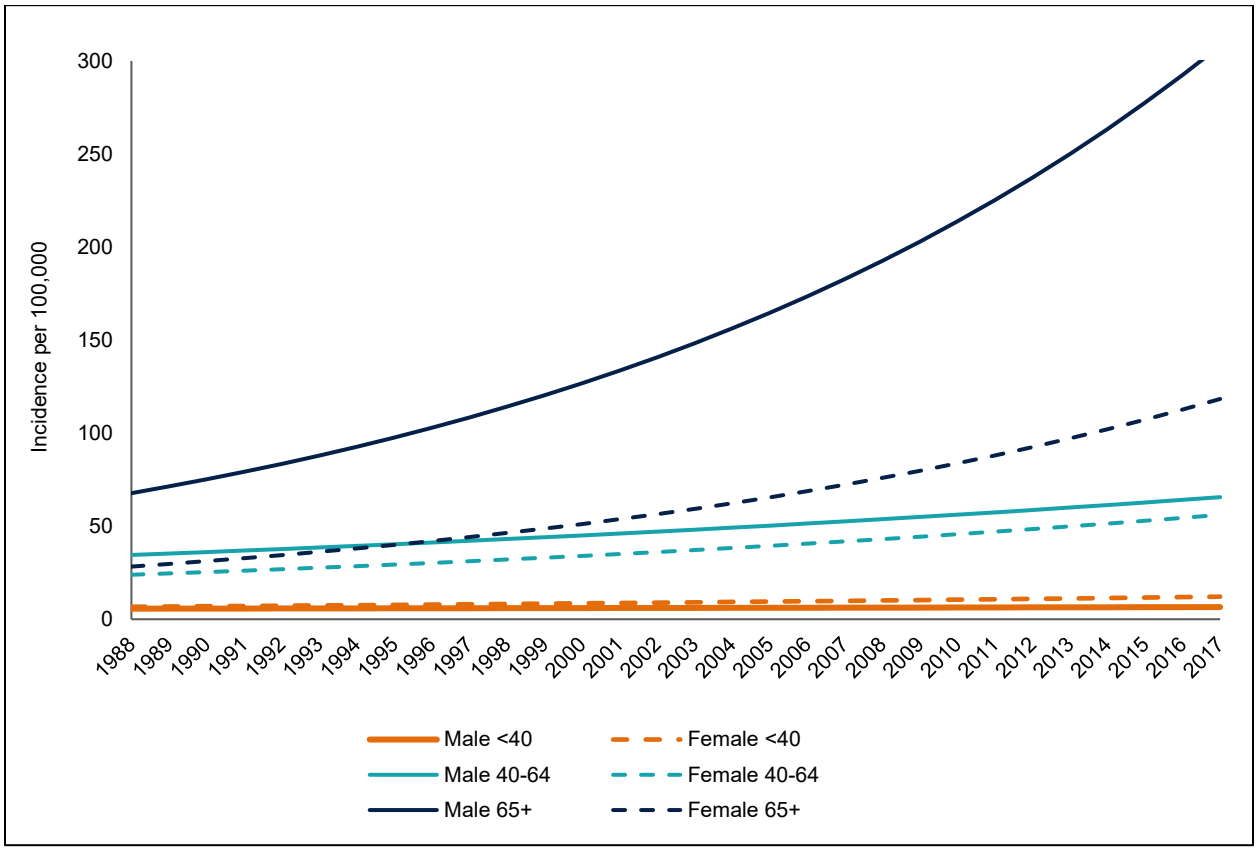
Melanoma incidence rates among NH White males and females increased substantially over time, particularly for males aged 65 years and older in comparison to all other age groups for males or females **(Figure 15)**. Overall, in the past decade, invasive melanoma incidence rates among NH White males and females have been significantly higher and increased more rapidly in the Greater Bay Area than in California. Among NH White males and females during the recent 5-year period (2013-2017), the incidence rates were significantly higher than rates for all of California **(Table 6).**

Table 6: Invasive Melanoma Age-Adjusted Incidence Rates per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2013-2017

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	34.3	20.2	30.5	17.2
Non-Hispanic White	58.1	36.9	48.5	29.0
Non-Hispanic Black	1.7	0.6	1.4	0.9
Hispanic	7.3	7.3	5.0	5.0
Asian/Pacific Islander	1.1	1.3	1.4	1.2

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

Figure 15: Invasive Melanoma Incidence Trends per 100,000 for ***NH White Males and Females*** in the Greater Bay Area by Sex and Age Group, 1988-2017



In situ melanoma is contained in the outer layer of skin and has not spread to deeper layers of the skin or surrounding tissues. It is likely that *in situ* melanoma is diagnosed exclusively through physician skin examination; as such, its occurrence may be associated with access to health care. Incidence rates of *in situ* melanoma in the Greater Bay Area for NH White males and females (57.5 and 36.4 per 100,000) were markedly higher than rates for California. Mortality rates due to invasive melanoma in the Greater Bay Area have decreased slightly since 1988 for all races/ethnicities and for both sexes combined, by an average of -1.4% per year. For NH White females, a slight decrease in mortality rates, with a -1.4% average decline per year, was observed for recent years (1988 through 2017), yet in NH White males, mortality rates remained stable from 1988 through 2017. Melanoma mortality rates were three times as high for NH White males as NH White females (4.8 vs. 1.6 per 100,000, respectively) for 2013-2017, a poorly understood difference. For NH White males and females, the 2013-2017 mortality rate in the Greater Bay Area (3.0 per 100,000) was slightly lower than the mortality rate in California (3.5 per 100,000).

VIII. COLORECTAL CANCER

Invasive colorectal cancer (cancer of the colon or rectum) is the 4th most commonly diagnosed cancer among males and females in the Greater Bay Area. Obesity, smoking, history of colorectal polyps, and a diet high in red meat are associated with increased risk of this cancer [42, 43]. Among males, incidence rates of invasive colorectal cancer have been declining over time, with any increases being temporary and non-significant. Significant annual declines have occurred from 1988 through 2017 in all racial/ethnic groups: NH White males (-2.5%), NH Black males (-2.0%), Hispanic males (-1.1%) and Asian/Pacific Islander males (-1.9%). There were also significant annual declines in colorectal cancer incidence rates among females: NH White females (-1.8% per year), NH Black females (-1.3%), Hispanic females (-1.1%), and Asian/Pacific Islander females (-1.9%). These declines have been attributed to greater uptake of colorectal cancer screening [44].

Colorectal cancer screening is important clinically because it can identify polyps that could lead to *in situ* or invasive cancer, allowing for intervention (removal of the polyp) before the diagnosis of cancer. Currently, the United States Preventive Services Task Force (USPSTF) recommends screening for those 50 years of age and older [45]. Since 1988, there was an overall decrease in incidence, commensurate with improved screening uptake. While incidence of colorectal cancer is decreasing overall, a recent analysis of incidence in California evaluated early onset cases (< 50 years) compared to those aged ≥ 50 years. Early onset colorectal cancer cases did, in fact, increase in the younger age group for NH White and Hispanic males and females [46].
The 2013-2017 incidence rates were higher among males (38.1 per 100,000) than females (29.9 per 100,000). Incidence rates in NH Black males and females were higher than those for other racial/ethnic groups (45.5 and 37.4 per 100,000, respectively). For 2013-2017, colorectal cancer incidence rates for NH White males in the Greater Bay Area were lower than in California, whereas incidence rates for NH Black, Asian/Pacific Islander, and Hispanic males were comparable. Incidence among females in the GBACR were comparable to California **(Figure 16)**.

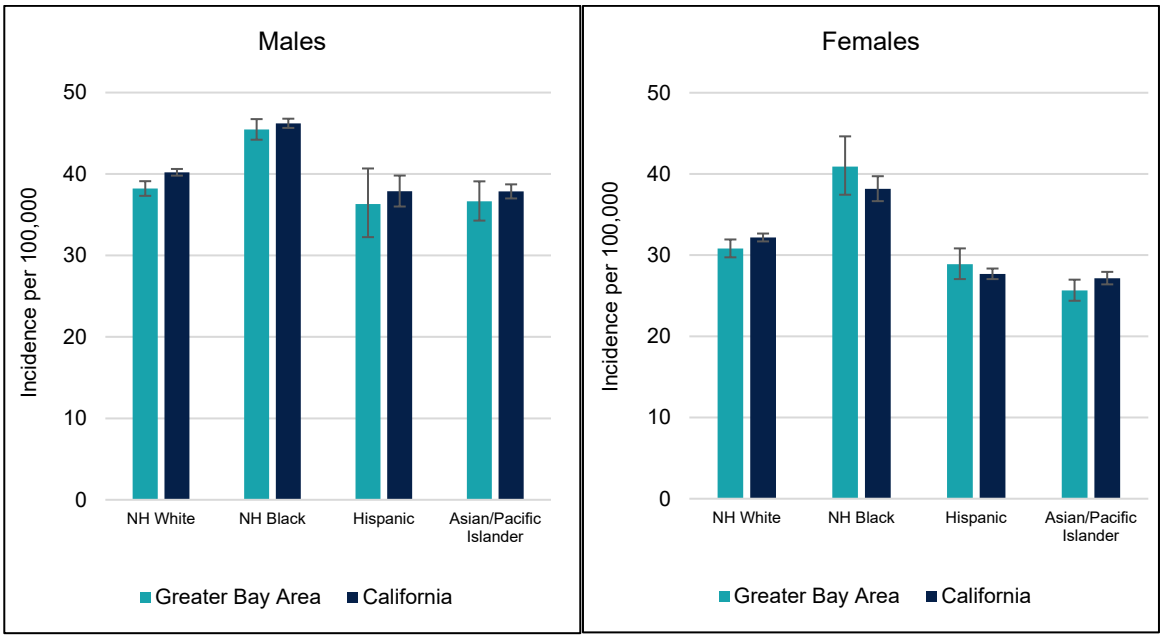
Mortality due to colorectal cancer for both males and females declined substantially from 1988 through 2017 for all racial/ethnic groups **(Figure 17)**. This is likely due to early detection as a result of effective cancer screening strategies. The greatest annual declines in mortality were observed in NH White males (-3.2%) and NH White females (-2.8%). Hispanic males had a non-significant increase in mortality from 1988 to 1998, and then a significant decrease of -3.3% per year from 1998 to 2017. For the period 2013-2017, the mortality rate in males was highest among NH Blacks (17.8 per 100,000) and lowest among Asians/Pacific Islanders (11.3 per 100,000). Similarly, in females, mortality rate of colorectal cancer was highest in NH Blacks (16.2 per 100,000) and lowest in Asians/Pacific Islanders (7.9 per 100,000).

Mortality rates of colorectal cancer in the Greater Bay Area were lower than rates in California for NH White and Asian/Pacific Islander males and females, but comparable to

CA rates for NH Black and Hispanic males and females.

