



CALIFORNIA HPV VACCINATION ROUNDTABLE

Working to prevent HPV cancers

**Assessment of Human Papillomavirus (HPV)
Attributable Cancers and Vaccination
Rates in California:
Report of Findings of the
California HPV Vaccination Roundtable**

**Published May 2020
CAHPVRoundtable.org**

Assessment of Human Papillomavirus (HPV) Attributable Cancers and Vaccination Rates in California: Report of Findings of the California HPV Vaccination Roundtable

EXECUTIVE SUMMARY

The purpose of this report is to:

- Assess available sources of data for determining human papillomavirus (HPV) vaccination rates in California communities.
- Make recommendations for improving data quality and utilizing data to improve HPV vaccination.
- Describe HPV-attributable cancer rates by county or region for 2012-16 using data from the California Cancer Registry (CCR).

In October 2018 the American Cancer Society and the California Dialogue on Cancer co-founded the California HPV Vaccination Roundtable to mobilize collective action to prevent HPV-associated cancers by increasing HPV vaccination coverage in California. The Roundtable is a coalition of diverse stakeholders who adopted the American Cancer Society's *Mission: HPV Cancer Free* goal of 80% HPV vaccination completion coverage for 13-year-olds by 2026, which will be the 20-year anniversary of the FDA's approval of the first HPV vaccine.

In early 2019, the Using and Improving HPV Vaccination Data Workgroup (Data Workgroup) of the California HPV Vaccination Roundtable identified the need to locate data describing HPV vaccination rates at the county level, both to develop a baseline to measure progress and to provide stakeholders data to help guide local and regional action to protect teens from future cancers.

The Workgroup reviewed the limitations, strengths, and immunization coverage levels estimated by the following sources:

- Healthcare performance data for managed care health plans
 - Medi-Cal and commercially-insured teens represent a total of 42% and 20% respectively of the 13-year-olds in our state.
 - In Medi-Cal managed care, 45% of members who turned 13 years of age in 2018 were up to date on their HPV vaccination. These data show a wide range in health plan performance (31-67%).
 - In commercially-insured managed care, 50% of members who turned 13 years of age in 2018 were up to date on their HPV vaccination as reported by the Integrated Healthcare Association.
- National Immunization Survey-Teen (NIS-Teen) data collected by CDC suggesting HPV vaccination is increasing statewide.
- The California Immunization Registry (CAIR), the statewide immunization information system (IIS)
 - Of teens in CAIR, 28% of those who turned 13 years of age in 2018 were up to date on their HPV vaccination.
 - There is wide variation in vaccine series completion by geographic region (8-42%).

These data sources suggest that only 28-50% of California's adolescents were fully immunized against HPV by their 13th birthday in 2018, presenting a large public health opportunity for more timely immunization and cancer prevention. For example, if the Medi-Cal managed care plans raised their HPV vaccination series completion from the current level of 45% to the goal of 80%, an estimated 375 additional HPV-associated cancers could be averted during the lifetime of each year's cohort of Medi-Cal managed care members.

The Data Workgroup also wanted to understand and describe HPV-attributable rates of cancer in California. Counties between the Oregon border and Sacramento have low HPV vaccination completion rates for 13-year-olds (around 9-20%), and the highest HPV-attributable cancer rates in the state (10-12 cases per 100,000 persons in 2012-2016).

Finally, this report includes recommendations for next steps various stakeholders can take to collect better data and more effectively use it to focus their efforts, address disparities, and raise on-time HPV vaccination to protect teens from cancer.

Key Findings:

Rates of HPV-Attributable Cancers

- California counties with the highest historic rates of HPV-attributable cancers are
 - In the Northern third of the state
 - More rural than urban.
- Cancers that are predominately or partially attributable to HPV include cervical, anal, oropharyngeal, penile, vaginal, and vulvar cancers.

Rates of HPV Immunization

- There is considerable variation in the metrics and limitations of each data source. Therefore, estimates from these datasets are not easily comparable.
- The data sources suggest that in 2018 only 28-50% of California's adolescents were fully immunized against HPV by their 13th birthday. No county or health system achieved an 80% vaccination rate.
- Healthcare performance data varied widely between Medi-Cal managed care health plans and within the same health plan operating in different counties. This highlights opportunity for improvement and suggests that despite similar resources within a health plan, other factors may strongly influence HPV reported vaccination rates.
- CAIR estimates of HPV vaccination coverage (28%) are lower than those for Medi-Cal managed care (45%) and commercial HMO members (50%), believed due to incomplete information in CAIR. Increasing provider participation in CAIR will support improved data quality.
- Boys and girls are vaccinated at similar rates.
- Rural areas have lower HPV vaccination coverage than urban areas.

