HEAT MAPS: TRENDS IN LATE-STAGE DIAGNOSES OF SCREEN-DETECTABLE CANCERS IN CALIFORNIA COUNTIES, 2000 – 2018

UCDAVIS HEALTH | COMPREHENSIVE CANCER CENTER

ACKNOWLEDGEMENTS AND DISCLAIMER

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SUMMARY OF FINDINGS

This report presents data on seven types of cancer that have the greatest potential for early diagnosis through screening: (1) female breast, (2) colorectal, (3) cervical, (4) prostate, (5) melanoma, (6) oropharyngeal, and (7) lung cancers. From 2009-2018, late-stage (spread beyond the site of origin) diagnoses have significantly increased for colorectal and prostate cancers; significantly decreased for melanoma and lung cancers; and remained relatively constant for breast, cervical, and oropharyngeal cancers.

ORAL CAVITY/PHARYNX

FEMALE BREAST

LUNG

SKIN (MELANOMA)

COLON/RECTUM

UTERINE CERVIX

PROSTATE
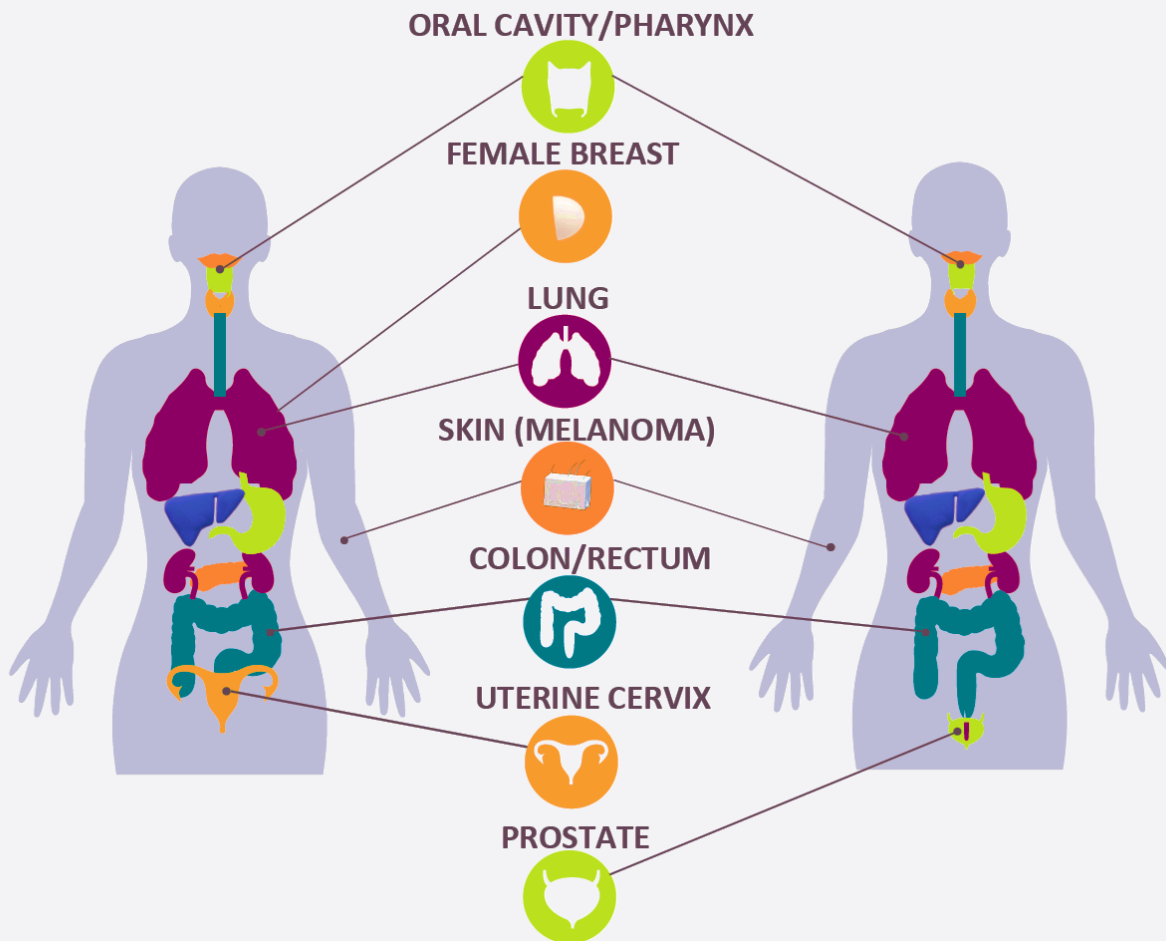
For the 10-year period 2009 through 2018, the trends of cancers diagnosed at late stages were assessed for California counties.

- The proportion of breast cancer diagnosed at late stage remained relatively constant in most regions of the state, except for Los Angeles-Orange where late-stage diagnoses significantly decreased. The Bay Area and Sacramento regions had the lowest percentage of late-stage diagnoses (< 29.4%) while the Inland Empire (> 30.5%) and Central Valley (mostly > 30.5%) regions had the highest percentages.
- Significant increases in late-stage colorectal cancers were seen throughout the state. In 2018, 60.6% to 62.8% of colorectal cancers were diagnosed late stage compared to 55.4% to 57.1% in 2009. Every region except the Central Coast had a significantly increasing trend in late-stage diagnoses.
- Late-stage diagnoses of cervical cancer remained relatively constant but high (52.6% to 57.9%) statewide. The Bay Area had low percentages (48.2% to 52.5%) while Los Angeles-Orange (52.6% to 62.6%), Inland Empire (54.8% to 62.6%), Central Valley (54.8% to 62.6%), Sacramento (54.8% to 62.6%), and Northern California (58.0% to 78.9%) regions had consistently high percentages of late-stage diagnoses.
- Significant increases in late-stage prostate cancers were seen throughout California, with the proportion of late-stage diagnoses increasing from 4.9% to 5.6% in 2009 to 8.2% to 10.3% in 2018. The regions with the highest percentage (10.4% to 25.0%) in 2018 were the Bay Area, San Diego-Imperial, Sacramento, and Northern California.
- Late-stage diagnoses of melanoma significantly decreased in the state with the proportion of late-stage diagnoses declining from 7.2% to 7.9% in 2009 to 6.4% to 7.1% in 2018. This was most notable in Los Angeles-Orange, Inland Empire, and San Diego-Imperial regions. The Bay Area (< 6.4%) and the Central Coast (< 8.0%) regions had consistently low percentages of late-stage diagnoses while San Bernardino and Imperial counties had consistently high percentages (8.0% to 29.4%).
- Late-stage diagnoses of oropharyngeal cancer remained high (65.1% to 70.9%) and relatively unchanged. The Bay Area had a significantly increasing trend as did several counties including Riverside, San Joaquin, Merced, Madera, Del Norte-Humboldt, and Inyo-Mono.
- Late-stage diagnoses of lung cancer significantly decreased throughout the state, but the percentages remained high (60.0% to 82.5%). Most counties had significantly decreasing trends of late-stage diagnoses with the exception of Merced and Siskiyou-Trinity, where trends were significantly increasing.
- San Bernardino and Imperial counties had consistently high percentages of late-stage diagnoses across cancer sites.

INTRODUCTION

This report presents data on seven types of cancer diagnosed at a late stage in California from 2000 through 2018. These cancers are: (1) female breast, (2) colorectal, (3) cervical, (4) prostate, (5) melanoma, (6) oropharyngeal, and (7) lung. These cancers have the greatest potential for early diagnosis through screening, whether by visual inspection (oropharyngeal and melanoma) or procedures such as mammography, Pap tests, endoscopic evaluation (e.g., colonoscopy), fecal tests (FIT), low-dose CT, and prostate-specific antigen (PSA) tests. Diagnosis at lower stage is associated with better outcomes.

Cancer staging describes the severity of the disease at the time of diagnosis, taking into account the growth and size of the tumor and whether it has spread to adjacent organs, lymph nodes, or distant organs. The staging of a cancer determines the most effective treatment and is one of the strongest predictors of survival. For screen-detectable cancers, late-stage diagnosis represents a possible failure to screen. Maps in this report show trends of late-stage diagnoses over time in individual California counties and regions. Monitoring these trends helps evaluate the impact of screening.

