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## San Francisco Department of Public Health

Grant Colfax, MD  
Director of Health

Tomás Aragón, MD, DrPH  
Health Officer

### Cover Summary

Date: March 6, 2019

From: Tomás Aragón, MD, DrPH, Health Officer

Re: Greater Bay Area Cancer Registry, University of California, San Francisco report:  
“Cancer Incidence Among Residents of the Bayview-Hunters Point Neighborhood, San Francisco, California, 2008—2012”

At the request of the San Francisco Department of Public Health, the Greater Bay Area Cancer Registry (GBACR) at the University of California, San Francisco conducted a cancer incidence analysis for Bayview Hunters Point (BVHP) neighborhood for the period 2008–2012, the latest period for which reliable population and cancer estimates are available. BVHP residents have expressed concerns about cancer rates in the neighborhood because of the Hunters Point Naval Shipyard (HPNS), a U.S. Environmental Protection Agency Superfund site undergoing clean up and restoration. The GBACR evaluated 12 cancer types that, according to the American Cancer Society [1], have been linked to radiation exposures. A similar BVHP cancer analysis was conducted in 1998 for the period 1993–1995 that found no elevated cancer rates [2].

The current GBACR cancer incidence analysis compared the observed number of cancers in BVHP from 2008–2012 to the expected number of cancers if the BVHP neighborhood experienced the same cancer rates as similar neighborhoods in the Greater Bay Area nine-county region. The following cancers were evaluated for men and women: lung, colon, thyroid, myeloma, bladder, esophageal, stomach, liver, and lymphoma; and for women only: breast, uterine, and ovary.

For all cancers combined, including both men and women, there was not an excess number of cases seen in BVHP. No excess number of cancers of any type was seen in women. There was an excess number of cases of one cancer—lung cancer—in men. There were no other significant findings in men. The analysis did not study causes or risk factors, and provides no evidence of any causes of the lung cancer among men.

The GBACR analysis identified a 31% increase in lung cancer cases among men. This finding was statistically significant. Because the most common cause of lung cancer is smoking, the GBACR evaluated whether smoking rates are elevated in BVHP. According to 2016 data from the Centers for Disease Control and Prevention “500 Cities Project: Local Data for Better Health,” and included in the GBACR study, BVHP census tracts have increased smoking prevalence compared to other areas in San Francisco.

The GBACR data analysis could not address potential past or current radiation exposures, or any other potential causes or risks for the cancer cases in the BVHP from 2008-2012. The California Department of Public Health (CDPH), Radiation Health Branch recently completed a radiation health and safety scan of a specific portion of the BVHP, Parcel A at the Hunters Point Shipyard, which was transferred to San Francisco in 2004, and where residents are living in new housing developments. The CDPH concluded that there are “no radiological health and safety hazards to the residents of Parcel A-1” [3].

We have asked the GBACR to analyze additional years so that we can see if the elevated lung cancer in men is a pattern, and if it is changing over time. We also will be examining our tobacco cessation efforts in the Bayview Hunters Point to see where they can be strengthened. We will continue working with the GBACR, the UCSF San Francisco Cancer Initiative, the SF Health Network and other health system providers in BVHP to address the primary prevention of lung cancer.

Sincerely,



Tomás Aragón, MD, DrPH  
Health Officer, City & County of San Francisco  
Director, Population Health Division, SFDPH

## References

1. American Cancer Society. Do x-rays and gamma rays cause cancer? Online: <https://www.cancer.org/cancer/cancer-causes/radiation-exposure/x-rays-gamma-rays/do-xrays-and-gamma-rays-cause-cancer.html>
2. Glaser ER, Davis MM, Aragón T. Cancer Incidence Among Residents of the Bayview-Hunters Point Neighborhood, San Francisco, California 1993-1995. Report. California Cancer Registry, California Department of Health Services. January 1998, Available from: <https://www.sfdph.org/dph/files/reports/StudiesData/DiseaseInjury/bvhuntca.pdf>
3. California Department of Public Health, Radiation Health Branch. “Hunters Point Shipyard Parcel A Health and Safety Survey: Update for CAC Environment and Reuse Subcommittee” (slide presentation). February 25, 2019. Full report available from: <https://www.cdph.ca.gov/Programs/CEH/DRSEM/Pages/RHB-Environment/Hunters-Point-Naval-Shipyard-Parcel-A-1-Survey.aspx>



