



Melanoma incidence in Marin County, California, 1988-2011

A special report from the Greater Bay Area Cancer Registry

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Executive summary:

As part of our regular surveillance of cancer in the nine-county Greater Bay Area region of California, we have identified some recent changes in invasive melanoma incidence in the non-Hispanic white population of Marin County with implications for melanoma screening and prevention activities. Our review of the most complete data available (1988-2011), which comes from the California Cancer Registry, finds:

1. Melanoma incidence is 43% higher in Marin County than the rest of the Bay Area.
2. In Marin County, melanoma incidence is now higher than lung cancer incidence.
3. Melanoma death rate in Marin County is 18% higher than the statewide death rate.
4. The elevation in melanoma incidence in Marin County is mostly limited to persons aged 65 and over at diagnosis.
5. In 2003, melanoma incidence in Marin County residents aged 65 and over was similar to melanoma incidence in other regions. Since then, it has risen almost 200%.
6. In Marin County, slightly higher proportions of melanoma are diagnosed when the tumor is thinner and more curable.
7. Among Marin County men of all ages, melanoma is now the second most commonly diagnosed cancer after prostate cancer.

Greater public attention to melanoma prevention is urgently needed in this population, including 1) more targeted screening of at-risk persons (especially those over age 65) to detect melanomas when they are thinner and more curable, and 2) more innovative interventions encouraging sun safety, to reduce intense sun exposure among all ages, but children and teenagers in particular, as these ages are considered the most vulnerable for later skin cancer risk.

Background:

Melanoma is the most lethal form of skin cancer. Important risk factors for melanoma include male sex, fair complexion (fair skin that freckles or burns easily and does not tan, blue or green eyes, red or blonde hair), having multiple or large moles, family history of melanoma, and race/ethnicity (melanoma rates are 20-30 times higher in non-Hispanic whites than Asian/Pacific Islanders or African-Americans and 4-5 times higher than Hispanics¹ in national data). Other important risk factors for melanoma are modifiable and include intermittent, intense exposure to sunlight or artificial sunlight such as from tanning beds, especially on skin that is usually covered by clothing. Multiple, blistering sunburns, especially in childhood or the teenage years, are associated with higher risk. Melanoma rates have been shown to associate with lower latitude and higher socioeconomic status².

Among all cancers, melanoma is particularly prone to metastasize. Thus, it is critical to detect and surgically remove the melanoma when it is as small and thin as possible. Five-year survival of melanomas diagnosed when localized exceeds 90%. However, once a melanoma has metastasized, 5-year survival drops to only 16%. Formal recommendations for widespread screening do not exist because of the lack of clinical trial evidence showing that screening decreases melanoma deaths. However, in Germany five years after the completion of a screening program involving over 360,000 participants \geq age 20, melanoma deaths in the screened area were nearly 50% lower in both men and women than in the nonscreened areas³.

Melanoma rates have been increasing dramatically in the past 50 years throughout much of the world, with the highest rates observed among fair-skinned persons in Australia, New Zealand, and North America⁴. In California, we have been

closely monitoring and reporting on increases in invasive melanoma among non-Hispanic white and Hispanic populations of both sexes and different ages over the last decade⁵⁻⁸.

Methods:

Detailed methodology is provided at the end of this document. In brief, we obtained information from the California Cancer Registry (<http://ccrca.org>) regarding all incident cases of invasive melanoma of the skin diagnosed between January 1, 1988 (the beginning of statewide cancer registration) and December 31, 2011 (the most recent year for which registry data were complete). In order to be included in this assessment, a melanoma would have been diagnosed by a physician as invasive (spreading to surrounding tissue, not benign or *in situ*) and reported to the cancer registry. We examined data for non-Hispanic white residents of the following geographic areas: Marin County, other counties of the San Francisco Bay Area (Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties) and the rest of California. Using SEER*Stat software (<http://seer.cancer.gov/seerstat/>), we calculated case distributions, age-adjusted incidence and mortality rates, and appropriate tests of statistical significance to describe any differences in melanoma occurrence by geography and over time.