Information presented in this report was gathered by the California Cancer Registry (CCR), the state mandated population-based cancer surveillance system. Data collected by the CCR on cancers diagnosed in California are used to monitor cancer incidence and mortality over time, thus providing the foundation for cancer control initiatives throughout the state. Since 2012, the California Cancer Reporting and Epidemiologic Surveillance (CalCARES) Program within the University of California Davis Comprehensive Cancer Center, University of California Davis Health, has partnered with the California Department of Public Health to manage day-to-day operations of the CCR.

METHODS

Incident cases of female breast, colorectal, cervical, prostate, melanoma, oropharyngeal, and lung cancer reported to the CCR from 2000 to 2018 are included in this report. Cancer sites were based on site recodes adopted by the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) program.[1]

Summary stage at the time of diagnosis was used to classify the cases into early and late stages. This staging system was used because complete information is available for all years included in this analysis. For all cancer types except prostate, in situ (if collected) and localized tumors were classified as early stage while regional and distant tumors were classified as late stage. For prostate cancer, localized and regional tumors had the same five-year relative survival (near 100%). Relative survival compares cancer patient survival to the survival of cancer-free individuals with similar age, race/ethnicity, and sex. A relative survival of 100 percent means that patients diagnosed with cancer are just as likely to survive the specified time period as similar individuals in the general population without cancer. Therefore, for prostate cancer regional tumors were included in the early stage category. For female breast, colorectal, cervical, oropharyngeal, and lung cancer, the five-year relative survival rates for cases with

unknown stage values fell between the regional and remote survival rates. Therefore, the unknown stage values were included in the late stage category. For prostate and melanoma, the five-year relative survival rates for cases with unknown stage values were close to the localized rates so the unknown stage values were included in the early stage category. The percentage of unknown stage for each cancer site ranged from 2% to 8%: 2% for breast, 6% for colorectal, 5% for cervical, 7% for prostate, 4% for melanoma, 6% for oropharyngeal, and 8% for lung.

The percent of cases diagnosed at a late stage for each cancer type in each county or region was calculated by dividing the number of late-stage cases by the total number of cases for each year. This range of percentages of late-stage cases for each cancer type was divided into eight categories which are represented on the map by eight colors. Counties with fewer than fifteen cases were excluded from the county analysis but were included in the regional and state calculations. For cervical and oropharyngeal cancers, years were grouped because the annual number of cases was small.

The proportion of late stage cases in each county are displayed for each of the nineteen years from 2000 to 2018. Linear regression was used to determine trends and to assess whether increases or decreases were statistically significant at the 0.05 level. Trends were calculated only for the most recent ten years (2009 to 2018) in order to identify new or emerging trends. The heat maps display regions and counties in order of decreasing population size, and display 2018 populations estimated by the National Center for Health Statistics.

CAUTIONS ON INTERPRETATION
This report is intended as a descriptive analysis, and it does not evaluate the effectiveness of screening programs or the health services available in each county. The statistical significance of changes in late stage diagnoses over the most recent ten years was estimated. The significance of year to year fluctuations was not calculated. Substantial variation in year to year frequencies can occur by chance alone, particularly in counties with small population sizes and a small number of cancers diagnosed in a single year. To reduce fluctuations due to a small number of cases, percentages of late stage diagnoses for each cancer were only mapped in counties that had at least 15 cases of that specific cancer diagnosed in each year. Frequencies of late-stage diagnoses for small counties that did not meet that threshold were combined into larger areas. However, a more rigorous assessment is required to identify chance occurrences.

FEMALE BREAST CANCER

Breast cancer is the most commonly occurring cancer in California women, accounting for 32% of all cancers diagnosed in women.[2] There were 28,183 new cases diagnosed in California in 2018, and 4,569 deaths.[2] Risk factors include a personal history of breast cancer, inherited risk of breast cancer, reproductive history resulting in greater exposure to estrogen, older age, use of postmenopausal hormone therapy, dense breast tissue, history of radiation to the chest, alcohol consumption, and obesity.[3]

Incidence of breast cancer has been stable in the most recent ten-year period covered in this report (2009-2018), while mortality has declined by 1.5% per year.[2] The majority (63%) of breast cancers in California are diagnosed at a localized stage.[2] Five-year relative survival rates are 99% for localized stage, 86% for regional stage cancer, and 29% for cancers with distant spread.[2] Current American Cancer Society screening guidelines for women at average risk recommend that those 40 to 44 years of age consider annual mammography; those 45 to 54 have annual mammography; and those 55 year of age and older have biennial or annual mammography, continuing as long as overall health is good and life expectancy is 10 or more years.[4] Women at increased risk (by family history, genetic predisposition, history of radiation therapy to chest), are advised to get a breast MRI and a mammogram every year, typically starting at age 30.[4] In 2018, 72% of women 40 years of age and older in California reported having a mammogram in the past two years.[5]

Overall, the proportion of breast cancer cases diagnosed at late stages in California has decreased from 2000 to 2008 and remained fairly unchanged (27.9% to 30.5%) from 2009-2018 (Figure 1). Los Angeles-Orange was the only region that experienced a significant decrease in late-stage diagnoses. The Bay Area (< 27.9%) and Sacramento (< 29.4%) regions had the lowest percentage of late-stage diagnoses in the most recent ten-year period while the Inland Empire (30.6% to 60.0%) and Central Valley (27.9% to 35.5%) had the highest percentages. Los Angeles, Orange, Alameda, San Mateo, and Butte counties had significantly decreasing percentages of late-stage diagnoses while Riverside and Nevada counties showed significantly increasing percentages of late-stage diagnoses from 2009 to 2018. San Bernardino, Imperial, and Lassen-Modoc-Plumas counties have had consistently high proportions of breast cancer diagnosed at late stage over the entire nineteen-year time period. In 2018, San Bernardino, Del Norte-Humboldt, Lassen-Modoc-Plumas, San Benito, and Inyo-Mono counties had the highest percentages of late-stage diagnoses in the state (35.6%-60.0%).
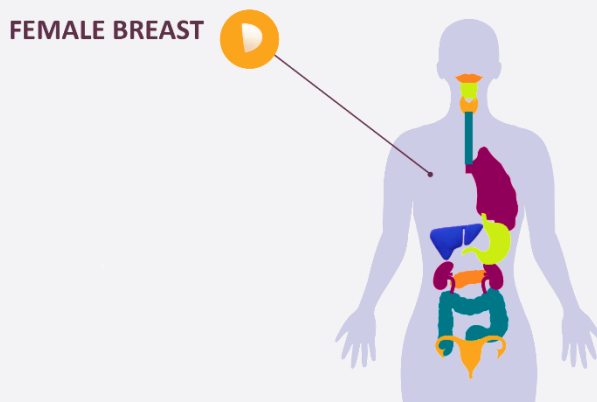
FEMALE BREAST