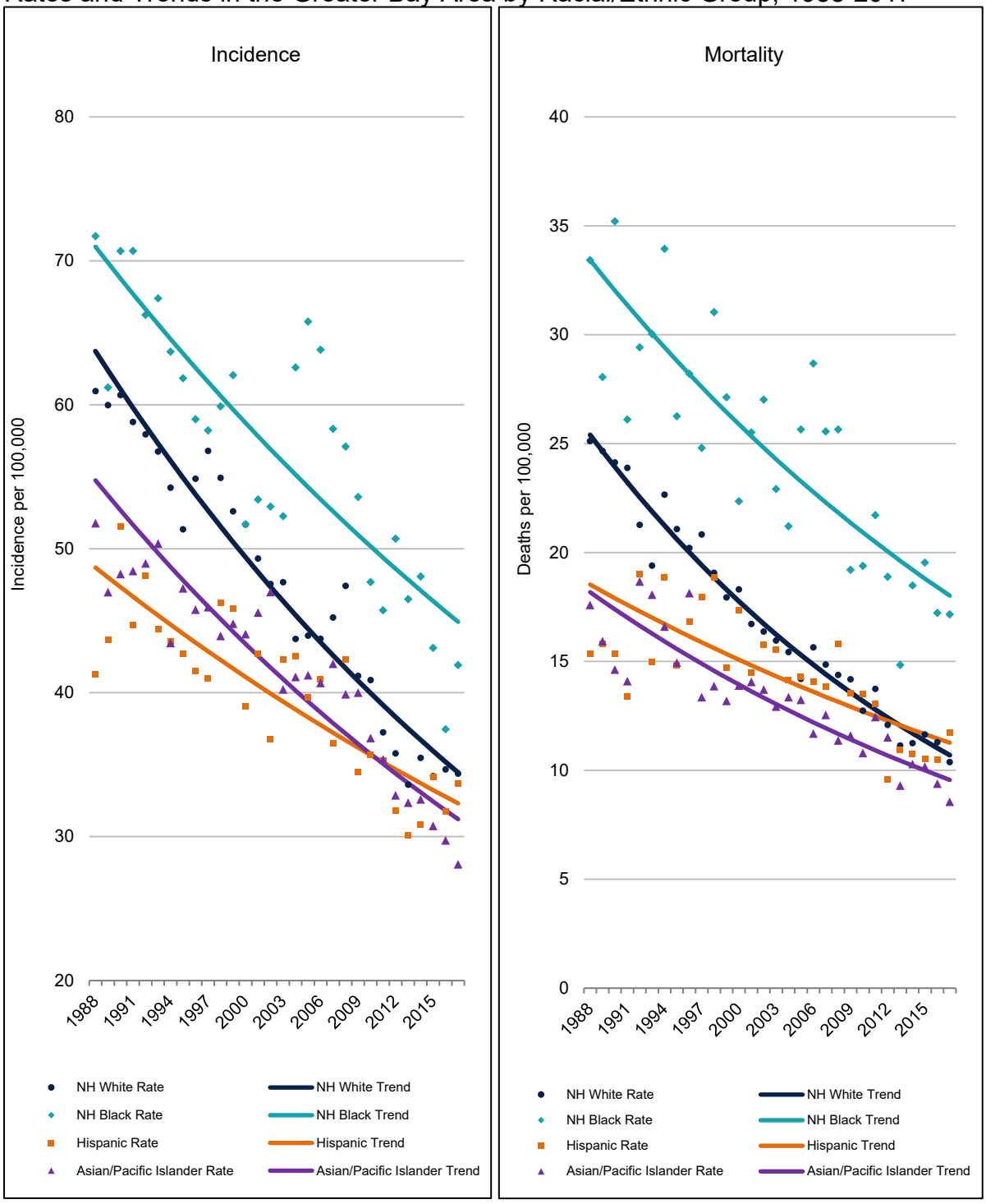
In situ colorectal cancer is detected before it has spread beyond the inner layer of the colon or rectum [43]. The declines in both *in situ* and invasive colorectal cancer incidence and mortality in the Greater Bay Area likely reflect the success from wide implementation of colorectal cancer screening across the population [42-44]. Annual declines in incidence of in situ colorectal cancer from 1988 through 2017 were observed for both males (-4.7% per year) and females (-4.4%). Significant average annual declines in incidence were observed since 1988 for males and females, in all racial/ethnic groups: NH White (-4.8%), NH Black (-4.4), Hispanic (-3.7%), and Asian/Pacific Islander (-3.3%) per year. For 2013-2017, *in situ* colorectal cancer incidence rates for all racial/ethnic groups in the Greater Bay Area were comparable to those in California.

Figure 16: Invasive Colorectal Cancer Age-Adjusted Incidence Rates[1] by Sex, Racial/Ethnic Group, and Region[2], 2013-2017



[1] Error bars (in black at the top of the bars) indicate 95% confidence intervals surrounding the corresponding incidence rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county region of the Greater Bay Area

Figure 17: Invasive Colorectal Cancer Age-Adjusted Annual Incidence and Mortality Rates and Trends in the Greater Bay Area by Racial/Ethnic Group, 1988-2017



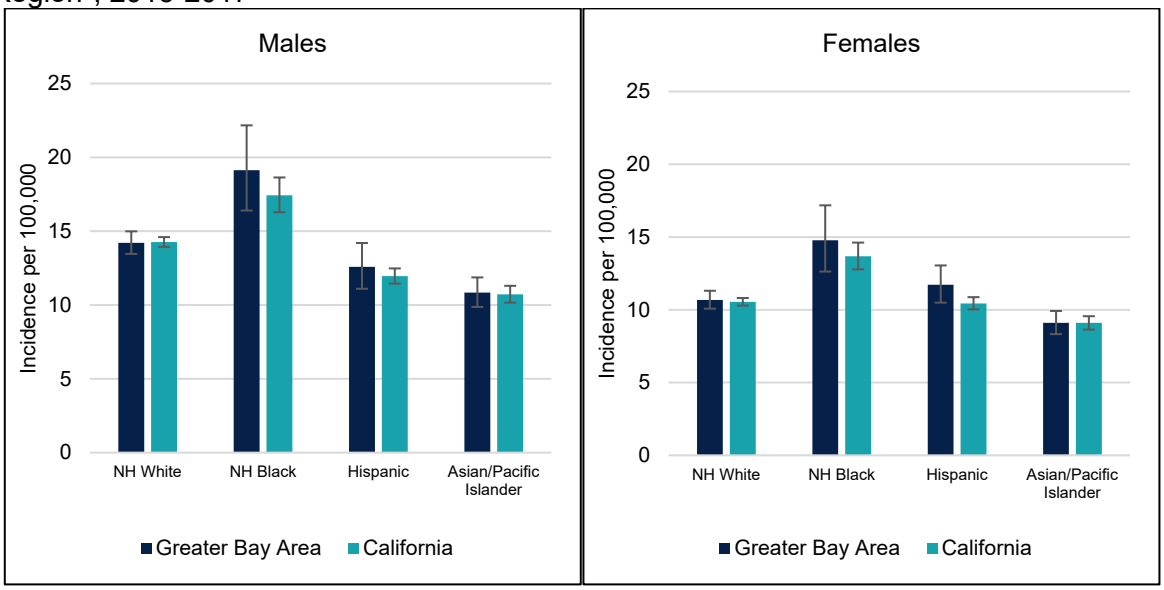
IX. PANCREATIC CANCER

Pancreatic cancer has been associated with smoking, obesity, personal history of diabetes or pancreatitis, family history of pancreatitis or pancreatic cancer, and certain hereditary conditions [47, 48]. In the U.S., pancreatic cancer is rare, but survival is poor [48, 49]. Since 2000, national incidence rates of pancreatic cancer have increased slightly while mortality rates have stabilized; however, racial/ethnic disparities persist with NH Black males and females having disproportionately higher incidence and mortality rates than any other major racial/ethnic group [49], although more recent evidence suggests similarly high rates among Native Hawaiians and Japanese Americans [50].

In the Greater Bay Area, since 1988, incidence rates of pancreatic cancer in males have remained relatively stable with significant increases of 0.6% per year for NH White males. Among females, incidence has increased since 1988 by 0.8% per year for Asians/Pacific Islanders and remained stable for other racial/ethnic groups. From 2013 through 2017, NH Black males and females experienced the highest incidence rates of pancreatic cancer (19.1 and 14.8 per 100,000, respectively) followed by NH White males (14.2 per 100,000), Hispanic males (12.6 per 100,000), and Hispanic females (11.7 per 100,000). Asian/Pacific Islander males and females and NH White females had the lowest rates (9.9, 9.1 and 10.1 per 100,000, respectively). Incidence rates in the Greater Bay Area were comparable to California rates for all racial/ethnic groups **(Figure 18)**.

Similar to incidence rates, mortality rates of pancreatic cancer have remained stable from 1988 through 2017, except for NH Black males, who experienced a decrease in mortality of 1.2% per year. Mortality was highest for NH Black males and females (15.7 and 12.0 per 100,000, respectively) and Asian/Pacific Islander males and females had the lowest mortality rates (8.6 and 7.2 per 100,000, respectively). The 2013-2017 mortality rates for all racial/ethnic groups in the Greater Bay Area were comparable to the rates in California.

Figure 18: Pancreatic Cancer Age-Adjusted Incidence Rates[1] by Sex, Racial/Ethnic Group and Region[2], 2013-2017



[1] Error bars (in black at the top of the bars) indicate 95% confidence intervals surrounding the corresponding incidence rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county region of the Greater Bay Area).

X. LIVER CANCER

Among all racial/ethnic groups and both sexes combined, the incidence of liver and intrahepatic bile duct cancer, herein referred to as liver cancer, in the Greater Bay Area increased substantially from 1988 through 2017. Furthermore, liver cancer is three times more common in males than females. To evaluate changes in incidence rates across racial/ethnic groups (1998-2017), liver cancer incidence rates are plotted across time points **(Figure 19)**.

For NH Black males, the increase in incidence was consistent from 1988 through 2017, rising by an average of 3.4% per year. Incidence for NH White males increased by an average 4.5% per year through 2012, and has since stabilized. For Hispanic males, the incidence increased by 4.9% per year from 1988 through 2009, and has since stabilized or decreased. Among Asian/Pacific Islander males, incidence was stable from 1988 through 2009, then experienced a decrease at an average of -4.5% per year through 2017.

NH Black and Hispanic females experienced average yearly increases of 2.4% and 3.7%, respectively. Incidence for NH White females also increased, at an average yearly rate of 2.9% **(Figure 19)**. Incidence rates for Asian/Pacific Islander females were stable from 1988 through 2017.

The increasing trends in NH White, NH Black and Hispanic males and females that have been noted nationwide may reflect an increasing prevalence of risk factors such as hepatitis infection, cirrhosis, alcohol abuse, and obesity in these populations [51, 52]. While these national patterns are observed among NH Black males, NH White, NH Black, and Hispanic females, recent data for GBACR suggest that for NH White and Hispanic males, the increasing trends in liver cancer incidence rates may be slowing down. In contrast, incidence among Asian/Pacific Islander males and females was stable, and has declined in recent years (2009-2017), with rates of -4.5% per year and -8.7% per year, respectively **(Figure 19)**.