Findings:

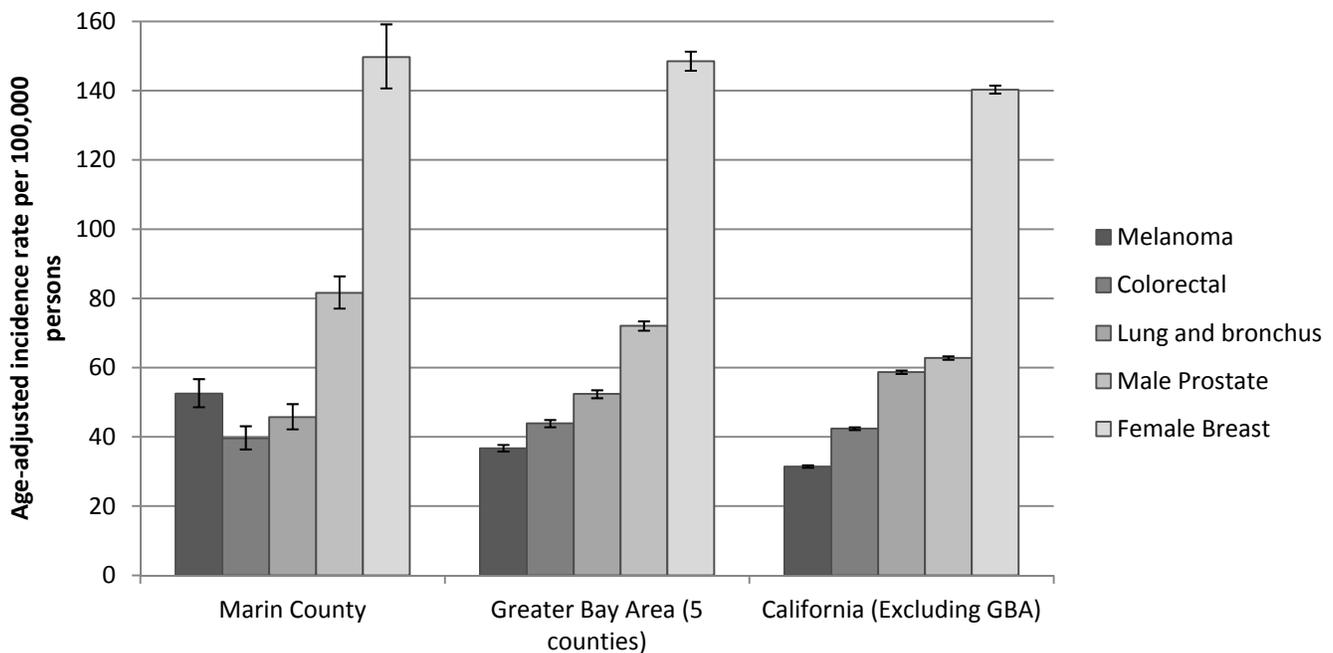
1. Melanoma incidence is 43% higher in Marin County than the rest of the Bay Area.

The overall, age-adjusted incidence of melanoma in whites in Marin County from 2007 through 2011 was 52.5 per 100,000 persons. This rate is 43% higher than the rate for the Bay Area (36.7 per 100,000) and 60% higher than that for California (31.4 per 100,000); these differences are statistically significant. However, the magnitude of the elevation is not uniform across all Marin County residents; it differs by age at diagnosis, sex, and stage of melanoma diagnosis, as described below.

2. In Marin County, the incidence of melanoma is now higher than the incidence of lung cancer.

Figure 1 shows the most recent five-year average age-adjusted incidence rates of the five most commonly diagnosed invasive cancers among whites in California. The most common cancer diagnosed was female breast cancer and the second was male prostate cancer. In Marin County, melanoma was the third most commonly diagnosed cancer overall; it was fifth, after lung and colorectal cancer, in the Bay Area and California. Nationally, melanoma remains the fifth most commonly diagnosed cancer among whites, after male prostate, female breast, lung/bronchus and colorectal cancers.