FIGURE 1. PERCENT OF FEMALE BREAST CANCER CASES DIAGNOSED AT A LATE STAGE[a] BY CALIFORNIA REGION AND COUNTY (2000-2018)
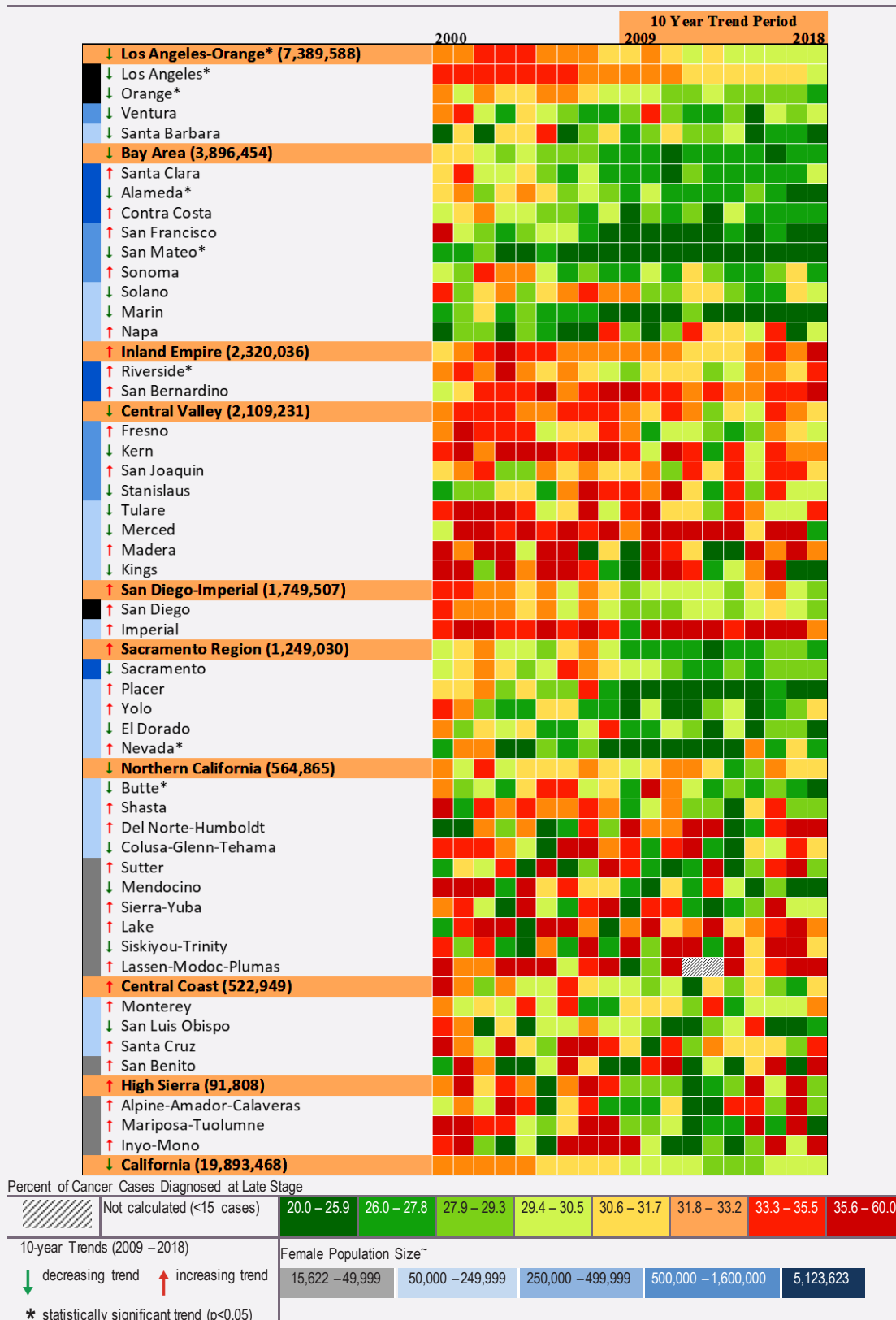
Percent of Cancer Cases Diagnosed at Late Stage

Not calculated (<15 cases)	20.0 – 25.9	26.0 – 27.8	27.9 – 29.3	29.4 – 30.5	30.6 – 31.7	31.8 – 33.2	33.3 – 35.5	35.6 – 60.0

10-year Trends (2009 – 2018)

↓ decreasing trend   ↑ increasing trend

✱ statistically significant trend (p<0.05)

Female Population Size~

15,622 – 49,999	50,000 – 249,999	250,000 – 499,999	500,000 – 1,600,000	5,123,623

~ *Number of people in 2018 estimated by National Center for Health Statistics (NCHS); Number in parentheses represents the female population size in the region/state.*
[a] *Late Stage includes summary stage values of regional, remote, and unknown.*

COLORECTAL

Colon and rectum (colorectal) cancer is the third most common cancer in California among both men and women, and it is the third most common cause of cancer-related death for each sex.[2] It is less common than either breast or prostate cancer but has a worse prognosis. The five-year survival rate for colorectal cancer for all stages combined is 64% compared to 90% for breast cancer and 97% for prostate cancer.[2] The worse prognosis is related to it being detected more often at a later stage.

Colorectal cancer screening offers opportunities for both prevention and early detection. Current guidelines recommend that screening begin at age 45 for men and women who are at average risk of developing colorectal cancer.[6] This can be done with a stool-based test (FIT) or an endoscopic exam (colonoscopy, sigmoidoscopy) that looks at the colon and rectum and allows for the removal of polyps that might become cancerous. When detected at a localized stage, the five-year relative survival rate for colorectal cancer is 90%, compared to 15% when diagnosed after it has metastasized to distant disease.[2]

Colorectal cancer risk declined in California from 2009 to 2018, with incidence and mortality rates decreasing approximately 2% per year for both men and women.[2] This trend likely reflects improvements in effective prevention and treatment. However, only 40% of colorectal cancers were diagnosed at a localized stage from 2009 to 2013.[2] In 2016, 70.8% of California adults ages 50 to 75 years had a current colorectal cancer screening test.[7] Men (69.1%) had lower screening rates than women (72.3%), Hispanic/Latinos (55.6%) had lower rates than non-Hispanic/Latino Whites (77.3%), and the uninsured (34.4%) had lower rates than the insured (67.3%).[7]

From 2000 to 2009 the proportion of colorectal cancers diagnosed late stage decreased. However, trends in late-stage diagnoses significantly increased over the most recent ten-year period (Figure 2). In 2018, 60.6% to 62.8% of colorectal cancers were diagnosed at late stage compared to 55.4% to 57.1% in 2009. Every region except the Central Coast had a significantly increasing trend in late-stage diagnoses. Los Angeles, Orange, Ventura, Santa Clara, Contra Costa, San Mateo, Solano, Marin, Riverside, San Bernardino, Fresno, San Joaquin, San Diego, Sacramento, Nevada, Shasta, Monterey, and Alpine-Amador-Calaveras counties all experienced significantly increasing proportions of late-stage diagnoses in the most recent ten-year period. The only counties that experienced a significant decrease in late-stage diagnoses were Inyo-Mono. In 2018, Marin, Placer, Nevada, Butte, Shasta, Colusa-Glenn-Tehama, Lake, and Alpine-Amador-Calaveras had the highest percentage of late-stage diagnoses in the state (65.9%-82.8%).
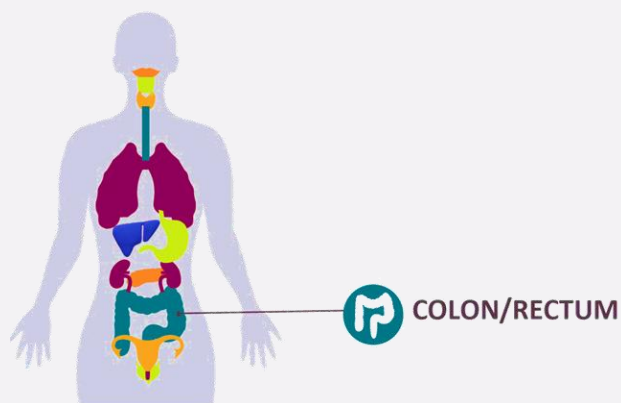
FIGURE 2. PERCENT OF COLORECTAL CANCER CASES DIAGNOSED AT A LATE STAGE[a] BY CALIFORNIA REGION AND COUNTY (2000-2018)