# Cancer Incidence Among Residents of the Bayview-Hunters Point Neighborhood, San Francisco, California, 2008—2012

Greater Bay Area Cancer Registry  
University of California, San Francisco  
February 27, 2019

## Introduction

The Greater Bay Area Cancer Registry (GBACR), as part of the California Cancer Registry (CCR), collects and manages cancer-related data on persons diagnosed with cancer in the Greater Bay Area (Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Santa Cruz, Monterey, and San Benito counties). Data are obtained from physicians, hospitals, and other cancer treatment facilities, which are required by state law to report all cancer cases to the registry.

This report is in response to a request by the San Francisco Department of Public Health to evaluate the incidence of cancer in the Bayview and Hunters Point neighborhoods. The GBACR cannot address any potential radiation exposure to residents in this area. However, cancer registry data can tell us whether or not an excess of specific types of cancers (such as those types of cancers linked with radiation exposure) have occurred in a particular region, in relation to the incidence of such cancers in the Greater Bay Area as a whole.

Therefore, the GBACR has conducted an analysis in relation to the incidence (new cases) of such cancers for the Bayview and Hunters Point neighborhoods in San Francisco. The cancer sites evaluated include myeloma, thyroid, bladder, breast, lung, ovarian, colon, esophageal, stomach, liver and lymphoma<sup>1</sup>.

## Methods

In our analysis, the number of cases observed in the designated area during a specified time period is compared to the number of cases expected to have occurred in the area given the number of persons who live there, and the rates of cancer in the Greater Bay Area. In this analysis, cancer registry data were used to determine whether an excess number of cancer cases were diagnosed in residents of the neighborhoods identified as Bayview and Hunters Point, given the expected occurrences of these cancers in the entire Greater Bay Area population. Eleven Census tracts were selected for analysis

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<sup>1</sup> Obtained from the American Cancer Society's list of cancer sites linked with radiation exposure: <https://www.cancer.org/cancer/cancer-causes/radiation-exposure/x-rays-gamma-rays/do-xrays-and-gamma-rays-cause-cancer.html>



(Figure 1). These Census tracts were: 9809.00, 9806.00, 0612.00, 0231.03, 0230.03, 0610.00, 0234.00, 0233.00, 0232.00, 0231.02, and 0230.01.

Because populations are enumerated at the census tract level only for decennial censuses, we examined cases diagnosed in the 5-year period surrounding the 2010 Census (2008-2012). Thus, cancer cases of all races/ethnicities and both sexes diagnosed among residents of the identified Census tracts, during the years 2008-2012 were obtained from the GBACR and served as the *observed* cases. For each cancer site evaluated, the observed number of cases were compared to an *expected* number of cases. Using the observed and the expected numbers of cases, a standardized incidence ratio (SIR) and 95% confidence intervals (CI) around the SIR were calculated for each cancer site.

- *Observed*: Obtained from the GBACR, these are the number of cancer cases diagnosed in residents of the selected Census tracts during the time period evaluated, 2008-2012.
- *Expected*: The number of cases one would expect to see in the selected Census tracts, if the pattern of cancer occurrence in the Census tracts was the same as in the reference area (all nine counties of the GBACR). This number is calculated by multiplying the age-, sex-, and race/ethnicity-specific cancer incidence rates for the reference population by the Census tract population, retrieved from the 2010 Census data.