Asian/Pacific Islander males and females historically have had the highest liver cancer incidence rates of all racial/ethnic groups due to higher prevalence of hepatitis B infection [53], although incidence differences across Asian/Pacific Islander groups have been noted [12, 54-57]. In the Greater Bay Area, the 2013-2017 incidence rate was 14.3 per 100,000 in males and 4.4 per 100,000 in females **(Table 7a)**. For males, rates were highest among NH Blacks (22.4 per 100,000), followed by Asians/Pacific Islanders (19.3 per 100,000), Hispanics (18.6 per 100,000) and NH Whites (9.7 per 100,000). For females, rates were highest among Hispanics (7.6 per 100,000), followed by Asians/Pacific Islanders (5.9 per 100,000), NH Blacks (5.4 per 100,000) and NH Whites (2.6 per 100,000).

Liver cancer incidence rates from 2013 through 2017 were higher for NH Black males in the Greater Bay Area compared to California, while all other racial/ethnic groups had incidence rates that were comparable to the rates in California **(Table 7a)**.

Figure 19: Liver Cancer Incidence Trends in the Greater Bay Area by Sex and Racial/Ethnic Group, 1988-2017

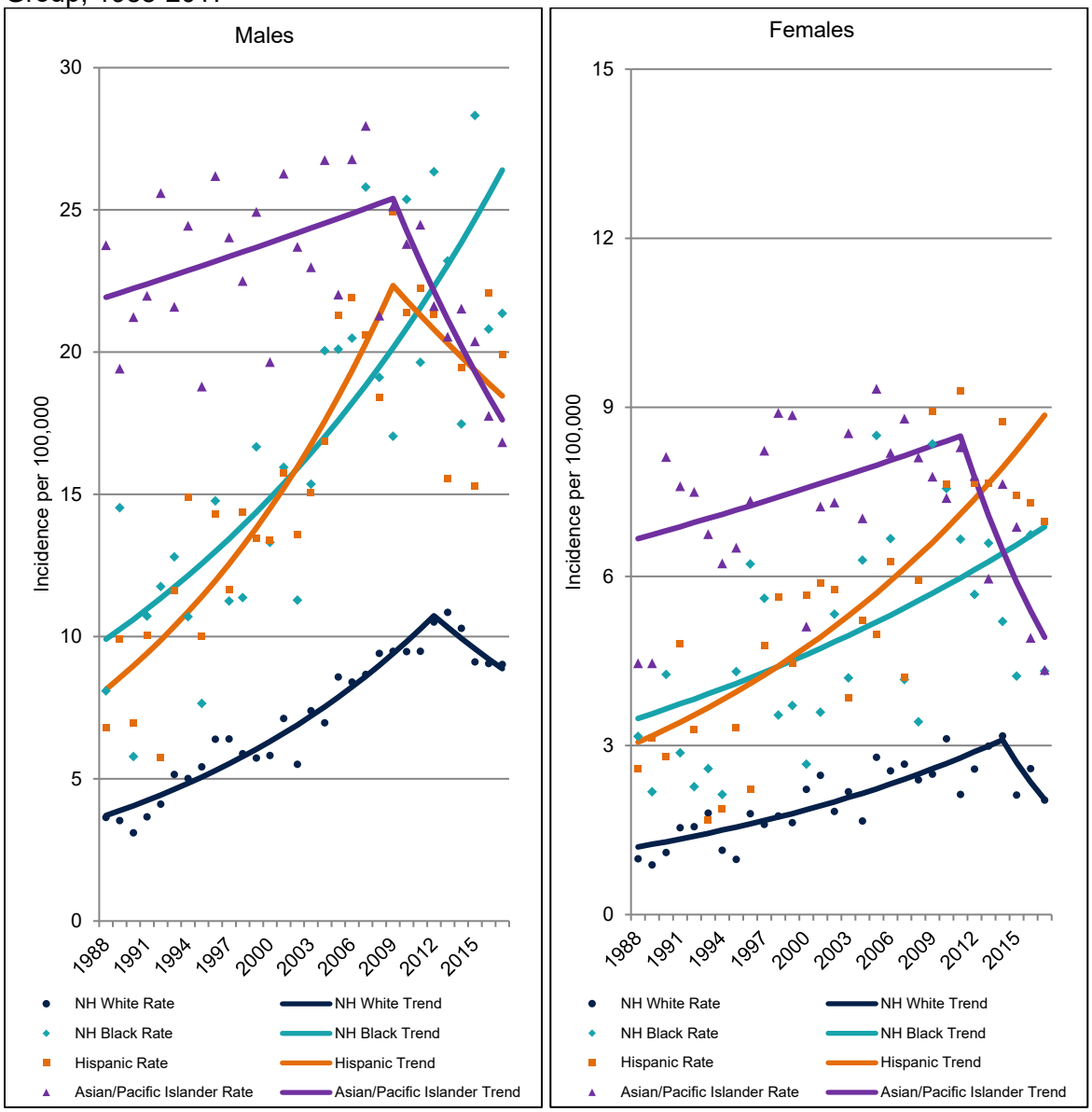


Table 7a and 7b: Liver Cancer Age-Adjusted Incidence and Mortality Rates per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2013-2017

7a: Incidence

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Female
All Races/Ethnicities	14.3	4.4	13.4	4.5
Non-Hispanic White	9.7	2.6	9.5	2.9
Non-Hispanic Black	22.4	5.4	17.5	5.1
Hispanic	18.6	7.6	18.2	6.9
Asian/Pacific Islander	19.3	5.9	18.4	6.0

7b: Mortality

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Female
All Races/Ethnicities	8.9	2.7	9.1	3.2
Non-Hispanic White	6.1	1.6	6.5	2.2
Non-Hispanic Black	14.8	3.8	11.8	4.0
Hispanic	10.8	4.4	12.5	5.0
Asian/Pacific Islander	11.8	3.7	12.3	4.1

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

Liver cancer mortality rates increased overall by 1.4% per year for males and 0.9% for females from 1988 through 2017 in the Greater Bay Area. Mortality rates were similar for NH White and NH Black males (~2% per year), while mortality rates were slightly higher for Hispanic males (3.1% per year). Rates were stable for NH White females. A decrease in mortality by an average of -1.9% per year occurred from 1988 through 2017 among Asians/Pacific Islander males and females. For 2013-2017, mortality rates were more than three times higher for males than for females in the Greater Bay Area (8.9 and 2.7 per 100,000, respectively; **Table 7b**). During this time, NH Black (14.8 per 100,000), Hispanic (10.8 per 100,000) and Asian/Pacific Islander (11.8 per 100,000) males experienced markedly higher rates of mortality due to liver cancer than NH White males (6.1 per 100,000). Females experienced a much lower mortality rate, ranging from 1.6 per 100,000 in NH White persons to 4.4 per 100,000 in Hispanics. For 2013-2017, liver cancer mortality rates for NH Black males were notably higher in the Greater Bay Area (14.8 per 100,000) compared to California (11.8 per 100,000) **(Table 7b)**, while for all other racial/ethnic groups, Greater Bay Area mortality rates were similar to those in California.

XI. THYROID CANCER

Thyroid cancer incidence increased dramatically in the Greater Bay Area for males and females starting in the early 2000s, but while the rate has stabilized since 2010 for females of all races/ethnicities combined, it has continued to increase for males **(Figure 20)**. In females, thyroid cancer incidence increased on average 6.5% per year from 2001 through 2010, then stabilized through 2017. Whereas for males, incidence increased 4.8% annually from 2001 through 2017. The overall increase in thyroid cancer during the 30-year period from 1988-2017 may be due to improved imaging technology and thus increased detection of thyroid cancers, as well as to the increased prevalence of suspected risk factors (e.g., prior radiation exposure, obesity, insulin resistance due to obesity or type 2 diabetes) [58-60]. There has been substantial scientific discourse as to whether or not the increase in papillary thyroid cancer diagnoses represents "overdiagnosis" of a harmless condition [61], and questions about potential over-treatment of otherwise indolent cancers.

From 2013 through 2017, thyroid cancer incidence rates were strikingly higher among females than males in all racial/ethnic groups, and NH Black males and females had significantly lower rates than the other racial/ethnic groups, while Hispanic males had significantly lower rates than NH White and Asian/Pacific Islander males. Incidence for NH White males and females were 7.6 and 18.2 per 100,000, respectively. For NH Black males and females, incidence rates were 2.7 and 7.9 per 100,000, respectively). Hispanic males and females had incidence rates of 5.1 and 16.6 per 100,000, respectively. And, Asian/Pacific Islander males and females had incidence rates of 6.8 and 18.5 per 100,000, respectively. In the Greater Bay Area, incidence rates of thyroid cancer in females were significantly lower than rates in California for all races/ethnicities, whereas in males, rates were similar between the Greater Bay Area and all of California **(Figure 21)**.

Mortality due to thyroid cancer remained very low among all racial/ethnic groups for both males and females (0.5 and 0.7 per 100,000, respectively) and was stable from 1988 through 2017. The mortality rates of thyroid cancer in 2013-2017 were significantly higher in Hispanic females (1.0 per 100,000) and Asian/Pacific Islander females (0.9 per 100,000) compared to the rate in NH White females (0.5 per 100,000) and NH White males (0.5 per 100,000). Mortality rates in California were similar to those in the Greater Bay Area for both sexes and all racial/ethnic groups.