Percent of Cancer Cases Diagnosed at Late Stage
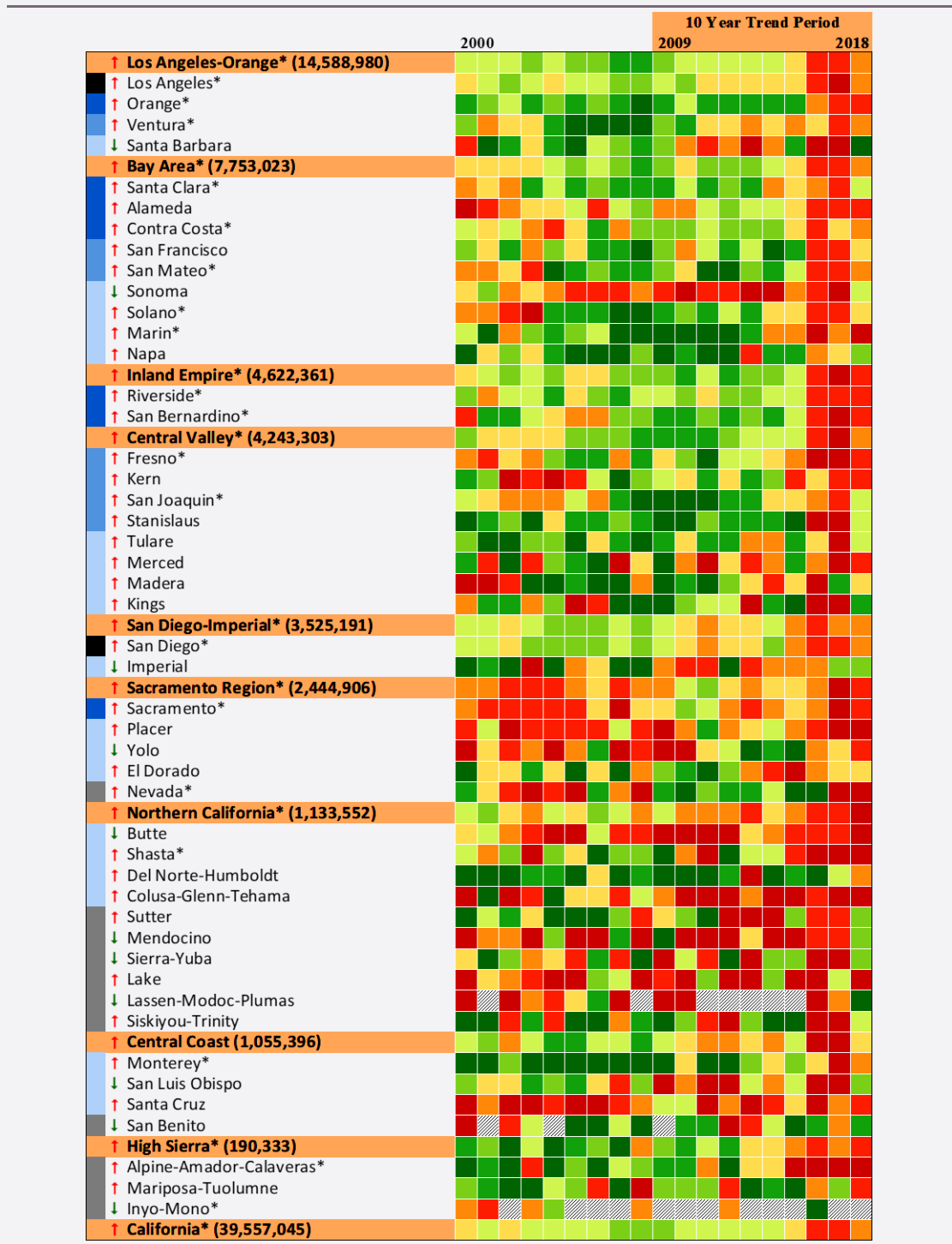
Not calculated (<15 cases)	30.0 – 52.5	52.6 – 55.3	55.4 – 57.1	57.2 – 58.6	58.7 – 60.5	60.6 – 62.8	62.9 – 65.8	65.9 – 82.8

10-year Trends (2009 – 2018)

↓ decreasing trend   ↑ increasing trend

✱ statistically significant trend (p<0.05)

Population Size~

32,237 – 99,999	100,000 – 499,999	500,000 – 999,999	1,000,000 – 3,300,000	10,105,518

~ Number of people in 2018 estimated by National Center for Health Statistics (NCHS); Number in parentheses represents the population size in the region/state.
[a] Late Stage includes summary stage values of regional, remote, and unknown.

CERVICAL CANCER

Cervical cancer incidence and mortality rates have decreased in California from 1988 to 2018, largely due to earlier diagnosis and detection of precancerous changes through Pap test screening.[8] However, in the most recent 10-year period covered in this report (2009-2018), both incidence and mortality remained fairly unchanged.[2,8] Screening can detect cervical cancer early and identify precancerous changes that can be removed before they become cancer. The number one risk factor for cervical cancer is infection with human papillomavirus (HPV).[9] Almost all cervical cancers (more than 99%) are related to HPV.[9] Effective vaccines against HPV have been available since 2006 and are recommended for preteens of both sexes between the ages of 9 to 12.[10] Despite the availability of screening and vaccines, there were 1,542 cases of cervical cancer diagnosed in 2018 and 469 deaths in California.[2]

If detected early (localized stage), cervical cancer is highly curable with a five-year relative survival rate of 92%. This survival rate decreases to 57% for cases diagnosed at a regional stage and 18% when detected at a distant stage.[2] From 2009 to 2013, 45% of cases were diagnosed at a localized stage.[2] The American Cancer Society recommends that cervical cancer screening begin at age 25 with a primary HPV test every five years.[11] Alternatively, screening may be done with either a co-test that combines an HPV test with a Pap test every five years or a Pap test alone every three years.[11] Women over 65 who have had regular screening in the previous ten years with normal results and no history of cervical intraepithelial neoplasia grade 2 (CIN2, a precancerous lesion) or more serious diagnosis within the past 25 years should stop screening.[11] Women without a cervix should stop screening unless they have a history of cervical cancer or serious pre-cancer.[11] In 2016 fewer than two-thirds of women aged 30 to 65 were up to date with cervical cancer screening.[12]

From 2000 to 2018 the percentage of cervical cancer cases diagnosed at a late stage increased from 48.2%-50.6% to 54.8%-57.9% (Figure 3). In the most recent ten-year period, the proportion diagnosed late stage remained high (52.6% to 57.9%) and relatively unchanged. The Bay Area had the lowest percentage (50.7% to 52.5%) of late-stage diagnoses and the Central Coast had the highest (62.7% to 78.9%) percentage in the most recent time period (2015 to 2018). Napa, Kings, El Dorado, Nevada, Mendocino, Sierra-Yuba, Lake, and San Luis Obispo counties had significantly increasing proportions of late-stage diagnoses from 2009 to 2018 while Del Norte-Humboldt and Colusa-Glenn-Tehama had significantly decreasing proportions. Marin county had the lowest percentage (30.0% to 44.1%) of late-stage diagnoses from 2009 to 2018. Los Angeles-Orange, Inland Empire, Central Valley, Sacramento, and Northern California regions have had consistently high percentages (52.6% to 78.9%) of late-stage diagnoses over the most recent ten-year period.

UTERINE CERVIX

		10 Year Trend Period
	00-02	09-11 15-18

- ↑ **Los Angeles-Orange (7,389,588)**
- ↑ Los Angeles
- ↑ Orange
- ↑ Ventura
- ↑ Santa Barbara
- ↑ **Bay Area (3,896,454)**
- ↑ Santa Clara
- ↑ Alameda
- ↑ Contra Costa
- ↑ San Francisco
- ↑ San Mateo
- ↑ Sonoma
- ↓ Solano
- ↓ Marin
- ↑ Napa*
- ↑ **Inland Empire (2,320,036)**
- ↑ Riverside
- ↑ San Bernardino
- ↓ **Central Valley (2,109,231)**
- ↑ Fresno
- ↑ Kern
- ↓ San Joaquin
- ↓ Stanislaus
- ↓ Tulare
- ↓ Merced
- ↑ Madera
- ↑ Kings*
- ↑ **San Diego-Imperial (1,749,507)**
- ↑ San Diego
- ↑ Imperial
- ↑ **Sacramento Region (1,249,030)**
- ↑ Sacramento
- ↑ Placer
- ↓ Yolo
- ↑ El Dorado*
- ↑ Nevada*
- ↓ **Northern California (564,865)**
- ↑ Butte
- ↓ Shasta
- ↓ Del Norte-Humboldt*
- ↓ Colusa-Glenn-Tehama*
- Sutter
- ↑ Mendocino*
- ↑ Sierra-Yuba*
- ↑ Lake*
- Siskiyou-Trinity
- Lassen-Modoc-Plumas
- ↑ **Central Coast (522,949)**
- ↑ Monterey
- ↑ San Luis Obispo*
- ↑ Santa Cruz
- San Benito
- ↑ **High Sierra (91,808)**
- Alpine-Amador-Calaveras
- Mariposa-Tuolumne
- Inyo-Mono
- ↑ **California (19,893,468)**

Percent of Cancer Cases Diagnosed at Late Stage

▨ Not calculated (<15 cases)	30.0 – 44.1	44.2 – 48.1	48.2 – 50.6	50.7 – 52.5	52.6 – 54.7	54.8 – 57.9	58.0 – 62.6	62.7 – 78.9

10-year Trends (2009 – 2018)

↓ decreasing trend ↑ increasing trend

* statistically significant trend (p<0.05)

Female Population Size~

15,622 – 49,999	50,000 – 249,999	250,000 – 499,999	500,000 – 1,000,000	5,123,623

~ Number of people in 2018 estimated by National Center for Health Statistics (NCHS); Number in parentheses represents the female population size in the region/state.
[a] Late Stage includes summary stage values of regional, remote, and unknown. [b] Each column aggregates 3 years starting from 2000 while last column aggregates 4 years.