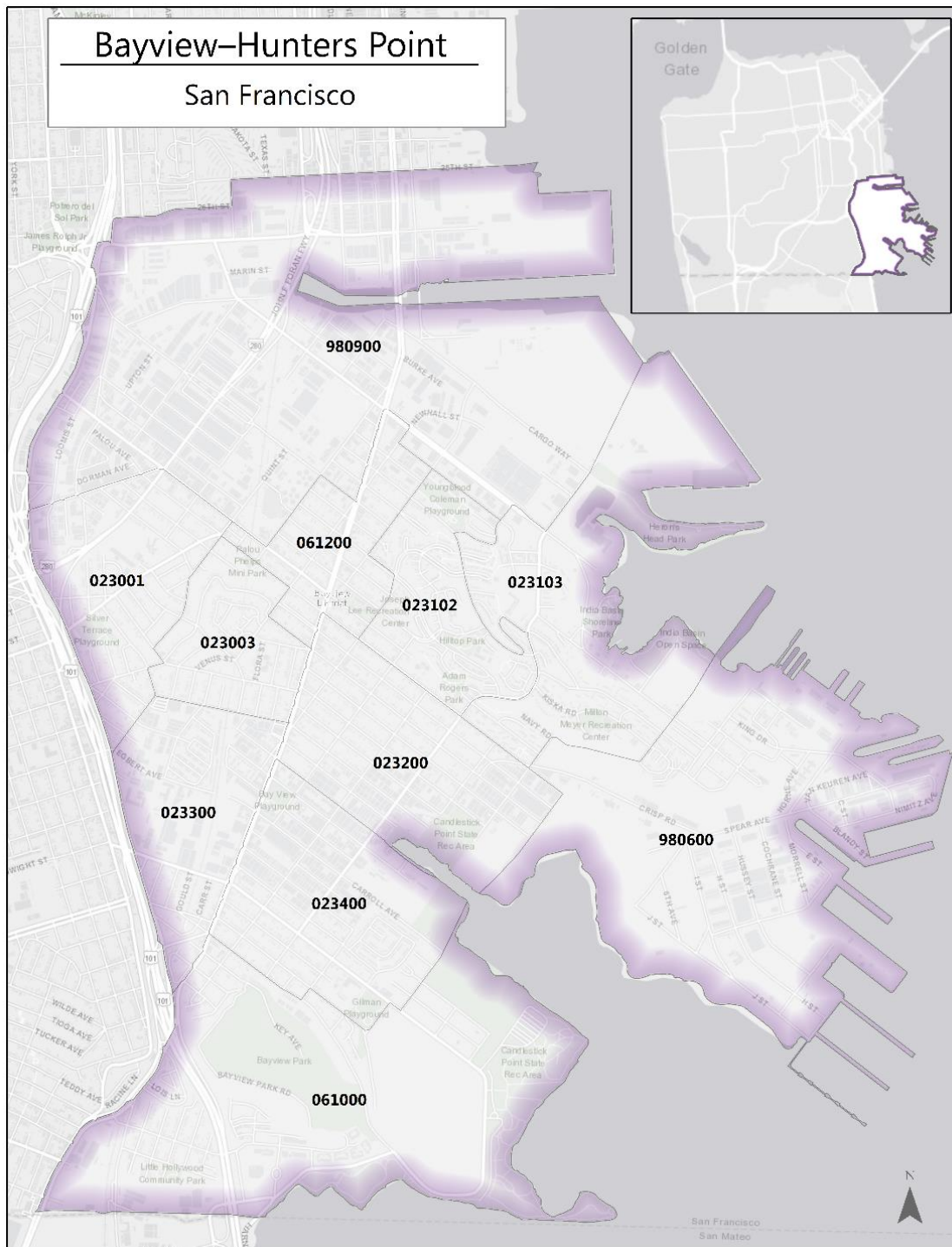
The SIR is the ratio of the observed number of cases to the expected number of cases. An SIR greater than 1.0 indicates that more cases were observed than were expected and an SIR less than 1.0 indicates that fewer cancer cases occurred than were expected. The 95% confidence interval determines if the ratio is “statistically significant” (i.e., the difference between observed and expected is unlikely due to chance). The confidence interval assesses the stability of the SIR.

This is the recommended method by the California Cancer Registry (CCR) and the Center for Disease Control and Council of State and Territorial Epidemiologists, for investigating cancer concerns<sup>2</sup>.