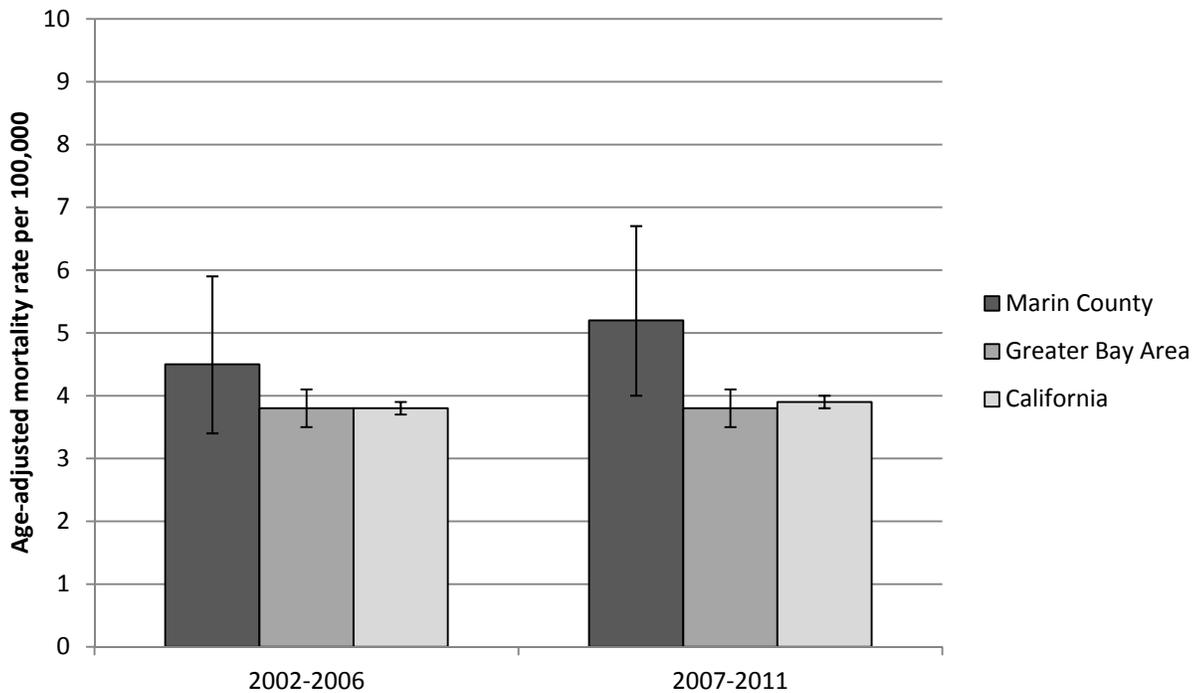
FIGURE 1: Incidence rates of five most common invasive cancers among whites in California, 2007-2011.



3. Melanoma death rates in Marin County white men and women are 18% higher than the state average.

Death rates are one of the most important ways to measure the burden of cancer on a community. Melanoma survival is generally favorable when this disease is detected early. Thus, rates of melanoma mortality are lower when high proportions of melanomas are caught early, as is the case in California (see finding 7. below). Fewer than 20 melanoma deaths are reported yearly in Marin County, making yearly or detailed statistical analysis difficult due to small numbers. Regardless, in the five most recent years for which we have complete data (2007-2011), the overall mortality rate for melanoma in Marin County men and women was 18% higher than that for the state, a statistically significant elevation (Figure 2). In prior years (2002-2006), mortality rates for melanoma in Marin County were not statistically different from mortality rates in the Bay Area in 2007-2011, nor from mortality rates in other regions. Thus, the burden of melanoma in Marin County is not only evident in the rate of new cases diagnosed, but also in a significantly higher death rate as compared to other parts of California. This difference also appears to be increasing in recent years.

FIGURE 2: Overall age-adjusted melanoma mortality rates, Marin County, by time period.