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I. Introduction

The human papillomavirus (HPV) is a common virus that can cause deadly cancers. The Centers for Disease Control and Prevention (CDC) estimates that nearly 80 million Americans are currently infected with HPV and 14 million new people become infected every year.ⁱ HPV infections are so common that nearly all people will get at least one type of HPV at some point in their lives. Most HPV infections (9 out of 10) go away by themselves, but persistent HPV infection can cause six known types of cancers years to decades after first acquiring the virus.

Every year in the United States, HPV infection causes 34,800 cases of cancer in men and women. HPV is linked with more than 90% of anal and cervical cancers, about 70% of vaginal, vulvar, and oropharyngeal (throat) cancers, and 60% of penile cancers. Using available estimates of population and cancer incidence, about 3,300 HPV-attributable cancer cases are diagnosed each year in California.ⁱⁱ That means approximately 10% of the nation's HPV-attributable cancers occur among Californians and the result may be early death, poor quality of life, loss of productivity, and substantial treatment costs.

The California HPV Vaccination Roundtable is a coalition of diverse stakeholders with a mission to work together to prevent HPV-attributable cancers and pre-cancers by increasing the California HPV vaccination rate to 80% by 2026.

Fortunately, there is an effective HPV vaccine that prevents over 90% of HPV cancers. The first quadrivalent HPV vaccine was licensed in 2006; the subsequent version is currently approved for ages 9-45 years.ⁱⁱⁱ The current nonavalent HPV vaccine protects against nine HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58, is safe and effective and will further reduce the incidence of HPV infection, as well as HPV-related cancers.^{iv} Importantly, early HPV vaccination results in a stronger immune response; therefore, early HPV vaccination prior to virus exposure enhances effectiveness. The CDC and the American Cancer Society recommend HPV vaccine for boys and girls at ages 11-12 years, and as early as age 9 years. When given at the recommended age, two doses are needed to complete the series. Those starting the series at age 15 or later will need three doses.^v

HPV vaccine is one of three important disease-preventing preteen vaccines: HPV, Tdap, and meningococcal conjugate (MCV). Despite the HPV vaccine being safe and effective at preventing the infection that causes six types of cancer, HPV vaccination coverage significantly lags behind those of other preteen vaccines. According to the 2018 National Immunization Survey-Teen (NIS-Teen), only 51% of the nation's adolescents aged 13-17 years in 2018 had completed the HPV vaccination series, compared to 89% for Tdap. In California, only 53% of adolescents had completed the HPV vaccine series.^{vi}

According to a health economic model recently reviewed by the Advisory Committee on Immunization Practices (ACIP), by vaccinating 22 adolescents we can prevent one future case of cervical precancer, and by vaccinating 202 adolescents we can prevent one future case of any HPV-associated cancer.^{vii} According to Baughan et al, if 99.5% of the population in California were to be fully vaccinated against HPV, 74% of cancer cases and \$52.2 million in treatment costs could be averted.^{viii} There is an urgent need to assess HPV vaccination coverage in California and identify under-vaccinated populations in order to focus efforts towards preventing HPV-linked diseases and cancers.

II. Background

The California HPV Vaccination Roundtable was formed in October of 2018 to mobilize collective action to prevent HPV cancers by increasing HPV vaccination coverage in California. The Roundtable consists of a coalition of diverse stakeholders who adopted the American Cancer Society's *Mission: HPV Cancer Free* goal of 80% HPV vaccination completion coverage for 13-year-olds by 2026, which will be the 20-year anniversary of the FDA's approval of the first HPV vaccine. The selection of 80% as a goal is intentional; it is estimated that increasing HPV vaccination coverage to 80% would prevent an additional 53,000 cases of cervical cancer alone during the lifetime of children who are younger than 12 years.^{ix}

The California HPV Vaccination Roundtable is modeled after the National HPV Vaccination Roundtable, and it serves as a platform to stimulate statewide work on key issues surrounding HPV vaccination. The California and National Roundtable's primary focus is increasing HPV vaccination among the recommended age group (by age 13). The California Roundtable has identified four priority areas:

- 1) Strengthening Provider Recommendations
- 2) Engaging Health Systems
- 3) Increasing Parent and Community Knowledge
- 4) Using and Improving HPV Vaccination Data

This report is a product of the Using and Improving HPV Vaccination Data Workgroup (Data Workgroup). The California Roundtable chose to focus on using HPV vaccination data as a priority area because such data will be critical to measure progress toward optimal HPV vaccination. The goal of 80% HPV vaccination completion by 2026 will protect teens from future HPV-attributable cancers.

III. Objectives

The objectives of the Data Workgroup include:

1. Analyze and display California's HPV-attributable cancer rates by county.
2. Describe and compare data sources for HPV vaccine uptake and completion in California.
3. Determine a baseline data source from which to measure progress toward HPV vaccination.
4. Map and identify geographic areas of California with low rates of HPV vaccine uptake and high rates of HPV-attributable cancer.
5. Provide recommendations for stakeholders to assess, use, and improve HPV immunization data and increase HPV immunization rates.