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<sup>2</sup> <https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6208a1.htm>

**Figure 1. Map of Bayview-Hunters Point census tracts included in analyses: 9809.00, 9806.00, 0612.00, 0231.03, 0230.03, 0610.00, 0234.00, 0233.00, 0232.00, 0231.02, and 0230.01.**



## Results

The observed number of cancer cases in persons residing in the Bayview and Hunters Point Census tracts from 2008 to 2012 are presented in Table 1. The cancer sites listed can be linked to radiation exposure according to the American Cancer Society.<sup>3</sup> Many of these sites have other risk factors as well, such as smoking. The total numbers for such cancers by sex are 182 in males and 305 in females. Among males and females, the total observed number of cancers did not differ from the total expected number (SIR = 1.10 for males, and SIR = 1.12 for females). For specific sites, the observed number of male lung cancers were 31% greater than expected (SIR = 1.31) (Table 2a,b).

**Table 1. Observed number of cancer cases\* in Bayview-Hunters Point Census tracts, by sex, 2008-2012**

CANCER SITE	MALE	FEMALE
BREAST	<5	107
LUNG	71	51
COLON	37	25
UTERINE	NA	29
THYROID	<5	20
MYELOMA	7	8
BLADDER	19	9
OVARY	NA	10
ESOPHAGEAL	<5	<5
STOMACH	6	12
LIVER	22	11
LYMPHOMA	15	21
<b>RADIATION EXPOSURE-LINKED CANCERS COMBINED</b>	<b>182</b>	<b>305</b>

\*Data are suppressed if number of cases is less than 5.

NA = not applicable

<sup>3</sup> American Cancer Society: <https://www.cancer.org/cancer/cancer-causes/radiation-exposure/x-rays-gamma-rays/do-xrays-and-gamma-rays-cause-cancer.html>

**Table 2a. Standardized Incidence Ratios (SIR) and 95% Confidence Intervals (CI) for Males**

CANCER SITE	SIR	95% CI	CONCLUSION
LUNG	1.31	1.02 - 1.65	SIG HIGH
COLON	1.32	0.93 - 1.82	OK
THYROID	--	--	--
MYELOMA	0.92	0.37 - 1.89	OK
BLADDER	1.15	0.69 - 1.80	OK
ESOPHAGEAL	--	--	--
STOMACH	0.55	0.20 - 1.19	OK
LIVER	1.02	0.64 - 1.55	OK
LYMPHOMA	0.83	0.46 - 1.37	OK
RADIATION EXPOSURE- LINKED CANCERS COMBINED	1.10	0.95 - 1.27	OK

**Table 2b. Standardized Incidence Ratios (SIR) and 95% Confidence Intervals (CI) for Females**

CANCER SITE	SIR	95% CI	CONCLUSION
BREAST	1.02	0.83 - 1.23	OK
LUNG	1.11	0.83 - 1.47	OK
COLON	0.91	0.59 - 1.35	OK
UTERINE	1.18	0.79 - 1.69	OK
THYROID	1.56	0.95 - 2.41	OK
MYELOMA	1.17	0.50 - 2.30	OK
BLADDER	1.48	0.68 - 2.80	OK
OVARY	0.96	0.46 - 1.76	OK
ESOPHAGEAL	--	--	--
STOMACH	1.39	0.72 - 2.44	OK
LIVER	1.41	0.70 - 2.52	OK
LYMPHOMA	1.39	0.86 - 2.13	OK
RADIATION EXPOSURE- LINKED CANCERS COMBINED	1.12	0.99 - 1.25	OK

<sup>a</sup> **OK** = Non-statistically significant finding, meaning that the observed number of cases was approximately equal to expected number of cases, i.e., the number we observed was not statistically significantly different from what we might have seen by chance alone given the comparison rates from the Greater Bay Area.