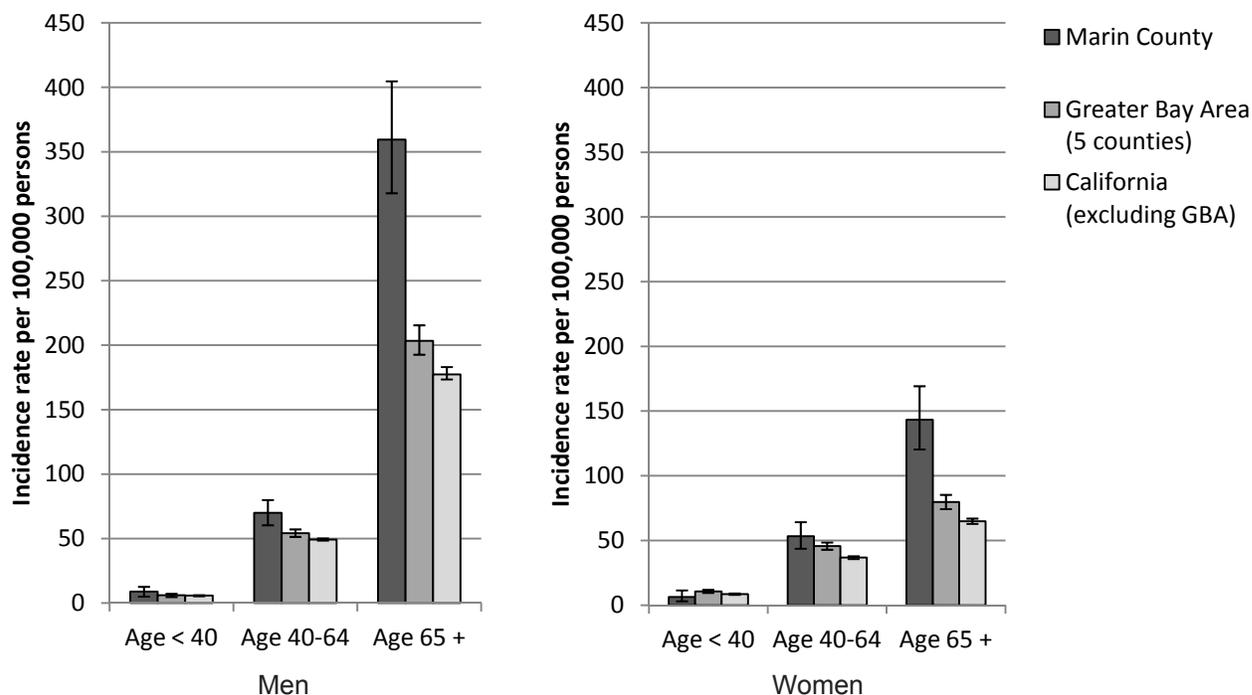


4. The elevation in melanoma incidence in Marin County is mostly limited to persons aged 65 and over.

Figure 3 shows the most recent five-year (2007-2011) average age-adjusted incidence rates of melanoma by age group and sex. In all regions examined in this report, rates were substantially higher among men than women. In Marin County, rates were 62% higher in men than women.

Among men (left panel), rates in Marin County residents aged 40-64 and 65+ years were 42% and 103% higher, respectively, than the California rates, and 29% and 77% higher than the Bay Area (GBA) rates. Among women (right panel), rates in Marin County residents aged 40-64 and 65+ years were 45% and 121% higher, respectively, than the California rate, and 14% and 17% higher than the Bay Area rate. These differences were all statistically significant with the exception of rates for women aged 40-64 in Marin County vs. the Bay Area. There were no significant regional differences among persons diagnosed under age 40. Thus, the elevation in melanoma in Marin County is greatest in persons aged 65 and over, among both men and women.

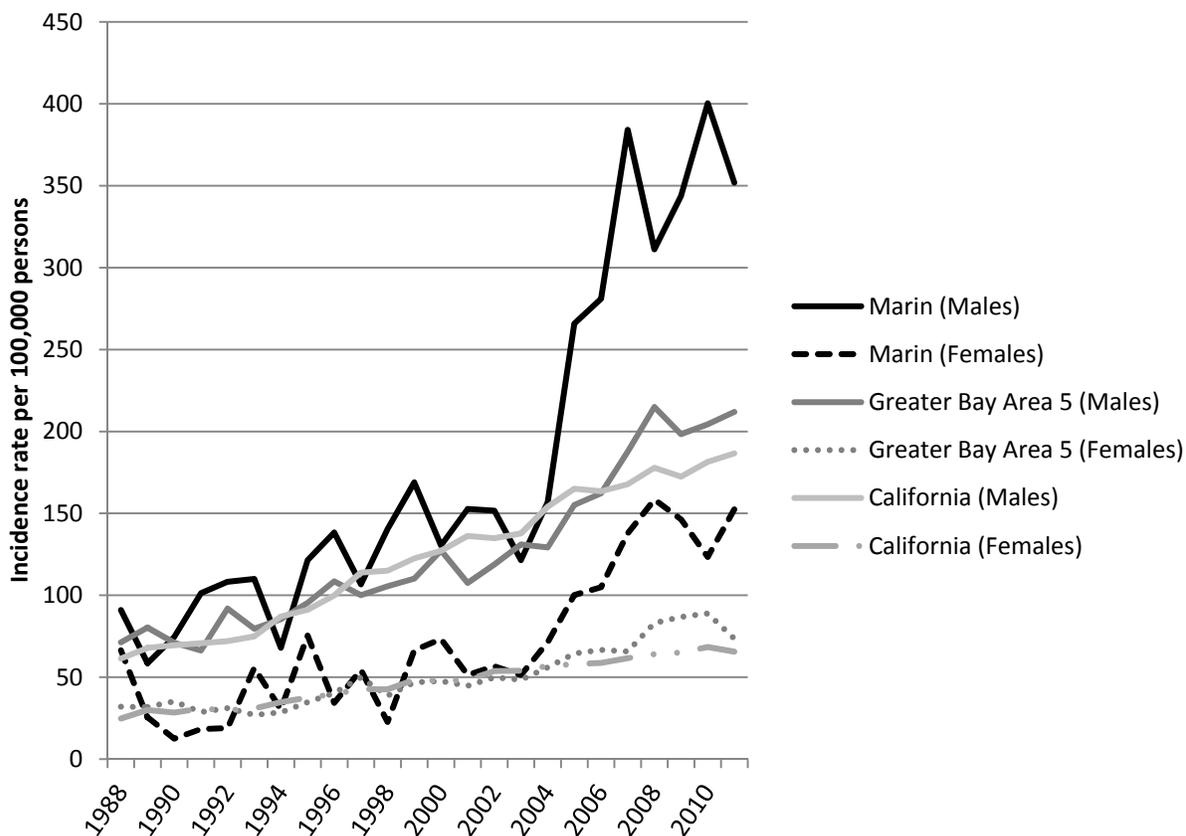
FIGURE 3: Melanoma incidence rate comparison by age group and sex, California, 2007-2011