Figure 20: Thyroid Cancer Age-Adjusted Incidence Rates and Trends in the Greater Bay Area by Sex, 1988-2017

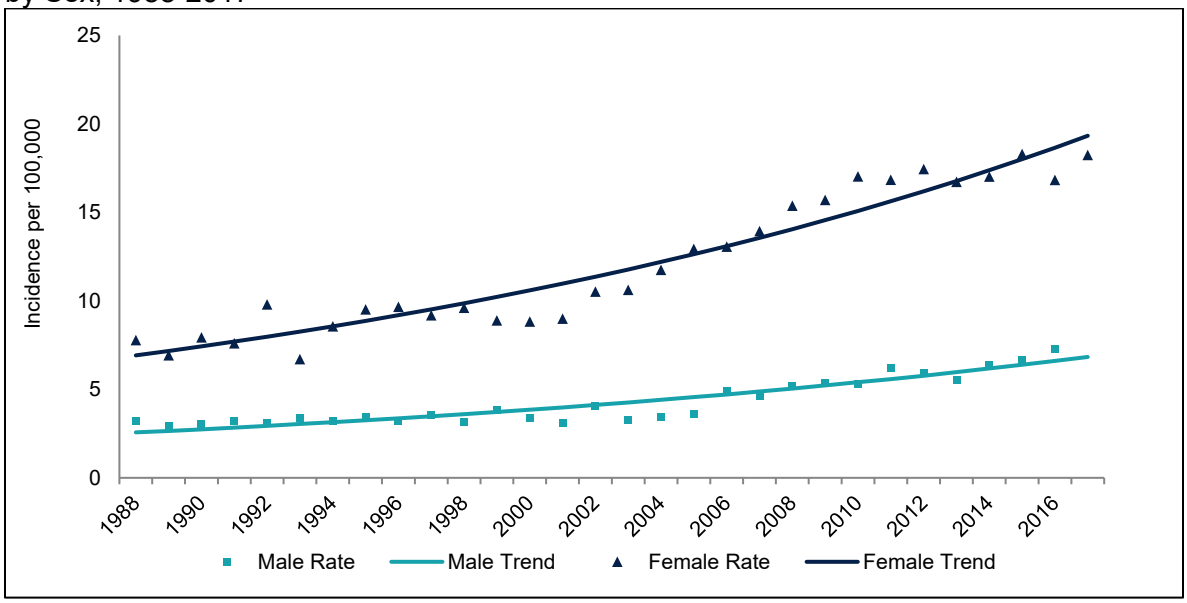
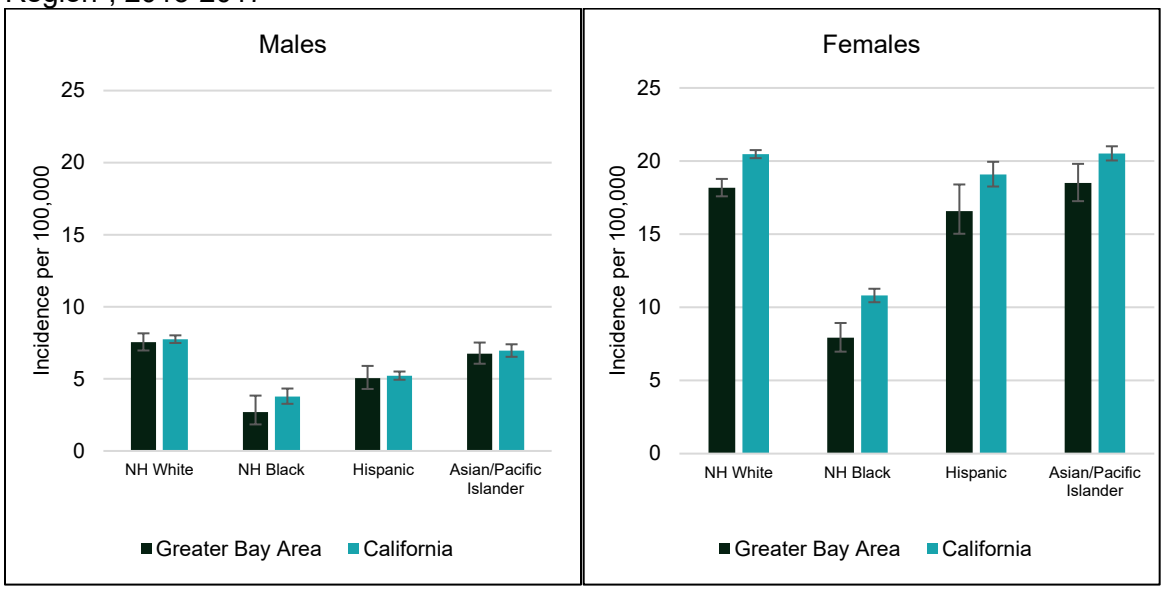


Figure 21: Thyroid Cancer Age-Adjusted Incidence Rates[1] by Sex, Racial/Ethnic Group, and Region[2], 2013-2017



[1] Error bars (in Black at the top of the bars) indicate 95% confidence intervals surrounding the corresponding incidence rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region), and (2) all of California (including the nine-county Greater Bay Area region).

XII. CERVICAL CANCER

Incidence rates of cervical cancer have declined substantially since 1988 in all racial/ethnic groups in the Greater Bay Area **(Figure 22)**. From 1988 through 2017, similarly steep declines were seen annually among Asian/Pacific Islander females (-3.9%), NH Black females (-3.9%), and Hispanic females (-3.6%). Significant, but lower magnitude declines were also observed among NH White females of -1.7% per year. Cervical cancer screening ("Pap" testing), which detects precancerous cells and early cervical cancers, has contributed significantly to the decline in cervical cancer incidence [62, 63].

The most common risk factor for cervical cancer is human papillomavirus (HPV) infection; HPV types 16 and 18 are responsible for approximately 70% of all cervical cancers [62-64]. In 2006, three highly effective vaccines against these strains of HPV were approved by the Food and Drug Administration (FDA) for the prevention of HPV-caused cancers [65]. In combination with continued cervical cancer screening, these vaccines are likely to result in further declines in cervical cancer incidence in future years.

In the Greater Bay Area, 2013-2017 incidence rates of cervical cancer were highest among Hispanic females (7.8 per 100,000) compared to other racial/ethnic groups, ranging from 5.2 per 100,000 among NH White and Asians/Pacific Islander females to 5.6 per 100,000 among NH Black females. The disproportionate burden of cervical cancer in Hispanic females can, in part, be attributable to low uptake of cervical cancer screening [66]. From 2013-2017, cervical cancer incidence rates were lower in the Greater Bay Area than in California among NH White and Asians/Pacific Islander females, whereas rates were similar between the regions for NH Black and Hispanic females **(Figure 23)**.

From 1988 through 2017, mortality rates due to cervical cancer decreased significantly among Hispanic and NH White females, with annual declines of -2.6% per year and -3.1% per year, respectively. Previous declines in mortality rates among Asian/Pacific Islander females between 1988 and 2008 have stabilized since 2008. From 2013-2017, cervical cancer mortality rates in the Greater Bay Area were highest in Hispanic females (2.1 per 100,000), which was significantly higher than the rate in NH White females (1.2 per 100,000). In the Greater Bay Area, cervical cancer mortality rates for all racial/ethnic groups were lower than in all of California, especially among NH Black females **(Figure 23).**

Although a vaccine against HPV has been available and recommended in the U.S. since 2006, its direct impact on cancer incidence and mortality rates remains unclear, in part, due to the targeting of vaccinations to primarily young populations, slow uptake in the U.S., and ~20 year latency between HPV infection and presentation of a pre-cancerous lesion. However, a recent study in the U.S. supports the conclusion that HPV vaccination is effective in reducing cervical cancer [67]. In addition, promising declines in HPV prevalence and related anogenital diseases have been recently documented in U.S. populations [68]. Additional ongoing surveillance and research will be able to determine the direct impact of HPV vaccination on population-level cervical cancer incidence and mortality over the next several years [69].

Figure 22: Cervical Cancer Incidence Rates and Trends in the Greater Bay Area by Racial/ Ethnic Group, 1988-2017

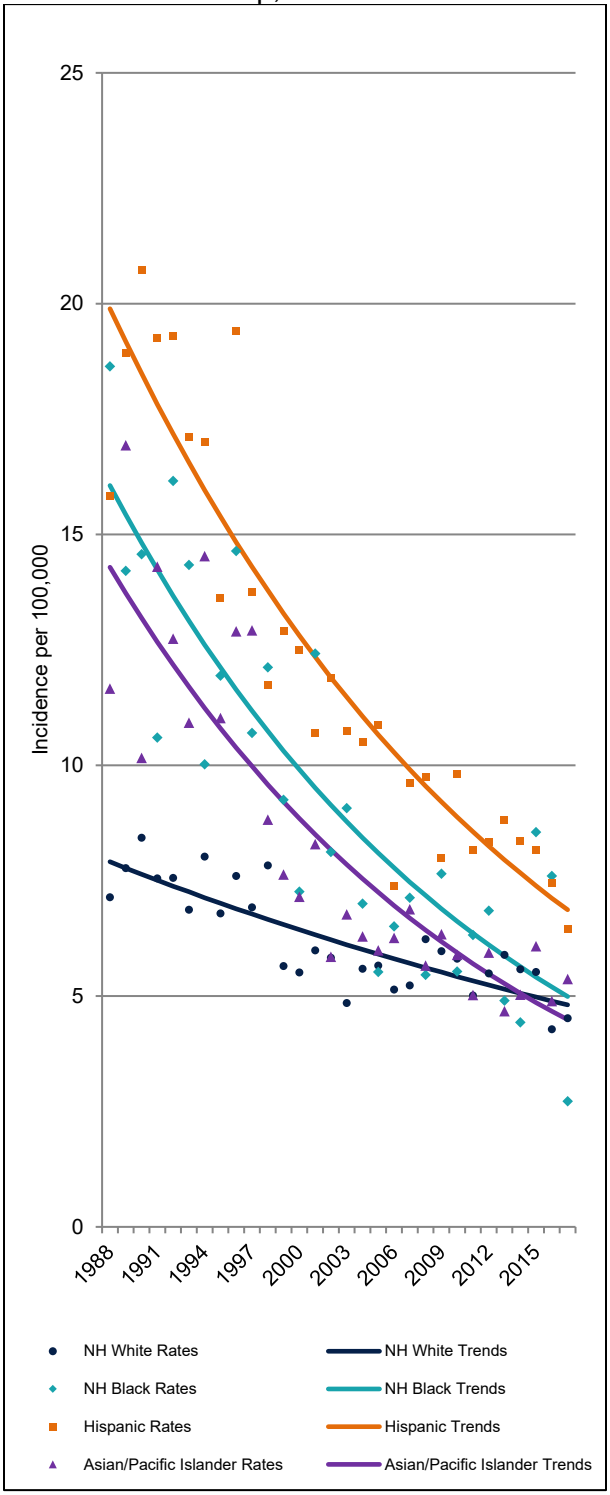
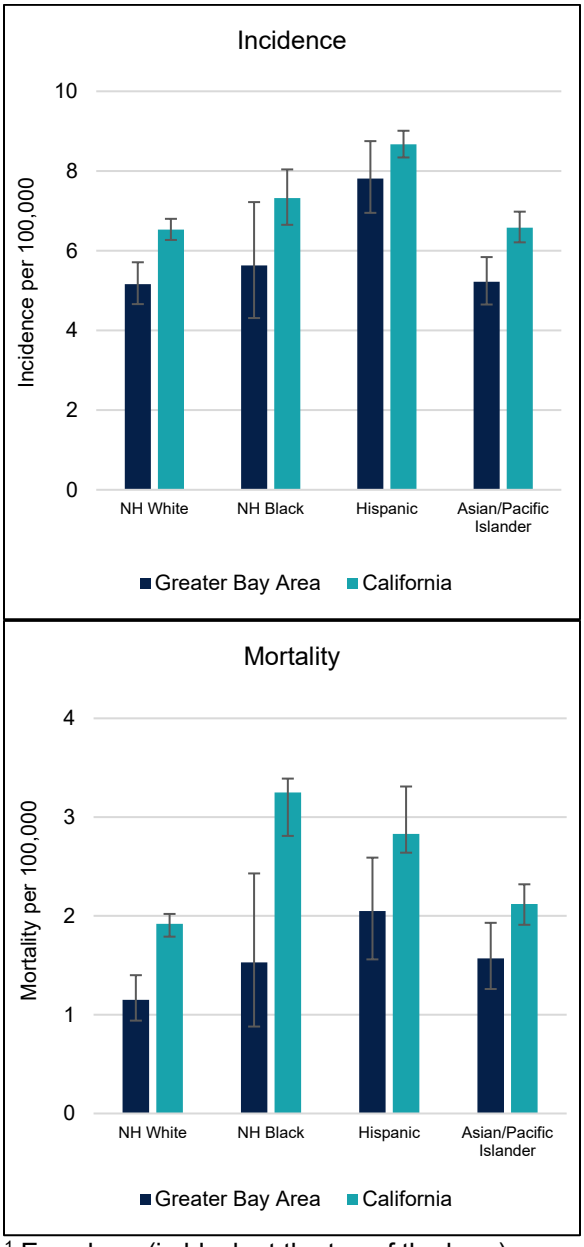


Figure 23: Cervical Cancer Age-Adjusted Incidence and Mortality Rates[1] by Racial/Ethnic Group and Region[2], 2013-2017



[1] Error bars (in black at the top of the bars) indicate 95% confidence intervals surrounding the corresponding incidence and mortality rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region), and (2) all of California (including the nine-county region of the Greater Bay Area).