**Sig High** = The number of observed cases was significantly greater than the number of cases expected given the rates in the Greater Bay Area during this time period

**Sig Low** = The number of observed cases was significantly less than the number of cases expected given the rates in the Greater Bay Area during this time period

**Standardized Incidence Ratios and associated Confidence Intervals cannot be calculated if case count is less than 5.**



## Discussion

Cancer is a complex disease with many different causes, and the reasons why it affects some people and not others are still poorly understood for many cancers. Oftentimes, it is difficult for epidemiologists to provide answers regarding cancer concerns and perceived cancer clusters. This is, in part, because cancer is a very common disease. Approximately 1 in 2 people will develop some type of cancer in their lifetime, and this estimate continues to rise due to our aging population. A 'true' cancer cluster is rare and might typically involve, (1) more cases (of the same type or similar types) of cancer than expected in a group of people, geographic area and/or period of time, (2) a rare type of cancer, or (3) cases that appear in age groups that might not normally be associated with a certain cancer. Although most cancer clusters occur by chance, it is not uncommon for people to be concerned that cancer clusters are caused by an exposure that occurs or occurred in their environment. However, clusters that are proven to be associated with an environmental or occupational carcinogen are extremely rare. And these would not be identified solely by looking at cancer registry data.

With regard to registry-based cancer cluster analyses, there are general limitations that pertain to *all* analyses that must be noted. Many of these are innate to the registry data itself:

- Registry data do not routinely include information on health behaviors such as smoking or diet, which affect cancer risk.
- The registry has no information on environmental exposures or exposure levels to known carcinogens at a residence or workplace.
- The registry does not collect information on how long people have lived in an area or where they lived before. This is significant because for many cancers, it can take years of exposure to a carcinogen to the development of the cancer. Prolonged exposure over many years may be necessary to cause cancer.
- Cancer registry data take time to be collected as they derive from multiple sources. It takes up to 2-3 years for case ascertainment to be considered complete for any given year. For example, cases diagnosed in 2016 would be available in the registry in 2018-2019. Therefore, it is often not possible to look at recent diagnoses and we must look at historical cases that may not be relevant to the concerned party.
- Because the expected number of cancers is calculated by applying the age and sex-specific incidence rates in the reference population (those with cancer in the GBACR) to the age and sex-specific population of the area under study (Census tracts), accurate and granular population data are required and obtained from the most recent census year. It is proven that mid-way between census years, the change in population structure can be significant. As a result, the analysis may not reflect the population changes in an area for the most recent years of diagnosis.





In addition, the problem with choosing small areas like specific Census tracts is that population numbers are often small and therefore confidence intervals of SIRs can be wide, and it may be challenging to detect a significant finding. However, if there is some exposure of concern, and there are enough long-term residents in a certain area, the data would pick up the increased incidence by comparing the observed cases found in a specific area to an expected number of cases based on cancer rates in a comparable area.

Based on our analysis of cancer registry data, ***there is evidence of an excess number of lung cancer cases among males, but not females, in the Bayview-Hunters Point area of San Francisco between 2008 and 2012.*** There is not evidence of other cancers linked to radiation exposure among males or females. Additionally, there is not evidence of an excess number of all radiation-exposure linked cancers combined, among males or females.

While the findings cannot speak to radiation exposures experienced by the Bayview-Hunters Point residents, they do provide some evidence of an increased incidence of lung cancer, specifically among males. The greatest risk factor for lung cancer is a history of smoking. Data obtained from the ***500 Cities Project: Local Data for Better Health***<sup>4</sup> shows that some of the Census tracts in the Bayview-Hunters Point area have a higher prevalence of current smoking than in other areas of San Francisco, referencing data from 2016 (see map)<sup>5</sup>.

Future efforts by the GBACR to address the findings in this report include a second phase of analysis to evaluate lung cancer incidence in the Bayview-Hunters Point neighborhood during earlier time periods surrounding Census years (1988-1992 and 1998-2002). In addition, any additional data found on smoking rates in this area will be evaluated further.