5. Melanoma incidence in Marin County persons aged 65 and over was similar to other regions until 2003, when it rose dramatically

Figure 3 shows yearly changes in melanoma incidence in Marin County and other regions since 1988, only for the population aged 65 and over. Prior to the year 2003, rates in Marin County for this age group were generally similar to those in the Bay Area and California in showing gradual increases, although with larger annual fluctuations in rates in Marin due to the smaller population. However, beginning in 2003 and until 2011 (the most recent year for which complete cancer data are available), there was a rapid increase in the numbers of melanomas reported and in the corresponding incidence rate for Marin County, both among men (190% increase) and women (197% increase). Although these increases are subject to some fluctuation due to small and thus statistically unstable yearly rates, they appear to have occurred in all groups. It is likely that these trends are influenced by improved reporting of melanomas to cancer registries (particularly by private physician offices), but it is unlikely that these improvements fully explain the substantial differences by region (see details in Conclusions section below).

FIGURE 4: Melanoma incidence rates in whites aged 65 and older, by sex and region, California, 1988 to 2011.



6. Among Marin white men, melanoma is now second only to prostate cancer as the most commonly diagnosed cancer.

Among white men in Marin County, melanoma incidence exceeds that of lung cancer and colorectal cancer. Smoking-related cancers, including lung and bladder cancers, have declined due to effective tobacco control in California (lung cancer rates are dropping three times faster in California than in other states⁹). Thus, melanoma now represents the second most important contributor to the cancer burden among white men in Marin County and the Bay Area (figure 4A). Among women over age 65, lung cancer rates have remained relatively stable while melanoma rates have significantly increased (figure 4B).

FIGURE 4A: Melanoma and lung cancer incidence rates in white males aged 65 years and older, by region, California 1988 to 2011