PROSTATE CANCER

Prostate cancer is the most commonly occurring cancer among men.[2] In the most recent ten years (2009 to 2018), the incidence rate of prostate cancer has significantly decreased by 3.9% per year while the mortality rate has remained relatively unchanged.[2] In 2018, there were 20,345 new cases of prostate cancer diagnosed in California, and 3,720 deaths.[2] Risk factors for prostate cancer include increasing age especially over age 50, African ancestry, a family history of the disease, and certain inherited gene mutations.[13] Approximately 60% of cases occur in men 65 years of age and older.[13]

Because of concerns about over-diagnosis and treatment of slow-growing cancers that would never have caused harm, routine prostate cancer screening with PSA (prostate-specific antigen) is not recommended for men at average risk. The American Cancer Society recommends that men of average risk have a conversation with their health care provider about the benefits and limitations of PSA testing beginning at age 50.[14] Men at high risk (Black/African American men with a first-degree relative diagnosed with prostate cancer younger than age 65 or men with more than one first-degree relative diagnosed before the age of 65) should have this conversation beginning at age 40 to 45.[14] Screening can be done with a PSA blood test and a digital rectal exam and be repeated every one to two years depending on the PSA level.[14]

The overwhelming majority (86%) of prostate cancers are diagnosed while still in a local or regional stage, when five-year relative survival rates approach 100%, meaning that men diagnosed with local or regional stage prostate cancer have a similar life expectancy to those without prostate cancer.[2]

From 2000 to 2018 the proportion of late-stage diagnoses of prostate cancer has increased. The trend significantly increased from 2009 to 2018 in all regions of the state, although the proportion of late-stage diagnoses is relatively low (< 25%) (Figure 4). Across the state, 8.2% to 10.3% of prostate cancers were diagnosed at late stage from 2014 to 2018, compared with 4.9% to 5.5% in 2009. The regions with the highest percentage of late-stage diagnoses (10.4% to 25.0%) in 2018 were the Bay Area, San Diego-Imperial, Sacramento, and Northern California.
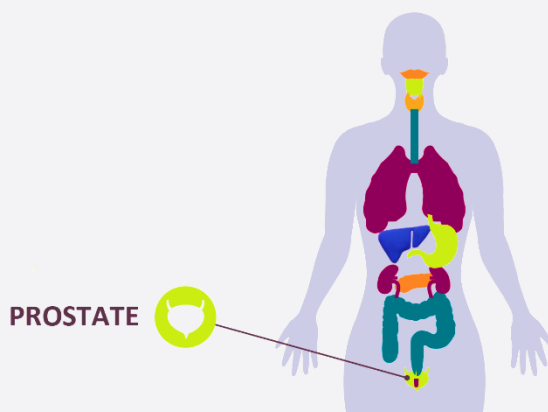
PROSTATE

FIGURE 4. PERCENT OF PROSTATE CANCER CASES DIAGNOSED AT LATE STAGE[a] BY CALIFORNIA REGION AND COUNTY (2000-2018)

	2000	10 Year Trend Period 2009 — 2018

↑ Los Angeles-Orange* (7,199,392)
↑ Los Angeles*
↑ Orange*
↑ Ventura*
↑ Santa Barbara
↑ Bay Area* (3,856,569)
↑ Santa Clara*
↑ Alameda*
↑ Contra Costa*
↑ San Francisco*
↑ San Mateo*
↑ Sonoma*
↑ Solano*
↑ Marin*
↑ Napa
↑ Inland Empire* (2,302,325)
↑ Riverside*
↑ San Bernardino*
↑ Central Valley* (2,134,072)
↑ Fresno*
↑ Kern*
↑ San Joaquin*
↑ Stanislaus
↑ Tulare
↑ Merced*
↑ Kings
↑ Madera*
↑ San Diego-Imperial* (1,775,684)
↑ San Diego*
↑ Imperial
↑ Sacramento Region* (1,195,876)
↑ Sacramento*
↑ Placer*
↑ Yolo
↑ El Dorado*
↑ Nevada
↑ Northern California* (568,687)
↑ Butte
↑ Shasta
↑ Del Norte-Humboldt*
↑ Colusa-Glenn-Tehama
↑ Sutter
↑ Mendocino*
↑ Sierra-Yuba
↑ Lassen-Modoc-Plumas
↑ Lake*
↑ Siskiyou-Trinity
↑ Central Coast* (532,447)
↑ Monterey*
↑ San Luis Obispo*
↑ Santa Cruz*
↓ San Benito
↑ High Sierra* (98,525)
↑ Alpine-Amador-Calaveras
↑ Mariposa-Tuolumne*
↓ Inyo-Mono
↑ California* (19,663,577)

Percent of Cancer Cases Diagnosed at Late Stage

	Not calculated (<15 cases)	< 3.4	3.4 – 4.3	4.4 – 4.8	4.9 – 5.6	5.7 – 6.7	6.8 – 8.1	8.2 – 10.3	10.4 – 25.0

10-year Trends (2009 – 2018)

↓ decreasing trend   ↑ increasing trend

∗ statistically significant trend (p<0.05)

Male Population Size~

16,615 – 49,999	50,000 – 249,999	250,000 – 499,999	500,000 – 1,700,000	4,981,895

~ Number of people in 2018 estimated by National Center for Health Statistics (NCHS); Number in parentheses represents the male population size in the region/state.
[a] Late Stage includes summary stage values of remote.

MELANOMA

Melanoma is the most serious and aggressive type of skin cancer. It accounts for about 1% of skin cancer cases but the vast majority of skin cancer deaths.[15] Risk factors for melanoma include a personal or family history of melanoma, presence of atypical, large, or numerous moles, ultraviolet light exposure, frequent sunburns (especially in childhood), having fair skin, and having a weakened or suppressed immune system.[15] The best way to detect melanoma early is to recognize new or changing skin growths, especially those that look different from other moles. Melanomas often start as small, mole-like growths that increase in size and change color. They are marked by asymmetry, irregular borders, non-uniform pigmentation, and diameters greater than 6 millimeters.[15] All major areas of the skin should be examined regularly, and any new, unusual, or progressive lesions promptly evaluated by a clinician.[15]

From 2009 to 2018, the incidence rate of melanoma significantly increased while the mortality rate significantly decreased.[2] It has been suggested that the combined effect of more screening skin exams, lower clinical thresholds to biopsy suspicious lesions, and changing pathological thresholds to label lesions as melanoma has driven the increase in melanoma diagnoses.[16] From 2009 to 2013, 83% of melanomas were diagnosed at a localized stage, which has a five-year relative survival of 97.2%.[2] Although melanoma is highly curable when detected early, it is more likely than other skin cancers to spread to other parts of the body.[15] In 2018, there were 10,180 new cases of melanoma diagnosed in California and 821 deaths.[2]

From 2000 to 2008 there was an increase in late-stage melanoma diagnoses but from 2009 to 2018, there has been a significant decrease in California (Figure 5). In more recent years (2016 to 2018) the state percentage has remained constant at 6.4%-7.1% of patients with late-stage diagnoses, compared with 7.2%-7.9% in 2009. Los Angeles-Orange, Inland Empire, and San Diego-Imperial regions all had significantly decreasing trends of late-stage diagnoses. The Bay Area (< 6.4%) and the Central Coast (< 8.0%) regions had consistently low percentages of late-stage diagnoses in the most recent ten years. Orange, Alameda, Riverside, San Diego, Del Norte-Humboldt, Lassen-Modoc-Plumas, and Inyo-Mono counties had significantly decreasing trends in late-stage melanomas while Yolo county had a significantly increasing trend. In 2018, the counties with the highest percentage of late-stage melanoma diagnoses (11.3% to 29.4%) were San Bernardino, Kern, Stanislaus, Kings, Imperial, and San Benito.