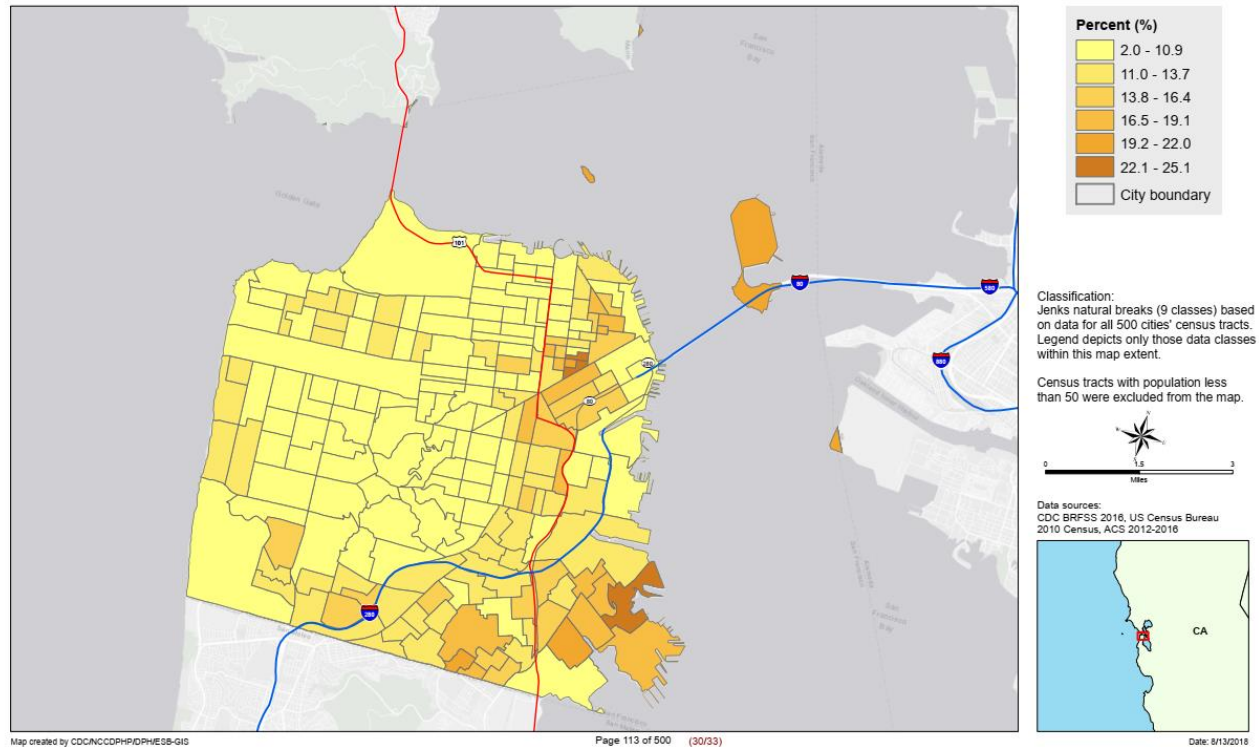
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<sup>4</sup> The 500 Cities Project provides city and census tract-level estimates for chronic disease risk factors, including current smoking. The purpose is to allow cities and local health departments to better understand the burden and geographic distribution of health-related variables in their jurisdictions, and assist them in planning public health interventions: <https://www.cdc.gov/500Cities/>

<sup>5</sup>

[https://nccd.cdc.gov/500\\_Cities/rdPage.aspx?rdReport=DPH\\_500\\_Cities.InteractiveMap&isStates=59&isCategories=UNHBEH&isMeasures=CSMOKING](https://nccd.cdc.gov/500_Cities/rdPage.aspx?rdReport=DPH_500_Cities.InteractiveMap&isStates=59&isCategories=UNHBEH&isMeasures=CSMOKING)

### Current smoking among adults aged ≥18 years by census tract, San Francisco, CA, 2016



The 500 Cities Project:

[https://nccd.cdc.gov/500\\_Cities/rdPage.aspx?rdReport=DPH\\_500\\_Cities.InteractiveMap&isStates=59&isCategories=UNHBEH&isMeasures=CSMOKING](https://nccd.cdc.gov/500_Cities/rdPage.aspx?rdReport=DPH_500_Cities.InteractiveMap&isStates=59&isCategories=UNHBEH&isMeasures=CSMOKING)

More information on lung cancer can be found here: <https://www.cancer.gov/types/lung>.

***This report will be shared with the San Francisco Department of Public Health and the California Department of Public Health.***