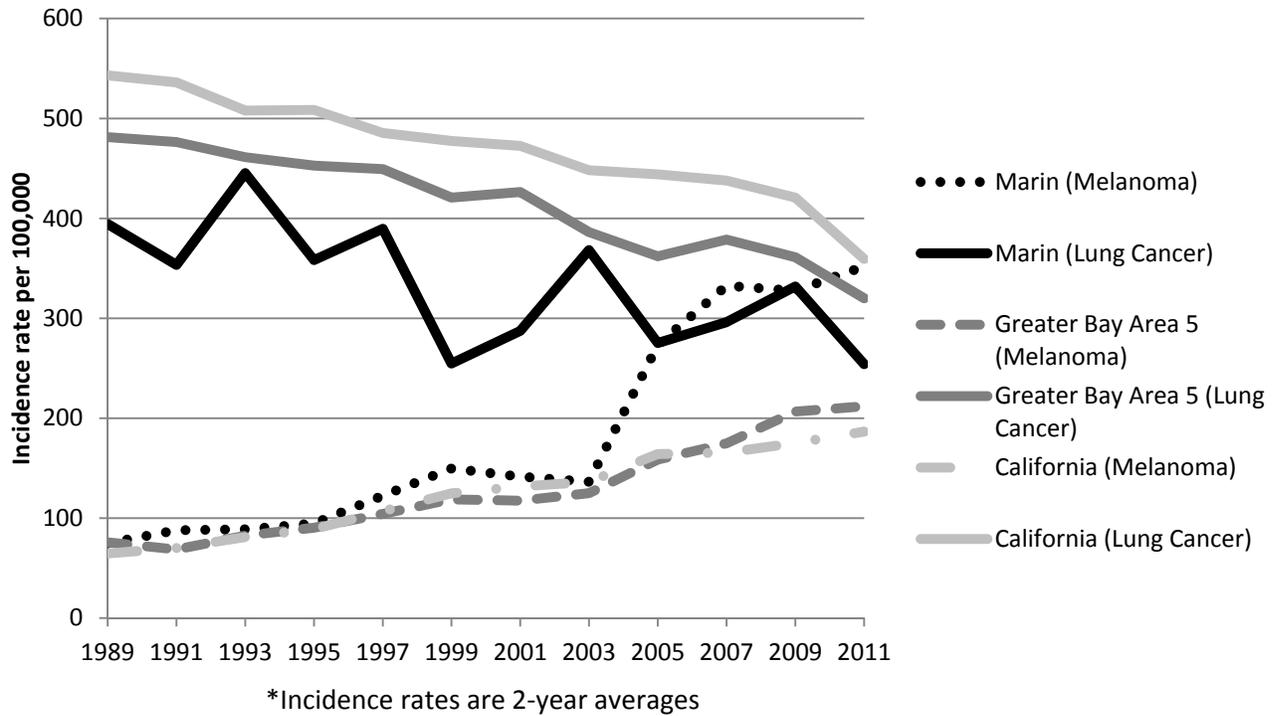
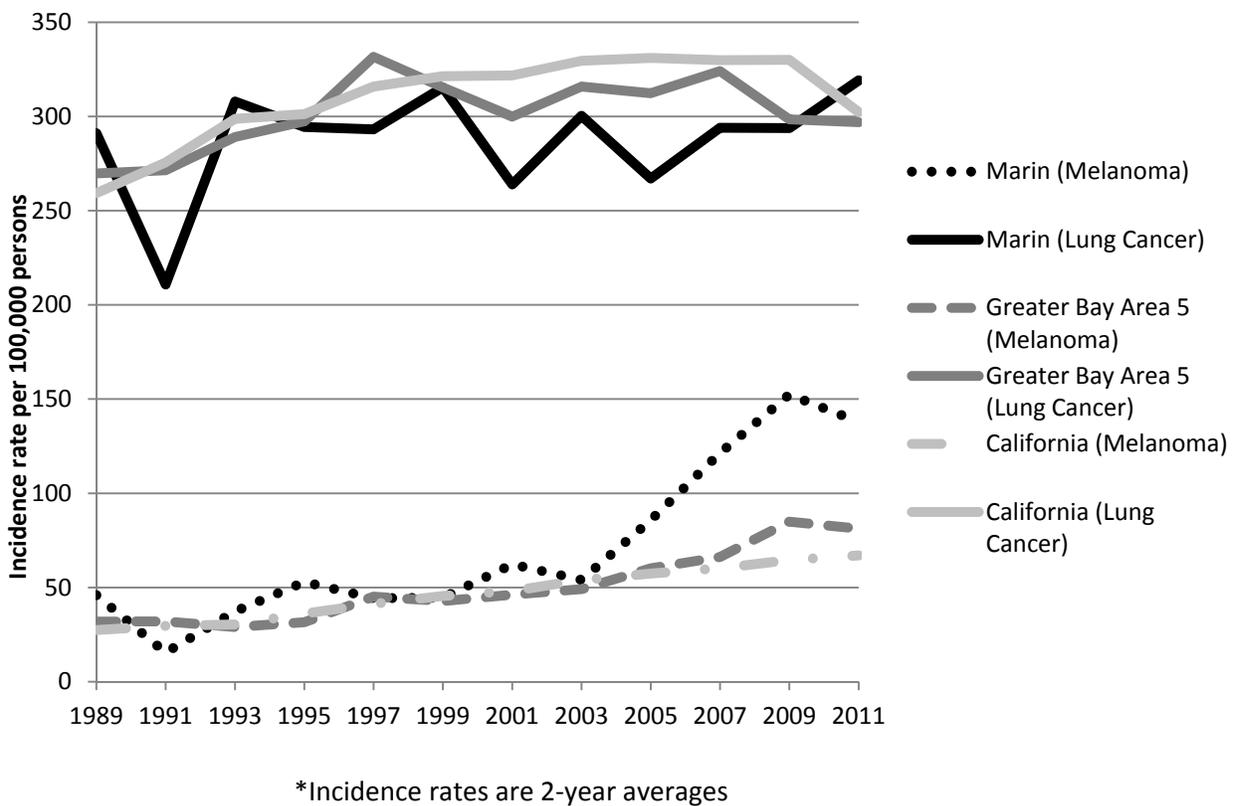


FIGURE 4B: Melanoma and lung cancer incidence rates in white females aged 65 years and older, by region, California 1988 to 2011



7. In Marin County, slightly higher proportions of melanoma are diagnosed when the tumor is thinner and more curable.

Tables 1 and 2 show that higher percentages of melanomas were diagnosed at a thinner, earlier stage (tumors of thickness less than or equal to 1mm) in Marin County than other regions among men and women over age 65 . Among men with melanoma, 69% were diagnosed with tumors less than or equal to 1mm in thickness in Marin County, compared to 63% in the Greater Bay Area and 56% in California. Among women, the difference is more substantial, with 74% of women with melanoma being diagnosed with tumors of less than or equal to 1 mm in thickness in Marin County, compared to 63% in the Greater Bay Area and 57% in California. The percent of missing/unknown tumor thickness does vary by region; 5- 6% of tumors in Marin have missing values for thickness, compared to 7% for the Greater Bay Area and 11% for California. Our comparison of histologic types of melanoma (like the less invasive lentigo maligna type) did not suggest major regional differences in histologic types.