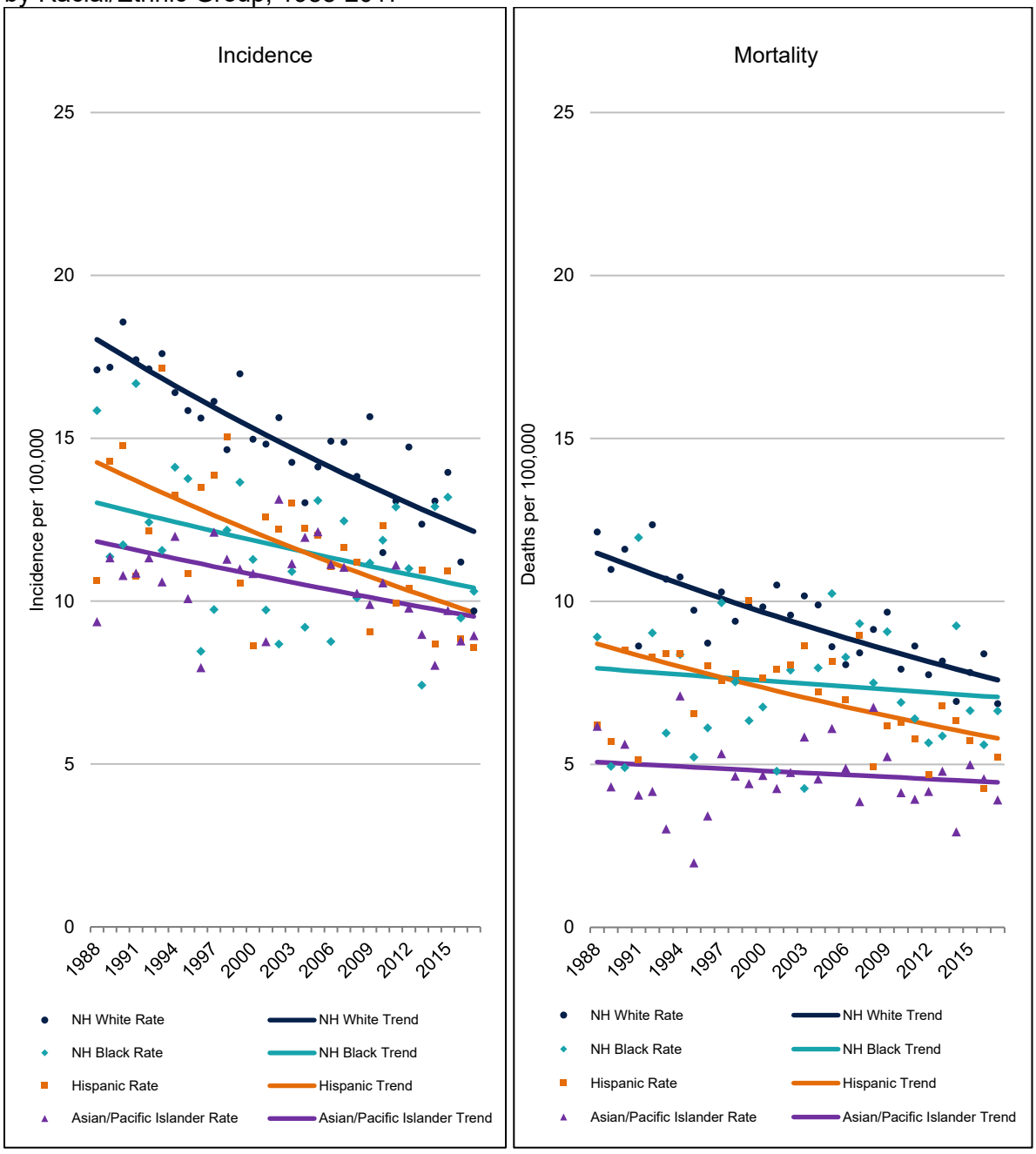
XIII. OVARIAN CANCER

In the Greater Bay Area, ovarian cancer was the 8th most common cancer diagnosed in females from 2013-2017, accounting for 3% of all female cancers, and the 5th leading cause of cancer deaths. Most ovarian cancers start from cells that cover the outer surface of the ovaries, and are often not diagnosed until late stage [70]. Risk factors include a family history of ovarian cancer, obesity and excessive weight gain, no pregnancies, use of postmenopausal hormone therapy, fertility drugs, and perineal use of talcum powder [71, 72].

Incidence rates of ovarian cancer have decreased annually in the Greater Bay Area for females of all racial/ethnic groups from 1988 through 2017: NH White persons (-1.4%), NH Black persons (-0.8%), Hispanics (-1.3%), and Asians/Pacific Islanders (-0.7%; **Figure 24)**. In the Greater Bay Area from 2013 through 2017, NH White females had a slightly higher incidence rate of ovarian cancer (12.1 per 100,000) than females in other racial/ethnic groups (Asians/Pacific Islanders: 8.9, Hispanics: 9.5, NH Black persons 10.7 per 100,000). For all racial/ethnic groups, Greater Bay Area incidence rates were comparable to those in California.

Mortality rates from ovarian cancer also decreased annually over the period 1988-2017 among NH White (-1.4%) and Hispanic females (-1.4%), and were stable in NH Black and Asian/Pacific Islander females. From 2013 through 2017, NH White females had significantly higher mortality rates from ovarian cancer (7.7 per 100,000) than Hispanic (5.7 per 100,000) and Asian/Pacific Islander females (4.1 per 100,000); but similar to NH Black females (6.9 per 100,000). The mortality rate for all racial/ethnic groups combined in the Greater Bay Area was significantly lower than California.

Figure 24: Ovarian Cancer Incidence and Mortality Rates and Trends in the Greater Bay Area by Racial/Ethnic Group, 1988-2017



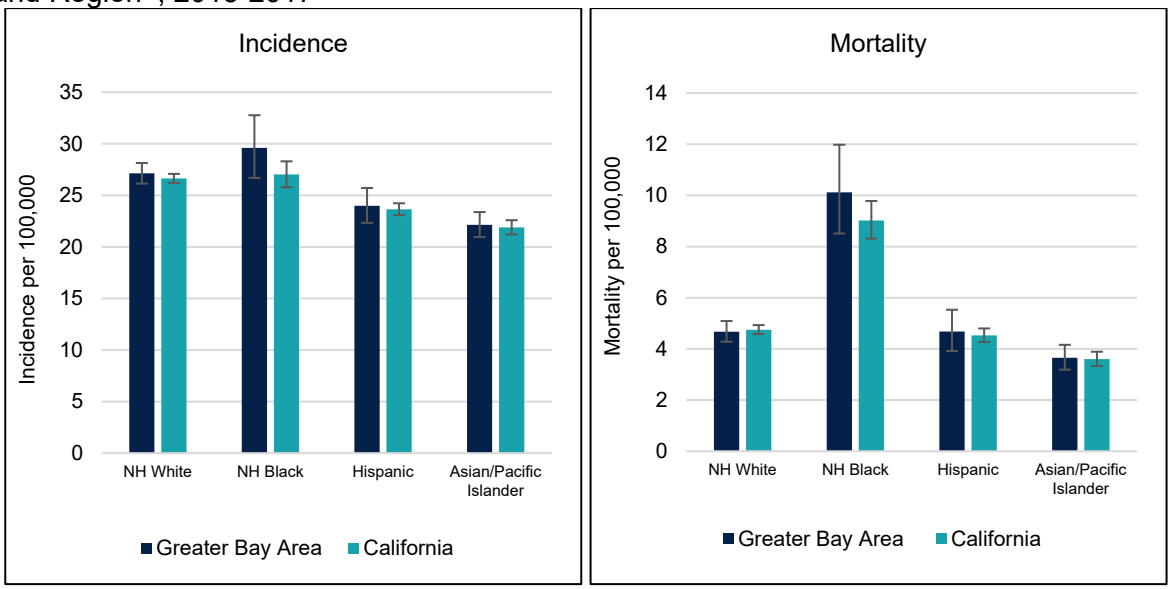
XIV. UTERINE CANCER

Uterine cancer is the most common gynecologic cancer and is primarily diagnosed in post-menopausal women, with incidence peaking in the sixth decade of life. Almost all uterine cancers occur in the endometrium (lining of the uterus) [73]. Over the past 15 years (from 2003 through 2017), incidence rates of uterine cancer in the Greater Bay Area have increased on average by 1.4% per year with Hispanic females experiencing the largest increase in incidence rates (2.7% per year), and the smallest increase in NH White females (0.7% per year). Increasing incidence rates may be related to the increasing prevalence of obesity [74, 75], especially in postmenopausal women for whom body fat is the primary source of estrogens. Other risk factors for uterine cancer related to estrogen exposure include early age of menarche (starting menstruation at an early age), late age of menopause, no pregnancies, and menopausal hormone use of unopposed estrogen (estrogen without progesterone) [75].

During the period 2013-2017, incidence rates in the Greater Bay Area were highest in NH Black (29.6 per 100,000) and NH White females (27.1 per 100,000), and lowest in Hispanic (24.0 per 100,000) and Asians/Pacific Islander females (22.1 per 100,000; **Figure 25)**. The incidence rates in the Greater Bay Area were similar to those in California among racial/ethnic groups. Because women who have had their uterus removed (hysterectomy) are no longer at risk for uterine cancer, the actual incidence rates are likely higher than reported. This is because the population counts used in calculating the rates do not account for the true at-risk population (i.e., women who have not had a hysterectomy [74, 76-78]. The prevalence of hysterectomy in the population varies by race/ethnicity, and one report suggests that correcting incidence rates by the prevalence of hysterectomy in the population would increase incidence rates by 55% for NH White females, 80% for NH Black females, and 44% for Hispanic females in California [77]. Additionally, as the prevalence of hysterectomy has changed over time, and differentially across racial/ethnic groups, observed incidence trends may in part be reflecting changes in the prevalence of hysterectomy rather than true changes in incidence rates, thus caution must be taken when comparing incidence rate trends by race/ethnicity [74, 76].