SKIN (MELANOMA)
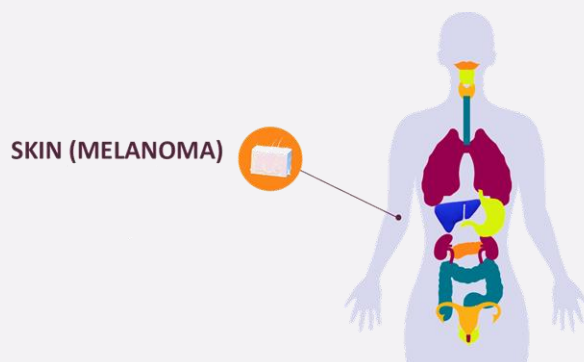
FIGURE 5. PERCENT OF MELANOMA CASES DIAGNOSED AT A LATE STAGE[a] BY CALIFORNIA REGION AND COUNTY (2000-2018)
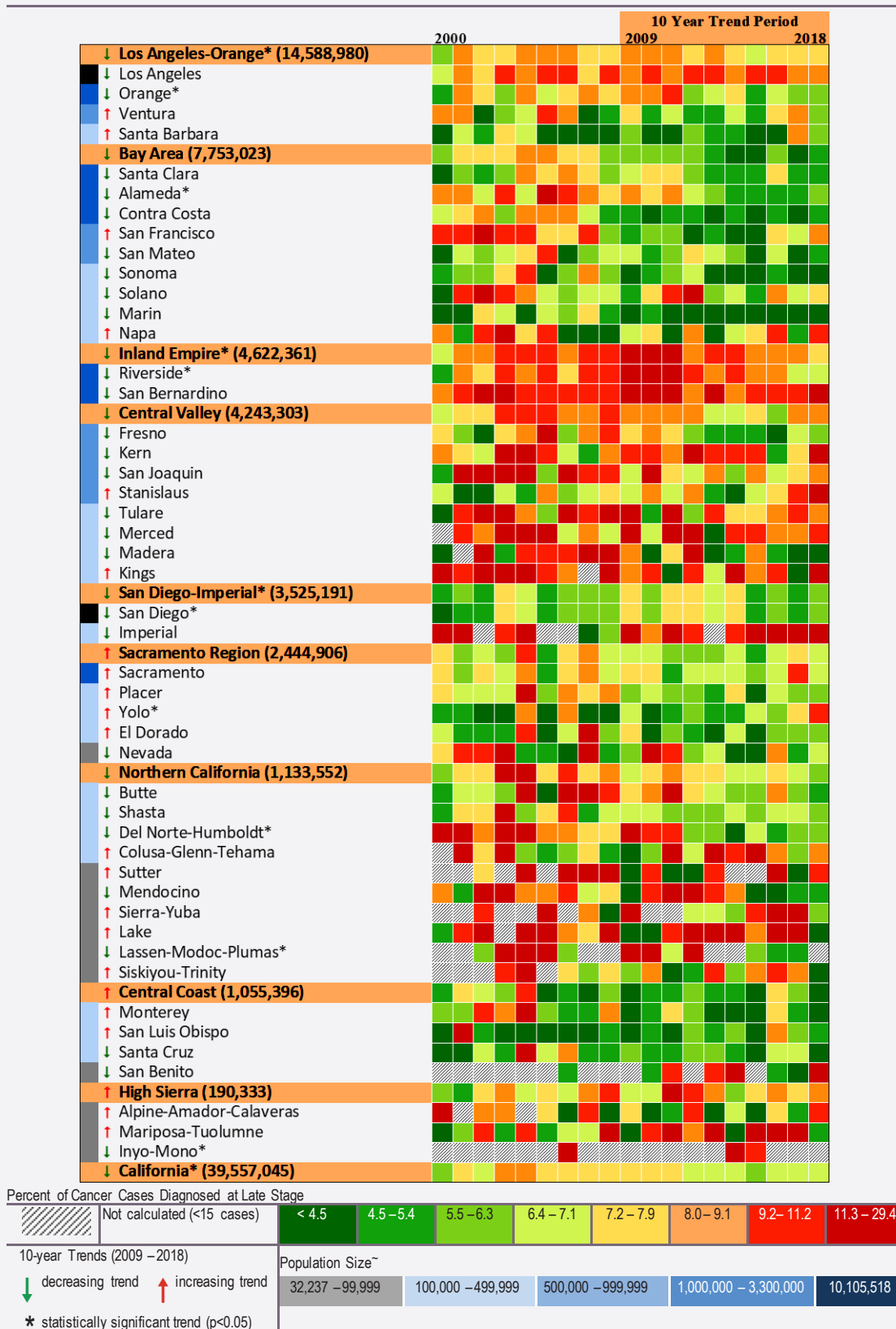
Percent of Cancer Cases Diagnosed at Late Stage

Not calculated (<15 cases)	< 4.5	4.5 – 5.4	5.5 – 6.3	6.4 – 7.1	7.2 – 7.9	8.0 – 9.1	9.2 – 11.2	11.3 – 29.4

10-year Trends (2009 – 2018)

↓ decreasing trend   ↑ increasing trend

✱ statistically significant trend (p<0.05)

Population Size~

32,237 – 99,999	100,000 – 499,999	500,000 – 999,999	1,000,000 – 3,300,000	10,105,518

~ Number of people in 2018 estimated by National Center for Health Statistics (NCHS); Number in parentheses represents the population size in the region/state.
[a] Late Stage includes summary stage values of regional and remote.

OROPHARYNGEAL CANCER

The oral cavity includes the lip, tongue, floor of the mouth, gingiva, buccal surface (mucosa), hard palate, and oropharynx. Although these sites are accessible for self-inspection and during medical and dental exams, cancer can be confused with common benign lesions.[17] As a result, the majority of oropharyngeal cancers (62%) are not diagnosed early, but instead at regional (44%) and distant (18%) stages.[2] The five year relative survival rate is 84% when diagnosed at a localized stage, 67% at a regional stage, and 41% at a distant stage.[2] The age-adjusted incidence and mortality rates of oropharyngeal cancer have remained fairly constant from 2009 to 2018 in California.[2] In 2018, there were 4,596 cases of oropharyngeal cancer diagnosed in California and 1,080 deaths.[2]

Primary risk factors for cancers of the oral cavity and pharynx include tobacco use, alcohol consumption, and infection with human papillomavirus (HPV).[17,18] Although there have been advances in surgical treatment, these cancers remain a challenge because of the functional and esthetic problems that may result from treatment.[17]