TABLE 1: Percentage of melanomas less than 1mm, greater than or equal to 1mm in size, or of unknown size, in white males age 65 and older, California, 2007-2011.

	Less than or equal to 1mm	Greater than 1mm	Unknown	Total
Marin County	69%	25%	5%	100%
Greater Bay Area	63%	29%	7%	100%
California	56%	34%	11%	100%

TABLE 2: Percentage of melanomas less than 1mm, greater than or equal to 1mm in size, or of unknown size, in white females age 65 and older, California, 2007-2011.

	Less than or equal to 1mm	Greater than 1mm	Unknown	Total
Marin County	74%	21%	6%	100%
Greater Bay Area	63%	29%	7%	100%
California	57%	32%	11%	100%

Conclusions and recommended next steps:

Melanoma incidence among white Marin County residents, especially persons aged 65 and older, is statistically significantly higher than melanoma incidence in the rest of the Bay Area and California. It also has been increasing rapidly in the past decade, such that melanoma now represents the second most common cancer diagnosed in males in Marin County. For the first time, melanoma mortality rates in Marin County are significantly higher than comparable California rates. While increasing trends in melanoma incidence have been noted in many fair-skinned populations in the USA and worldwide, the present data suggest that **more targeted regional prevention efforts are urgently needed**, including better screening of at-risk persons (especially those over age 65) for skin cancer, and primary prevention, aimed at educating individuals and parents regarding safe sun exposure practices.

Reasons for the elevated rates

Based on the sociodemographic characteristics of Marin County, it is likely that the elevation in melanoma is explained by a higher concentration of persons with known risk factors for melanoma, as opposed to any characteristics unique about the geography of the county. In a national assessment, counties with lower poverty, higher education, higher income, and lower unemployment had higher age-adjusted melanoma incidence rates than other counties². Relative to other parts of the United States, invasive melanoma rates among non-Hispanic whites in Marin County (overall rate 53 per 100,000) are comparable to those in the Canyonlands area of Utah (Garfield, Iron, and Morgan Counties, overall rate 51-53 per 100,000), but lower than those in Hawaii (overall rate 63 per 100,000). It is also possible that some of the excess incidence of melanoma in Marin County described for this time period is explained by better access to skin cancer

screening and diagnostic services, and/or faster reporting of melanomas (especially by private physician offices) than other regions.

Reasons for the increasing trend

Rapid increases in melanoma incidence have been reported in non-Hispanic white populations in most parts of the world⁴ and are thought to relate to changing patterns of sun exposure (i.e., from sun avoidance to sun seeking). However, there is also evidence that much of the increase represents the identification of thinner melanomas through expanded screening in the setting of better skin cancer awareness¹⁰. It is possible that better utilization of skin screening may have led to earlier detection of melanomas in Marin County and thus an acceleration of an increasing trend, with a higher rate of increase seen among thinner cancers compared with thicker or metastatic cancers.

The notion of better skin screening explaining melanoma incidence increases is well studied, in light of melanoma mortality rates that are stable and not increasing in the US and other countries. Indeed, the observed decrease in melanoma mortality rates after 1981 and previously reported evidence of general improvement in survival by stage over this time period are consistent with a shift toward earlier detection of disease through increased access to screening¹⁰. However, we previously reported increasing incidence trends in California (a doubling over two decades) for thicker and regional/distant cancers, which are less likely to be susceptible to screening biases⁷. We also found substantial melanoma increases among populations of the lowest socioeconomic status, for whom access to screening is likely to be poorer, and suggested that increases in melanomas of all thicknesses, in populations of all socioeconomic strata, likely represent true increases in pathologist-confirmed invasive melanoma⁷.

Some part of the increases in melanoma in the Bay Area in the mid-2000's may relate to improvements in reporting. State-mandated reporting of cancer in California extends to all health care providers, including hospitals, pathology labs and private physicians. In the mid 2000's, regional cancer registries in California made special efforts to help private physicians and stand-alone dermatopathology labs carry out their reporting responsibilities. In 2008, we reported on underreporting and our successful efforts to improve it¹¹. Our examination of trends by type of reporting entity (data not shown) does suggest that melanomas in Marin County (and the rest of the Bay Area) began to be better reported in the mid-2000's due to these efforts. If so, the known improvements in reporting may mean that rates prior to the mid-2000's are based on incomplete melanoma reporting, and thus underestimate the true rate. Thus, true upturns in incidence may have happened prior to 2003 but were not detected due to underreporting.