Since 1988, uterine cancer mortality rates have steadily increased in NH Black females by 2.2% per year and by 1.4% per year in Asian/Pacific Islander females, while remaining relatively stable in Hispanic and NH White females. From 2013-2017, the mortality rate was highest among NH Black females (10.1 per 100,000) and lowest among Asian/Pacific Islander females (3.7 per 100,000). NH White and Hispanic females had similar mortality rates (4.75 and 4.53 per 100,000, respectively). The disproportionately higher mortality rate in NH Black females, which has been noted nationwide, is likely due to many factors, including a higher proportion of more aggressive subtypes of uterine cancer and more advanced stage at diagnosis [79]. Overall, uterine cancer mortality rates for the Greater Bay Area were similar to those for California **(Figure 25)**.

Figure 25. Uterine Cancer Age-Adjusted Incidence and Mortality Rates[1] by Racial/Ethnic Group and Region[2], 2013-2017



[1] Error bars (in black at the top of the bars) indicate 95% confidence intervals surrounding the corresponding incidence and mortality rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region), and (2) all of California (including the nine-county Greater Bay Area region).

XV. KIDNEY CANCER

Kidney cancer is about twice as common in males as females. In addition to family history and genetic mutations, risk factors for kidney cancer include smoking, obesity, and high blood pressure [80-82]. In the Greater Bay Area, incidence rates of kidney cancer were highest in NH Black males and females (28.3 and 14.5 per 100,000, respectively) and lowest in Asian/Pacific Islander males and females (12.5 and 5.6 per 100,000, respectively). Kidney cancer rates have been increasing since 1988 at a rate of 2-3% per year for most groups in the Greater Bay Area The majority of kidney cancers (between 60-70%) are diagnosed before the cancer has spread outside the kidney (localized stage), and the observed incidence trends are driven by the trends in localized stage disease. Increasing rates can in part be attributed to the greater use of medical imaging procedures resulting in incidental detection of early kidney cancers. They may also reflect changes in the prevalence of kidney cancer risk factors, such as obesity and hypertension, in the population [80]. In some groups, incidence rates have stopped increasing. Following a sharp increase of 4.7% per year from 2002-2008, incidence rates leveled off in 2008 for NH White males in the Bay Area. Rates for both NH White and Hispanic females stopped rising in 2011, and though not statistically significant, appear to be decreasing **(Figure 26)**. For 2013 through 2017, kidney cancer incidence rates overall in the Greater Bay Area were lower than rates in California (18.7 per 100,000 vs. 20.2 per 100,000 for males and 8.6 per 100,000 vs. 10.0 per 100,000 for females, respectively) **(Table 8)**.

Kidney cancer mortality rates are lowest among Asian/Pacific Islander males and females (3.4 and 1.2 per 100,000, respectively) and highest among NH Black males and females (6.0 and 2.4 per 100,000, respectively). Greater use of sophisticated imaging procedures, resulting in diagnosis of early stage tumors, has led to improved survival, thus reducing mortality rates nationwide [80]. Mortality due to kidney cancer in the Greater Bay Area declined by 0.7% per year for males and 1.3% per year for females from 1988 through 2017. Mortality rates in the Greater Bay Area were comparable to California rates for all racial/ethnic groups.

Figure 26: Kidney Cancer Incidence and Mortality Rates and Trends in the Greater Bay Area by Racial/Ethnic Group, 1988-2017

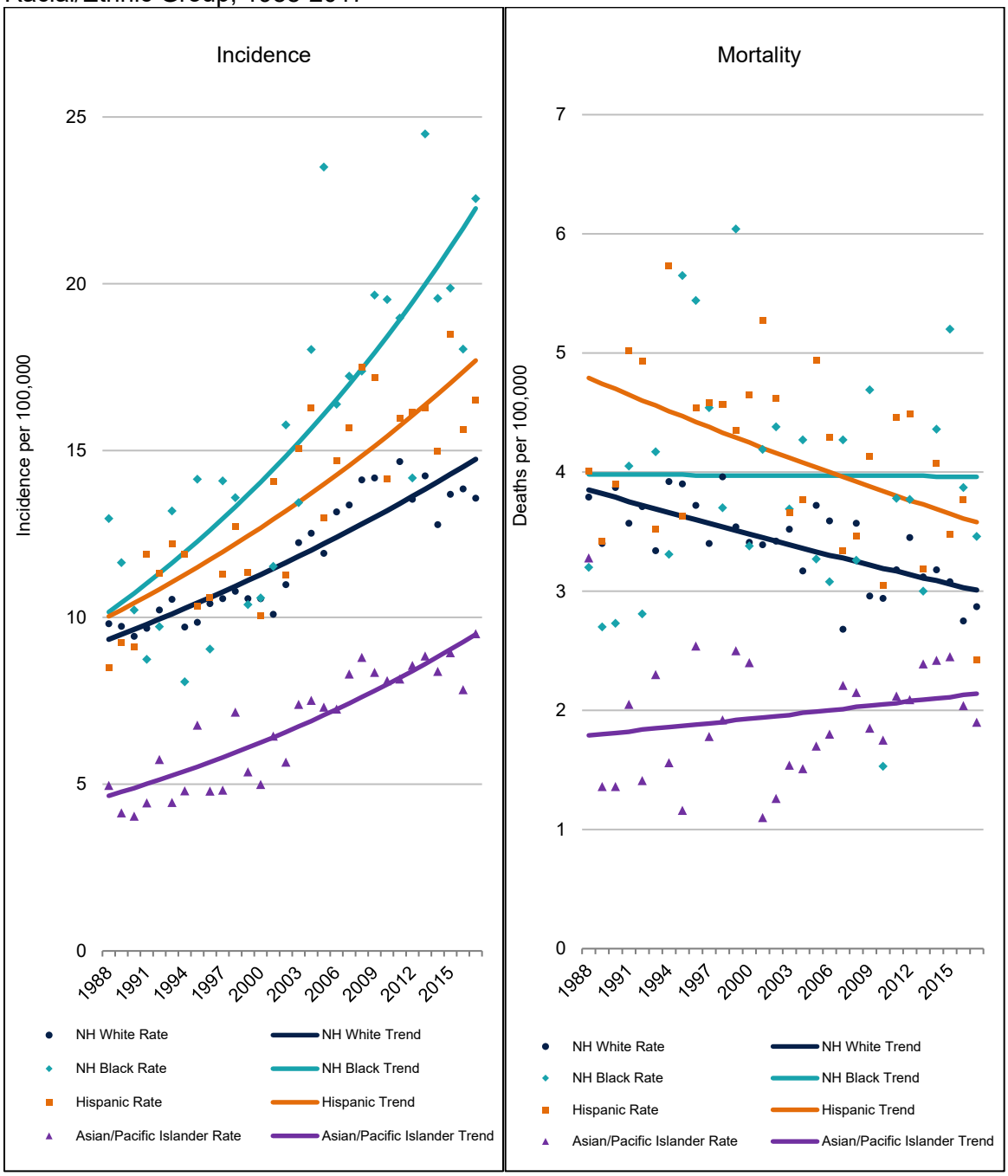


Table 8: Kidney Cancer Age-Adjusted Incidence Rates per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2013-2017

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	18.7	8.6	20.2	10.0
Non-Hispanic White	19.6	8.2	20.6	9.4
Non-Hispanic Black	28.3	14.5	24.8	12.8
Hispanic	21.9	11.9	22.5	12.3
Asian/Pacific Islander	12.5	5.6	12.3	5.7

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region), and (2) all of California (including the nine-county region of the Greater Bay Area).

XVI. BRAIN AND OTHER NERVOUS SYSTEM CANCERS

Brain and other nervous system cancers are the 13th and 16th most commonly diagnosed cancer among males and females, respectively, in the Greater Bay Area. There are many different types of brain and other nervous system tumors included in this classification: astrocytic tumors, oligodendroglial tumors, mixed gliomas, and others [83]. Risk factors for these tumors are generally unknown; however, having specific genetic syndromes may increase the risk of a central nervous system tumor. Among males, incidence rates of brain and other nervous system cancers have been declining over time (-0.4% per year since 1988); no significant decreases have occurred in most racial/ethnic groups, but a significant decrease has occurred in Hispanic males and females (-1.0% per year since 1988). Among females, there was a significant decrease since 1988 of -0.4% per year, but no significant trends in individual racial/ethnic groups. The 2013-2017 incidence rates were higher among males (7.3 per 100,000) than females (4.9 per 100,000). Incidence rates in NH White males and females were approximately twice the rates for other racial/ethnic groups. In 2013-2017, the incidence rates in the Greater Bay Area were comparable to the California rates **(Table 9a)**.

Similar to incidence rates, mortality rates were twice as high for NH White male and females than for other racial/ethnic groups. Mortality rates for all racial/ethnic groups in the GBACR were comparable to those of California **(Table 9b)**.

Glioblastoma

While glioblastoma multiforme (GBM) is relatively rare, its poor prognosis and resulting rates of mortality make it an important public health issue. These tumors arise in glial cells, a specific type of cell in the brain that surrounds neurons and provides support and insulation. Glial cells are the most abundant cell type in the central nervous system [84].

GBM is more common in males than females. In the Greater Bay Area, incidence rates were highest in NH White males and females (5.0 and 3.2 per 100,000, respectively) and lowest in Asian/Pacific Islander males and females (2.4 and 1.4 per 100,000, respectively). Incidence rates have generally been stable over the past three decades in the Greater Bay Area population as a whole, but GBM has been increasing significantly in NH White males (0.6% per year) and females (1.1% per year). The incidence rate for Hispanic females has been decreasing since 1988 (-1.7% per year).

GBM incidence rates in the Greater Bay Area were comparable to rates in California (3.9 per 100,000 vs. 3.7 per 100,000 for males and 2.3 per 100,000 vs. 2.3 per 100,000 for females). Incidence rates in the Greater Bay Area were higher than rates in California for NH White females. Among males of all racial/ethnic groups, incidence rates were comparable for the Greater Bay Area and California **(Figure 27)**.