From 2000 to 2018 there has been an increase in the proportion of oropharyngeal cancers diagnosed at late stage, from 60.8%-63.2% to 68.3%-70.9%. From 2009 to 2018, the percentage of late-stage diagnoses of oropharyngeal cancer in California remained high (65.1% to 70.9%) and relatively unchanged (Figure 6). The Bay Area had an increasing trend in the most recent time period as did several counties (Riverside, San Joaquin, Merced, Madera, Del Norte-Humboldt, and Inyo-Mono). Los Angeles-Orange, Inland Empire, Sacramento, and the High Sierra regions all had consistently high percentages (65.1% to 86.0%) of late-stage diagnoses in recent years. From 2015 to 2018 many counties had the highest percentage of late-stage diagnoses in the range (71.0% to 86.0%). These counties were Solano, San Bernardino, San Joaquin, Madera, Kings, Imperial, Sacramento, Nevada, Shasta, Del Norte-Humboldt, Colusa-Glenn-Tehama, Sutter, Sierra-Yuba, Lassen-Modoc-Plumas, Siskiyou-Trinity, and Alpine-Amador-Calaveras. No counties had the lowest percentage of late-stage diagnoses (< 58.0%) in the most recent time grouping (2015 to 2018). The lowest percentages from 2015 to 2018 of late-stage diagnoses (58.0% to 60.7%) were seen in Santa Clara, Napa, El Dorado, and Butte counties.
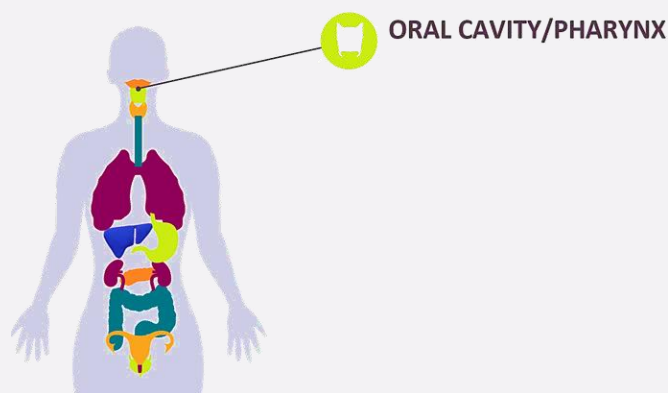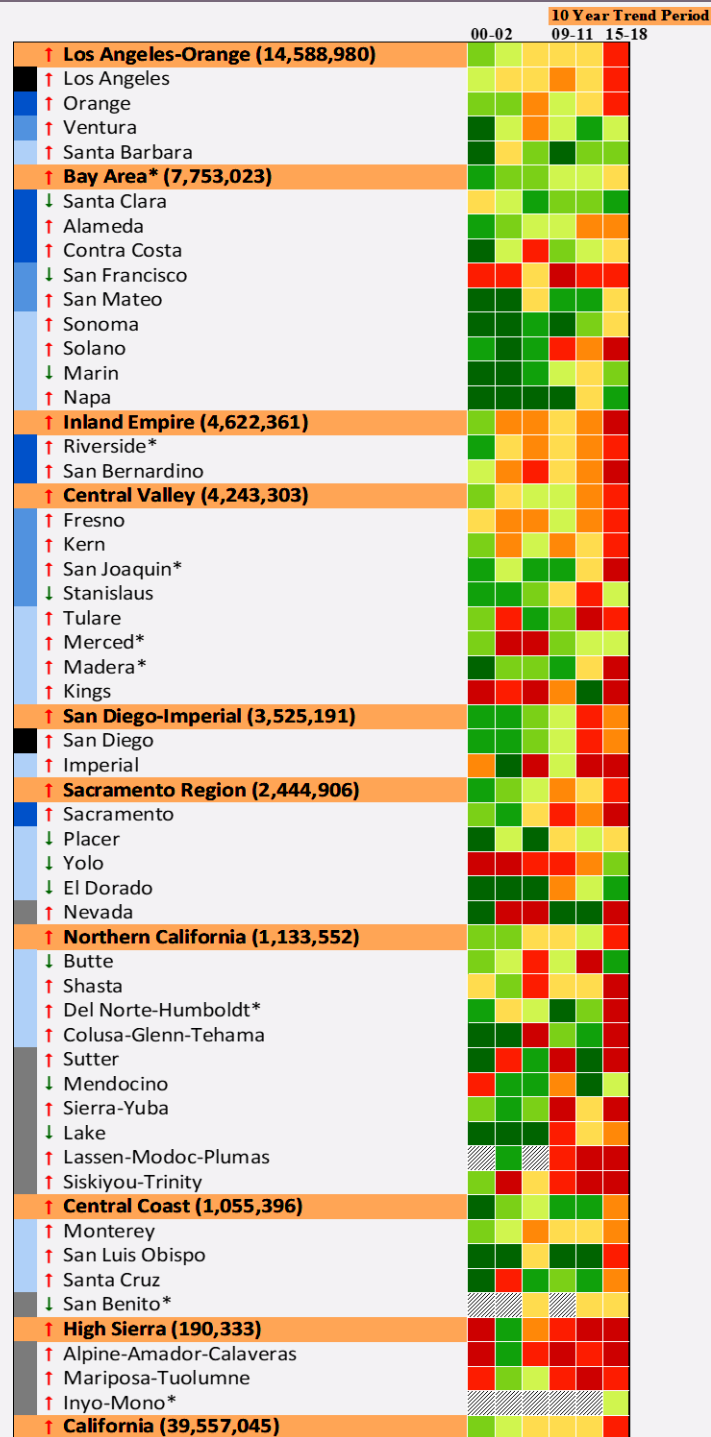
ORAL CAVITY/PHARYNX

FIGURE 6. PERCENT OF OROPHARYNGEAL CANCER CASES DIAGNOSED AT A LATE STAGE[a] BY CALIFORNIA REGION AND COUNTY (2000-2018[b])

	10 Year Trend Period
	00-02 09-11 15-18

↑ **Los Angeles-Orange (14,588,980)**
↑ Los Angeles
↑ Orange
↑ Ventura
↑ Santa Barbara
↑ **Bay Area* (7,753,023)**
↓ Santa Clara
↑ Alameda
↑ Contra Costa
↓ San Francisco
↑ San Mateo
↑ Sonoma
↑ Solano
↓ Marin
↑ Napa
↑ **Inland Empire (4,622,361)**
↑ Riverside*
↑ San Bernardino
↑ **Central Valley (4,243,303)**
↑ Fresno
↑ Kern
↑ San Joaquin*
↓ Stanislaus
↑ Tulare
↑ Merced*
↑ Madera*
↑ Kings
↑ **San Diego-Imperial (3,525,191)**
↑ San Diego
↑ Imperial
↑ **Sacramento Region (2,444,906)**
↑ Sacramento
↓ Placer
↓ Yolo
↓ El Dorado
↑ Nevada
↑ **Northern California (1,133,552)**
↓ Butte
↑ Shasta
↑ Del Norte-Humboldt*
↑ Colusa-Glenn-Tehama
↑ Sutter
↓ Mendocino
↑ Sierra-Yuba
↓ Lake
↑ Lassen-Modoc-Plumas
↑ Siskiyou-Trinity
↑ **Central Coast (1,055,396)**
↑ Monterey
↑ San Luis Obispo
↑ Santa Cruz
↓ San Benito*
↑ **High Sierra (190,333)**
↑ Alpine-Amador-Calaveras
↑ Mariposa-Tuolumne
↑ Inyo-Mono*
↑ **California (39,557,045)**

Percent of Cancer Cases Diagnosed at Late Stage

Not calculated (<15 cases)	50.0 – 57.9	58.0 – 60.7	60.8 – 63.2	63.3 – 65.0	65.1 – 66.7	66.8 – 68.2	68.3 – 70.9	71.0 – 86.0

10-year Trends (2009 – 2018)

↓ decreasing trend   ↑ increasing trend

* statistically significant trend (p<0.05)

Population Size~

32,237 – 99,999	100,000 – 499,999	500,000 – 999,999	1,000,000 – 3,300,000	10,105,518

~ Number of people in 2018 estimated by National Center for Health Statistics (NCHS); Number in parentheses represents the population size in the region/state.
[a] Late Stage includes summary stage values of regional, remote, and unknown. [b] Each column aggregates 3 years starting from 2000 while last column aggregates 4 years.