Encouraging early detection of melanoma

Professional- and self- skin examinations can help detect melanomas when thinner and more curable. Formal recommendations for primary care provider (PCP) screening of the general population are controversial because there are no clinical trials showing that widespread screening decreases melanoma mortality. However, five years after the completion of a PCP-based screening program involving >360,000 participants in Germany, mortality rates from melanoma in the screened state were nearly 50% lower than rates observed in the nonscreened regions³. Persons thought to be at high risk of melanoma due to family history or known sun damaged skin, especially men over age 60) should talk to their PCP or dermatologist about a strategy for regular skin examinations. Melanoma survivors must be especially vigilant for second primary melanomas, for which they are at elevated risk¹².

Regular self skin examination can also improve earlier detection. Melanoma often occurs on areas that are exposed to the sun sporadically, such as the back in men and legs in women, sites that are less amenable to self inspection. Thus, thorough screening requires help from a partner, family member, or friend. Regular self-examination, coupled with adequate education on what constitutes a problematic mole or potential melanoma, represents an easily utilized strategy for earlier detection in Marin County. The ABCDE rule (watch for moles that have Asymmetry, Border irregularity, Color variation, Diameter over 6 mm and Evolving (changing)) is a helpful metric as to what to look for.

Encouraging sun safety for all ages

Preventing melanoma from ever starting is our best strategy for reducing its burden, and requires safe sun exposure practices at all ages. Melanoma risk seems to be most strongly associated with intense, intermittent sun exposure (such as that received on tropical vacations in the winter)¹³. Risk is also associated with history of multiple severe sunburns before age 30¹⁴. Tanning bed usage was recently declared a carcinogen by the International Agency for Research on Cancer yet remains prevalent among young women. Thus, melanoma prevention for all ages involves never using tanning beds and sun protection appropriate to the outdoor activities being carried out. There are at least five main sun-protective behaviors that can reduce ultraviolet exposure at all ages recommended by the Centers for Disease Control and other health agencies: 1) wearing a broad-brimmed hat, 2) wearing a long-sleeve shirt, 3) using sunscreen with broad spectrum protection, 4) wearing sunglasses, and 5) seeking shade whenever possible.

Novel strategies for preventing melanoma needed

It is clear that new strategies are needed to turn the tide of increasing melanoma and skin cancer incidence in Marin County, California, and the US. More innovative solutions at both the individual- and community-levels are needed to increase adoption of sun safe lifestyle practices thought to reduce skin cancer. An example of a new policy expected to have impact on melanoma occurrence in young persons is legislation to ban minors from using tanning bed use, which California was the first state to pass in 2011. Research to identify barriers to sun-protective behavior—especially among teenagers—and development of further, innovative strategies to encourage a culture of sun safety at school, on vacation, and everyday should be a public health priority in Marin County in light of the melanoma statistics presented here. Educational interventions providing suggestions for ways to enjoy outdoor and vacation activities while minimizing intense sun exposure (e.g., using long sleeved swim shirts, UV-protective clothing, sunscreen foam), especially among children and teenagers, should be implemented. In the meantime, this report and other efforts will seek to inform and educate the public about the growing problem of melanoma, its warning signs, the importance of self-skin examination, and the need for better sun safety among individuals, families, and the community.

Detailed methodology:

We obtained from the state-mandated California Cancer Registry information regarding all incident cases of invasive melanoma of the skin diagnosed between January 1, 1988 and December 31, 2011 among non-Hispanic white residents of the following geographic areas: Marin County, other counties of the San Francisco Bay Area (Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties) and the rest of California. Invasive melanoma was defined as International Classification of Disease for Oncology, 3rd Edition [ICD-O-3], morphology codes 8720-8790 and topography codes C44.0 through C44.9. This report focuses on invasive cancers (determined by a pathologist to be spreading to surrounding tissue) and does not include *in situ* or benign cancers. It also focuses on non-Hispanic white populations because melanoma risk varies substantially by skin color, with the highest rates in persons with the fairest complexions, and because over 90% of all melanoma diagnoses in California occur in non-Hispanic whites. We obtained melanoma mortality data and population estimates from the National Cancer Institute SEER program through their SEER*Stat program (version 8.3.1, National Cancer Institute, Bethesda, MD). We used SEER*Stat for all calculations, including case distributions and incidence and mortality rates per 100,000 person-years and corresponding 95% confidence intervals (CI). All rates were age-adjusted to the 2000 US standard. Tests of statistical significance assumed a two-sided, p-value of <0.05. Rate ratios and 95% CI were calculated for comparison across categories of geographic region and time period.

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