Table 9a and 9b: Brain and Other Nervous System Cancer Age-Adjusted Incidence and Mortality Rates per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2013-2017

9a: Incidence

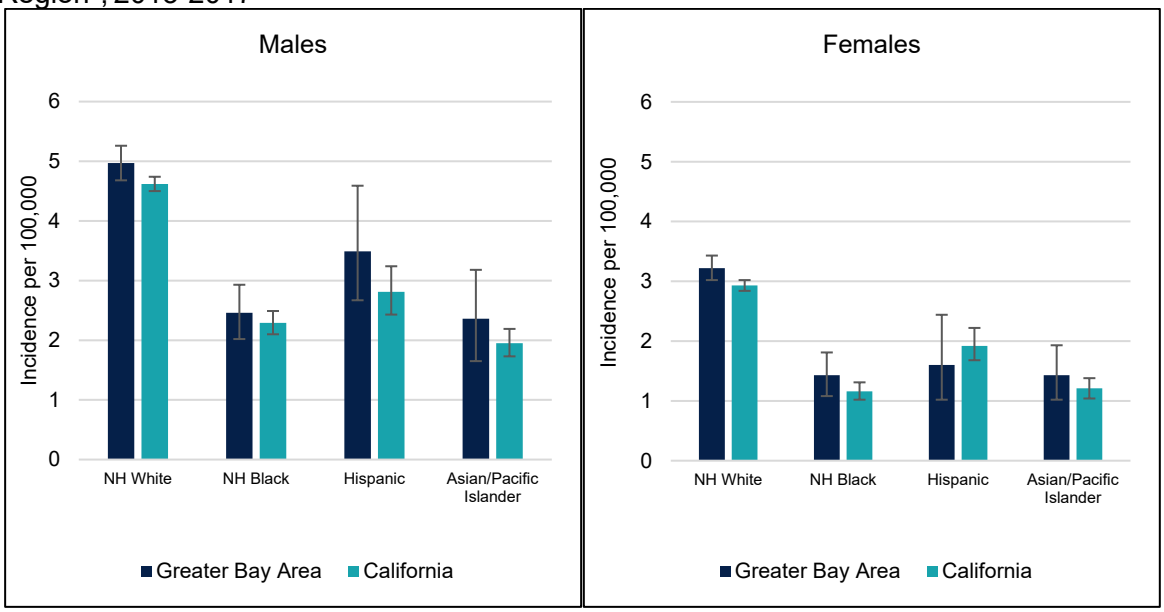
Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	7.3	4.9	7.0	5.0
Non-Hispanic White	9.5	6.3	9.1	6.4
Non-Hispanic Black	4.7	3.1	5.1	3.1
Hispanic	5.9	4.3	5.5	4.4
Asian/Pacific Islander	5.1	3.3	4.5	3.1

9b: Mortality

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	5.0	3.2	5.3	3.5
Non-Hispanic White	6.3	4.0	6.6	4.3
Non-Hispanic Black	3.3	2.1	3.9	2.1
Hispanic	3.9	2.6	4.0	3.0
Asian/Pacific Islander	3.4	2.3	3.1	2.1

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region), and (2) all of California (including the nine-county region of the Greater Bay Area).

Figure 27: Glioblastoma Age-Adjusted Incidence Rates[1] by Sex, Racial/Ethnic Group, and Region[2], 2013-2017



[1] Error bars (in Black at the top of the bars) indicate 95% confidence intervals surrounding the corresponding incidence rates.
[2] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county region of the Greater Bay Area).

XVII. LYMPHOMA

Hodgkin Lymphoma

Hodgkin lymphoma affects the immune system, originating from a specific type of white blood cells called lymphocytes. There are two major types of Hodgkin lymphoma: classical Hodgkin lymphoma and nodular lymphocyte-predominant Hodgkin lymphoma. Risk factors include family history, and past Epstein-Barr infection. Hodgkin lymphoma is more commonly found in males than in females [85, 86].

The incidence rates of Hodgkin lymphoma have decreased in the Greater Bay Area from 1988 through 2017, with the largest decline among NH White males (-1.0% per year). In 2013 to 2017, among males in the Greater Bay Area, the incidence was highest in NH Whites (3.2 per 100,000) and lowest in Asians/Pacific Islanders (1.7 per 100,000). Among females, incidence was also highest in NH Whites (2.6 per 100,000) and lowest in Asians/Pacific Islanders (1.1 per 100,000) **(Table 10a)**. Incidence of Hodgkin lymphoma in the Greater Bay Area in both males and females (2.3 per 100,000) is similar to overall rates in California (2.2 per 100,000).

Mortality rates in the Greater Bay Area have decreased annually among males (-2.7%) and females (-2.4%) from 1988 through 2017. From 2013 through 2017, mortality rates were the highest in Hispanic males and females (0.5 and 0.3 per 100,000, respectively). Mortality rates were lowest in Asian/Pacific Islander males and females (0.3 and 0.1 per 100,000, respectively). Mortality rates for Hodgkin lymphoma in the Greater Bay Area (0.2 per 100,000) was lower than overall rates in California (0.3 per 100,000).

Non-Hodgkin Lymphoma

From 2013 to 2017, Non-Hodgkin lymphoma (NHL) was the 7th most common cancer diagnosed in the Greater Bay Area. Approximately 90% of lymphomas are classified as NHL. It includes numerous types of illnesses affecting the lymphatic system. These cancers can range from mild to very aggressive [87]. They arise from lymphocytes that are at various stages of development, and the characteristics of the specific lymphoma subtype reflect those of the cell from which they originate. It is most common in NH White males. Other risk factors include family history and possibly exposure to benzene and radiation/ chemotherapy for other cancers [88].

There are differences in the incidence of NHL between high-income and low-income regions. B-cell lymphoma, a common type of NHL has higher incidence in low- and middle-income areas compared to high income areas [87]. This disparity is poorly understood.

Incidence rates for NHL have changed significantly for both males and females in the Greater Bay Area region over the past three decades. In males, rates decreased annually, especially for NH Whites (-0.5%). In females, there was an increasing annual rate of (0.3% per year) especially in NH Black females (1.2%) and NH White females (0.5% per year) **(Figure 28)**. In 2013-2017, the highest incidence in males was among NH Whites (27.1 per 100,000) and the lowest was among Asians/Pacific Islanders (18.3 per 100,000). From 1988 through 2017, mortality rates decreased annually overall (-2.3%). NH White

males and females experienced the greatest annual decline in mortality (-1.8% and -2.4%). From 2013 through 2017, the mortality rate was highest among NH White males (7.2 per 100,000) and lowest among Asian/Pacific Islander males (5.1 per 100,000). In females, Hispanics had the highest mortality rate (4.1 per 100,000) and Asians/Pacific Islanders had the lowest mortality rate (3.2 per 100,000).

The mortality rate for NH White males and females was higher for the Greater Bay Area than for California. All other racial/ethnic groups had similar incidence rates between the Greater Bay Area and California. Among males specifically, mortality rate in the Greater Bay Area were similar to California; however, the rate for females in the Greater Bay Area was lower than the statewide rate for females.

Table 10a and 10b: Hodgkin and Non-Hodgkin Lymphoma Age-Adjusted Incidence Rates per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2013-2017

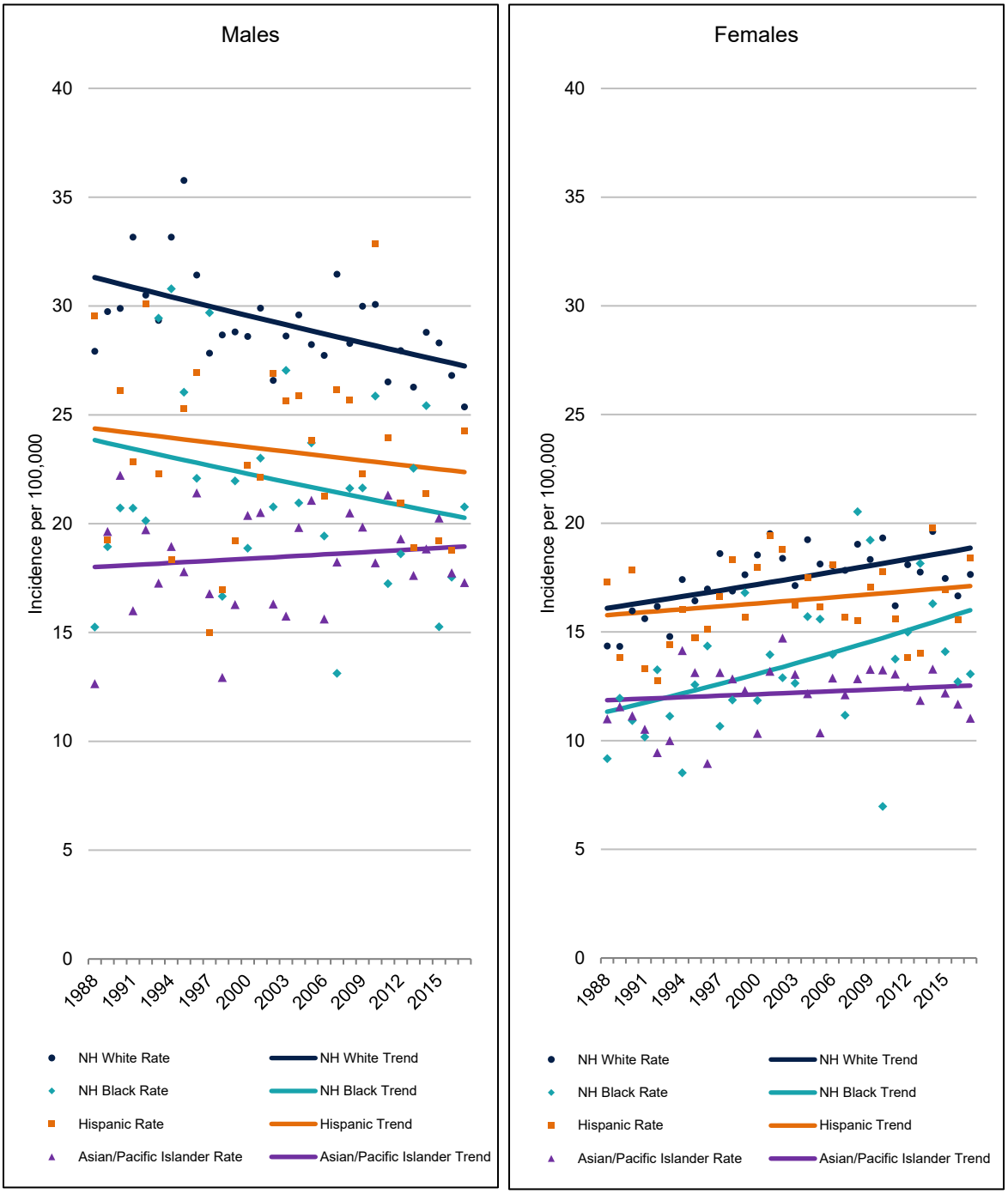
10a: Hodgkin Lymphoma

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	2.6	1.9	2.5	1.9
Non-Hispanic White	3.2	2.6	3.1	2.5
Non-Hispanic Black	3.0	2.4	2.6	2.1
Hispanic	2.8	1.9	2.3	1.8
Asian/Pacific Islander	1.7	1.1	1.6	1.1

10b: Non-Hodgkin Lymphoma

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	23.7	16.1	22.4	15.1
Non-Hispanic White	27.1	17.8	24.8	15.9
Non-Hispanic Black	20.3	14.8	17.4	12.8
Hispanic	20.6	17.0	19.9	15.3
Asian/Pacific Islander	18.3	12.0	17.3	11.6

Figure 28: Non-Hodgkin Lymphoma Incidence Rates and Trends in the Greater Bay Area, by Racial/Ethnic Group, 1988-2017



XVIII. LEUKEMIA

Acute lymphocytic leukemia

Acute lymphocytic leukemia (ALL) is the most frequent malignancy in children (aged 0-14 years) and the leading cause of cancer death in this age group in the U.S. [89, 90]. From 1988 through 2017, the incidence rates of childhood ALL in the Greater Bay Area remained stable for all racial/ethnic groups except Hispanics who experienced a slight annual increase of 1.0%. For the period 2013–2017, Hispanic males had the highest incidence rate of childhood ALL (2.8 per 100,000) while NH Black males had the lowest rate (1.1 per 100,000; **Table 11a)**. For males and females of all racial/ethnic groups, the incidence rates were 2.1 and 1.6 per 100,000, respectively, in the Greater Bay Area, which were slightly less than overall California rates for males and females (2.4 and 1.8 per 100,000, respectively).