LUNG CANCER

Lung cancer is the second most common cancer among men and women and the most common cause of cancer-related death.[2] There are two main types of lung cancer, non-small cell lung cancer (80% to 85% of lung cancers) and small cell lung cancer (10% to 15% of lung cancers).[19] The leading risk factor for lung cancer is smoking. Other risk factors include secondhand smoke, radon, arsenic, air pollution, and a personal or family history of lung cancer.[19] In 2018 there were 16,536 cases of lung cancer diagnosed in California and 11,071 deaths.[2]

From 2009 to 2018, the age-adjusted incidence and mortality rates of lung cancer significantly decreased in men and women by approximately 3% per year for incidence and 4% per year for mortality.[2] However, the majority of lung cancers (54%) are diagnosed at a distant stage, when five-year survival is poor (5.3%).[2] The U.S. Preventive Services Task Force recommends that adults aged 50 to 80 years who have a 20 pack-year smoking history and currently smoke or have quit within the past 15 years be screened annually with low-dose CT.[20] Many new treatments including targeted therapies and immunotherapies are now available for lung cancer[21] and evidence suggests that these new treatments have contributed to the large improvements in survival seen in recent years.[22]

From 2000 to 2018 the percentage of late-stage lung cancer diagnoses in California has declined but remained high (Figure 7). The trend significantly decreased from 81.1%-82.5% in 2009 to 60%-76.0% in 2018. Significantly decreasing trends in late-stage diagnoses were seen in the Los Angeles-Orange, Bay Area, Inland Empire, Central Valley, San Diego-Imperial, Sacramento, Northern California, and Central Coast regions. Most counties had decreasing trends of late-stage diagnoses, with the exception of Merced and Siskiyou-Trinity where trends were significantly increasing. Madera, Mendocino, and Siskiyou-Trinity counties have had persistently high percentages of late-stage diagnoses in recent years (>82.5%). Siskiyou-Trinity and San Benito had the highest percentages (>87.1%) of late-stage diagnoses in 2018.
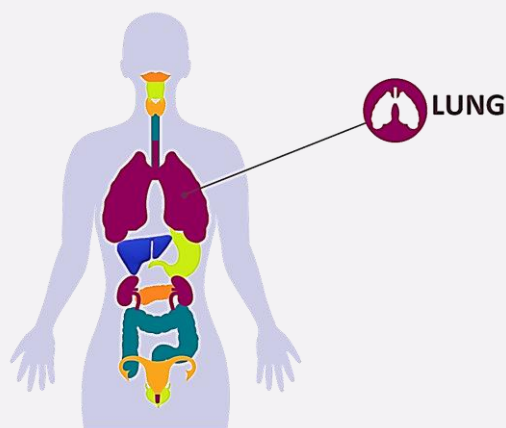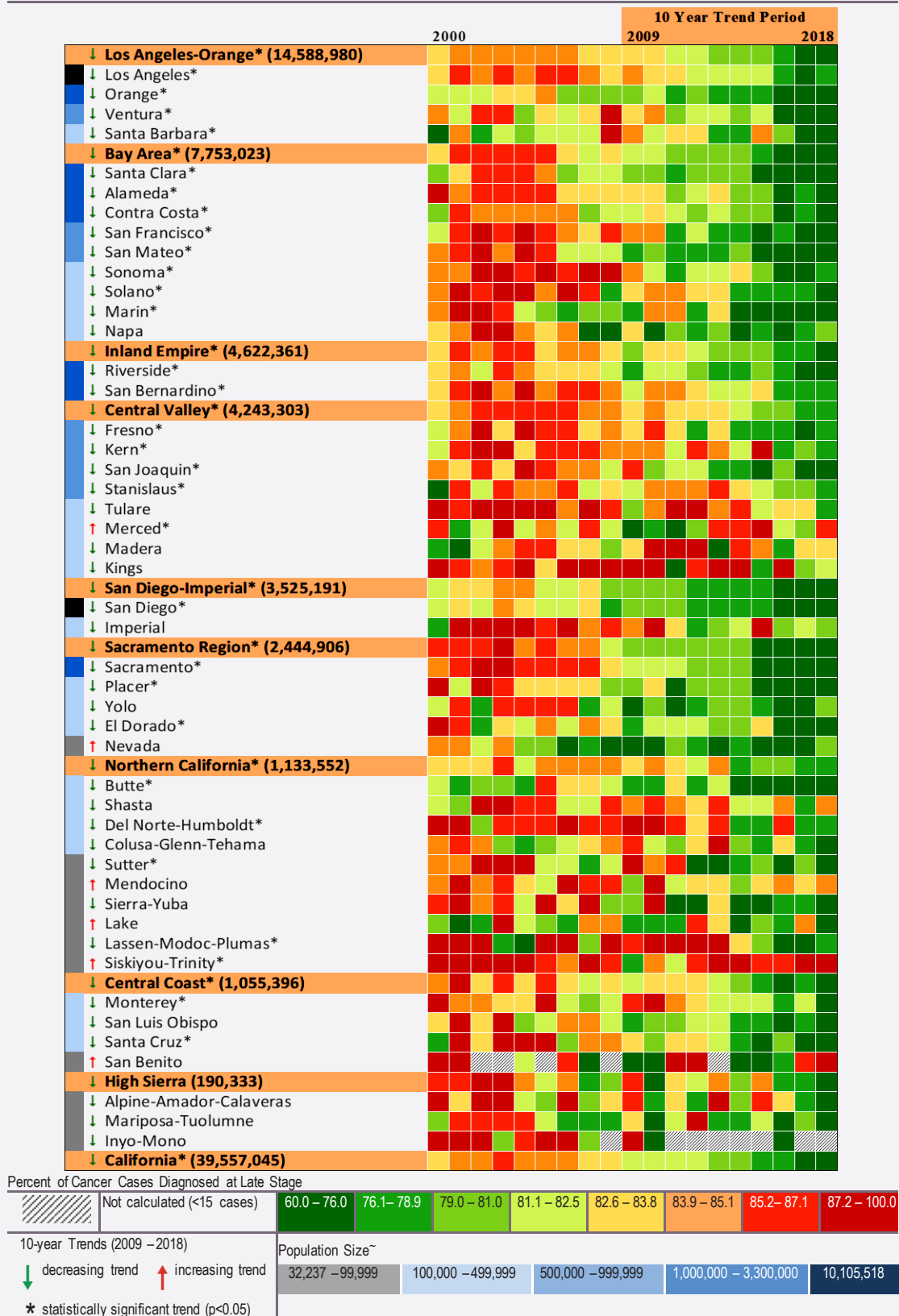
FIGURE 7. PERCENT OF LUNG CANCER CASES DIAGNOSED AT A LATE STAGE[a] BY CALIFORNIA REGION AND COUNTY (2000-2018)

Percent of Cancer Cases Diagnosed at Late Stage

	Not calculated (<15 cases)	60.0 – 76.0	76.1 – 78.9	79.0 – 81.0	81.1 – 82.5	82.6 – 83.8	83.9 – 85.1	85.2 – 87.1	87.2 – 100.0

10-year Trends (2009 – 2018)

↓ decreasing trend   ↑ increasing trend

* statistically significant trend (p<0.05)

Population Size~

32,237 – 99,999	100,000 – 499,999	500,000 – 999,999	1,000,000 – 3,300,000	10,105,518

~ *Number of people in 2018 estimated by National Center for Health Statistics (NCHS); Number in parentheses represents the population size in the region/state.*
[a] *Late Stage includes summary stage values of regional, remote, and unknown.*

CONCLUSION

This report shows regional and county level changes over time in late-stage diagnoses of cancers that have the potential to be detected early or even prevented through screening. In the most recent ten years, late-stage diagnoses have significantly increased for colorectal and prostate cancers; significantly decreased for melanoma and lung cancers; and remained relatively constant for female breast, cervical, and oropharyngeal cancers. The maps in this report identify regions and counties that might benefit from increased screening efforts and educational campaigns on cancer risk factors and prevention strategies.

For all of these cancer types, regional and county differences in late-stage diagnoses were evident and geographic areas with worsening trends or consistently high percentages were identified. For colorectal and prostate cancers, increasing late-stage trends were seen throughout the state but for the other cancer sites there was more variability. The Inland Empire and Central Valley had high percentages of late-stage diagnoses for female breast, cervical, and oropharyngeal cancers while the High Sierra had high percentages of late-stage diagnoses of melanoma and oropharyngeal cancers. Some counties, such as San Bernardino and Imperial, had consistently high percentages of late-stage diagnoses across cancer sites. The increasing trend seen for prostate cancer throughout the state is particularly worrisome because the late-stage category only includes distant disease unlike the other sites where it also includes regional stage disease. Although late-stage lung cancer decreased in most parts of the state, the percentage is still very high. Late-stage diagnoses for cervical and oropharyngeal cancers remained unchanged and high throughout the state suggesting more education on the benefits of HPV vaccination is warranted.

Further research is needed to determine possible reasons for the worsening trends or consistently high percentages found in these analyses and innovative approaches need to be developed to increase implementation of effective cancer screening strategies.

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