Childhood ALL is a highly curable disease, with five-year survival up to 80%–90% [89, 90]. Survival has improved dramatically in the last few decades due to advances in treatment and supportive care. The mortality rates in the Greater Bay Area from 2013-2017 for males and females of all racial/ethnic groups (0.6 and 0.4 per 100,000, respectively) were lower than California rates for males and females (0.7 and 0.5 per 100,000, respectively); **Table 11b**).

Table 11a and 11b: Childhood ALL Incidence and Mortality Rates per 100,000 by Sex, Racial/Ethnic Group, and Region[1], 2012-2016

11a: Incidence

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	2.1	1.6	2.4	1.8
Non-Hispanic White	1.7	1.2	1.9	1.5
Non-Hispanic Black	1.1	1.1	1.2	1.2
Hispanic	2.8	2.1	3.1	2.3
Asian/Pacific Islander	1.6	1.7	1.6	1.4

11b: Mortality

Race/Ethnicity	Greater Bay Area		California	
	Males	Females	Males	Females
All Races/Ethnicities	0.6	0.4	0.7	0.5
Non-Hispanic White	0.4	0.2	0.5	0.3
Non-Hispanic Black	^	^	0.3	0.4
Hispanic	0.9	0.7	1.0	0.7
Asian/Pacific Islander	0.6	0.3	0.5	0.4

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region), and (2) all of California (including the nine-county region of the Greater Bay Area).
^ Statistic not displayed due to fewer than 5 cases.

Acute myeloid leukemia (AML)

Acute myeloid leukemia is the most common type of leukemia and its incidence increases substantially with advancing age, particularly among males. Incidence rates of AML increased annually from 1988 through 2017 for NH Black males (2.1%), Hispanic males (1.7%), and NH White males (0.7%). The 2013-2017 incidence rates of AML were highest for NH White males and females combined (4.2 per 100,000), followed by NH Black persons (4.0 per 100,000), Hispanics (3.8 per 100,000), and lowest for Asians/Pacific Islanders (3.4 per 100,000). For all racial/ethnic groups, AML incidence rates for males and females in the Greater Bay Area and California were similar.

From 1988 through 2017, AML mortality rates increased annually for NH White males (1.2%) and females (1.0%). For all races/ethnicities and both sexes, AML mortality rates in the Greater Bay Area were similar to those in California **(Table 12)**.

Chronic lymphocytic leukemia (CLL)

The incidence of chronic lymphocytic leukemia increases with age, with more than 70% of patients older than 65 years at diagnosis [91]. Among all racial/ethnic groups, incidence is about twice as high in males as in females. In the Greater Bay Area, the incidence of CLL among NH White males and females increased per year by 1.0% and 1.2%, respectively, over the period 1988-2017. However, incidence trends differ significantly by time period for NH Whites who saw somewhat stable incidence rates from 1988 to 2001, then an increase in rates (6.5% per year) until 2008 followed by a decrease in rates (-4.4% per year). The 2013–2017 incidence rate was highest for NH White males and females (5.5 per 100,000), followed by NH Blacks (3.8 per 100,000), Hispanics (1.9 per 100,000), and Asians/Pacific Islanders (1.2 per 100,000). Incidence rates were higher in Marin and San Benito Counties than all other counties for both sexes and all racial/ethnic groups (6.2 and 7.1 per 100,000, respectively). Incidence for NH Black females was 20% higher in the Greater Bay Area (2.7 per 100,000) than California (2.2 per 100,000).

From 1988 through 2017, mortality rates for CLL were higher in males (1.4 per 100,000) than females (0.6 per 100,000) and decreased by -1.4% per year for males and by -1.8% for females. Among both males and females, mortality rates were highest in NH White persons (1.4 per 100,000) and lowest in Asians/Pacific Islanders (0.2 per 100,000). Mortality was higher in Marin County compared to all other counties for both sexes and all racial/ethnic groups (1.7 per 100,000). Mortality rates for CLL in the Greater Bay Area were similar to California rates except for NH Black males (0.9 vs 1.4 per 100,000) and NH Black females (0.5 vs 0.7 per 100,000).

Chronic myeloid leukemia (CML)

Chronic myeloid leukemia is more common in adults than children, and is characterized by the presence of the Philadelphia chromosome [92-95]. Incidence rates of CML in males declined from 1988 through 2017 by an average of -0.7% per year, mainly due to the decreasing incidence among Asian/Pacific Islander males (-1.4%). In females, incidence also declined by -0.9% per year. Incidence rates from 2013-2017 for both sexes combined were similar for NH Whites, NH Blacks, and Hispanics (approximately 1.5 per 100,000) but lower for Asians/Pacific Islanders (1.1 per 100,000). CML incidence

rates in the Greater Bay Area were lower in NH Black females and higher in Hispanic females compared to rates in California.

Mortality rates for CML declined by -6.3% per year from 1988-2017 for all sexes and racial/ethnic groups combined. In the last 15 years, the introduction of tyrosine kinase inhibitors as the first line treatment for CML has dramatically improved survival from this disease [96]. Mortality rates for all racial/ethnic groups in the Greater Bay Area (0.3 per 100,000 for males and 0.1 per 100,000 for females) were similar to those in California (0.4 per 100,000 for males and 0.2 per 100,000 for females).

Table 12. Leukemia Incidence and Mortality Rates for Both Sexes and All Racial/Ethnic Groups Combined, by Histology Type and Region[1], 2013-2017

Histology Type	Incidence per 100,000		Deaths per 100,000	
	Greater Bay Area	California	Greater Bay Area	California
Childhood Acute Lymphocytic Leukemia (ALL)[2]	1.8	2.0	0.5	0.6
Acute Myeloid Leukemia (AML)	4.0	4.0	2.8	2.7
Chronic Lymphocytic Leukemia (CLL)	3.9	3.7	0.9	1.2
Chronic Myeloid Leukemia (CML)	1.5	1.6	0.2	0.3

[1] The two regions represented include: (1) the Greater Bay Area (nine-county region) and (2) all of California (including the nine-county Greater Bay Area region).

[2] Childhood ALL includes cases diagnosed at 0-14 years of age; all other leukemia rates include all cases regardless of age at diagnosis.

XIX. ACKNOWLEDGMENTS

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XXI. APPENDIX

Glossary of Technical Terms

I. Analytic terms

Incidence: The number of new cases of cancer diagnosed in a certain period of time. In this report, incidence data are based on the number of new cases of cancer diagnosed each year in residents of the Greater Bay Area over the period January 1, 1988 through December 31, 2016.

Mortality: The number of deaths due to cancer in a certain period of time. In this report, mortality data are based on the number of deaths from cancer each year in residents of the Greater Bay Area over the period January 1, 1988 through December 31, 2016.

Incidence/mortality rate: The number of new cancer cases (*incidence*) or deaths (*mortality*) in a certain period of time in a specific population, divided by the size of that population. Incidence and mortality rates are expressed per 100,000 population. In this report, annual and cumulative (or average) 5-year incidence and mortality rates are presented.

Confidence interval: A statistical measure of the precision of the observed incidence or mortality rate. The observed rate is an estimate of the true rate based on counts of cancer cases (or deaths) and of the population, and is subject to variation from the true value of the rate. The confidence interval for the observed rate is a range of values within which the true rate is thought to lie, with a specified level of confidence, e.g., 95%. Rates based on larger numbers are subject to less variation.

Age-adjusted incidence/mortality rate: Age-adjustment is a statistical method that allows comparisons of incidence and mortality to be made between populations with different age distributions. An age-adjusted cancer incidence (or mortality) rate is defined as the number of new cancers (or deaths) per 100,000 population that would occur in a certain period of time if that population had a 'standard' age distribution. In this report, incidence and mortality rates are age-adjusted using the U.S. 2000 Standard Population.

Trend: Used to describe the change in the incidence or mortality rate over time. The Annual Percent Change (APC) is used to measure trends. For example, incidence rates may rise gradually over a period of several years, then drop sharply for several years. Statistical criteria are used to quantify the magnitude of change over a period of time.

Race/ethnicity: In this report, race/ethnicity is categorized as: All races/ethnicities, Non-Hispanic (NH) White, NH Black, Asian/Pacific Islander, or Hispanic. "All races" includes all of the above, as well as other/unknown race/ethnicity and American Indian/Alaska Native. The latter two groups are not reported separately due to small numbers for many cancer sites (<5 cases).

II. Cancer terms

Carcinoma: Cancer that begins in the skin or in tissues that line or cover internal organs.

Histology: The study of tissues and cells under a microscope. Cancers are identified and diagnosed primarily on the basis of histology. They often are classified further by histologic subtype.

In situ: Meaning 'in its original place'. For example, in carcinoma in situ, abnormal cells are found only in the place where they first formed. They have not spread.

Invasive: Cancer that has spread beyond the layer of tissue in which it developed and is growing into surrounding, healthy tissues. Also called infiltrating cancer. Invasive tumors are classified according to how far the cancer has spread at the time of diagnosis.

Malignant: Cancerous. Malignant cells can invade and destroy nearby tissue and spread to other parts of the body.

Stage: The extent of the cancer in the body, such as how large the tumor is, and if it has spread. In this report, four categories of stage are used: (1) In situ (see above), (2) localized – cancer is limited to the place where it started with no sign that it has spread, (3) regional – cancer has spread to nearby lymph nodes, tissues or organs, (4) distant – cancer has spread to distant parts of the body.

SEER: The Surveillance Epidemiology and End Results Program of the National Cancer Institute (NCI), which provides cancer statistics for the US population. U.S. SEER 20 is comprised of 20 cancer registries from around the U.S., including all regions in California (San Francisco-Oakland, San Jose-Monterey, Greater California, and Los Angeles), Alaska Native Tumor Registry, Arizona Indians, Cherokee Nation, Connecticut, Georgia Center for Cancer Statistics, Hawaii, Idaho, Iowa, Kentucky, Los Angeles, Louisiana, Massachusetts, New Mexico, New York, Seattle-Puget Sound, Utah, and Wisconsin.