IV. Methods

The Data Workgroup collected and analyzed HPV-attributable cancer incidence rates from the California Cancer Registry (CCR) to identify counties with high rates of cancer, where vaccination could impact future cancer rates. The Workgroup also collected, analyzed, and aggregated HPV vaccination data from a variety of sources including the CDC-sponsored National Immunization Survey for Teens (NIS-Teen); quality performance metrics from public and private health plans and provider groups; and the statewide California Immunization Registry (CAIR).

A. HPV-attributable cancer incidence

The Data Workgroup wanted to identify cancers that were probably caused by HPV and chose to collect HPV-attributable cancer incidence. The definitions used by CDC for two commonly used terms are defined here: <https://www.cdc.gov/cancer/hpv/statistics/cases.htm>

- **An HPV-associated cancer is a specific cellular type of cancer that is diagnosed in a part of the body where HPV is often found.** These parts of the body include the cervix, vagina, vulva, penis, anus, rectum, and oropharynx (back of the throat, including the base of the tongue and tonsils). These cellular types include carcinomas of the cervix and squamous cell carcinomas of the vagina, vulva, penis, anus, rectum, and oropharynx.
- **An HPV-attributable cancer is a cancer that is probably caused by HPV.** HPV causes nearly all cervical cancers and many cancers of the vagina, vulva, penis, anus, rectum, and oropharynx. The number of HPV-attributable cancers are estimated by multiplying the number of HPV-associated cancers by the percentage of these cancers that are probably caused by HPV.

California Cancer Registry (CCR) data was used to obtain 5-year (2012-16) incidence counts of each HPV-associated cancer by county, for each 5-year age group (<1, 1-4, 5-9, 10-14, ... 80-84, >85), based on CDC recommendations to determine cancers that are most likely to be HPV-associated. The following classifications were used for cancer site and morphology:^x

- Cervical: histologic types 8010-8761, 8940-8941
- Vaginal, vulvar, penile, anal, and rectal: histologic types 8050-8084, 8120-8131
- Oropharyngeal: histologic types 8050-8084, 8120-8131, and primary sites 19,24,28,51-52,90-91,98-104,108-109,140-142,148

Five-year site-specific HPV-attributable cancer incidence counts were determined by applying the percent of HPV-associated cancers estimated to be HPV-attributable, based on HPV types detected in a genotyping study.^{xi} These percentages are shown in Table 1 below.

Table 1. Types of HPV-associated cancers, percent HPV-attributable, and California age-adjusted HPV-attributable cancer rates (per 100,000 persons) by anatomic site

Cancer type	Percent HPV-attributable	Age-adjusted rate
Cervical	91%	3.27
Anal/Rectal	91%	1.57
Vaginal	75%	0.17
Oropharyngeal	70%	2.86
Vulvar	69%	0.52
Penile	63%	0.21

After determining the site-specific HPV-attributable cancer incidence counts by age group and county, all sites were added together to get a total count of 2012-2016 HPV-attributable cancers by age group and county. CCR standard county groupings were used to address data suppression issues in the smaller counties where the 2012-2016 total HPV-attributable case counts were <11. The following counties were grouped together: Alpine, Amador, and Calaveras; Del Norte and Humboldt; Lassen, Modoc and Plumas; Inyo and Mono; Sierra and Yuba; Siskiyou and Trinity; Colusa, Glenn, and Tehama; and Mariposa and Tuolumne.

The National Cancer Institute’s Surveillance, Epidemiology, and End Results (SEER) Program’s methodology^{xii} was used to calculate age-adjusted rates of HPV-attributable cancers for each county or county grouping, standardized to the 2000 U.S. Standard Population age distribution and expressed as cases per 100,000 persons. Adjusting by age provided a standardized way to compare cancer rates across counties with different population distributions by age. For example, counties with older populations generally have higher crude cancer incidence rates which may skew rate estimates. Five-year populations from SEER were used as denominators for each age group in each county.

B. HPV vaccination coverage data

The Data Workgroup reviewed HPV vaccination data from a variety of sources including 1) statewide data from NIS-Teen, 2) public and private health plans and provider groups reported quality performance metrics, and 3) the statewide CAIR.

1. Statewide data using National Immunization Surveys (NIS)

The National Immunization Surveys (NIS) are sponsored and conducted by the National Center for Immunization and Respiratory Diseases (NCIRD) of the CDC. NIS-Teen was launched in 2006 to monitor vaccination coverage among adolescents 13-17 years of age living in the United States. The NIS-Teen provides national, state, and selected local level estimates of vaccination coverage based on provider-reported vaccination histories for vaccines recommended by ACIP. Nationally, the NIS-Teen also looks at disparities in coverage by race/ethnicity, poverty, metropolitan statistical area (i.e. rural vs. urban), and health insurance status. The NIS-Teen includes coverage of the following routine adolescent vaccines:

- Tetanus, diphtheria, acellular pertussis (Tdap)
- Meningococcal conjugate (MCV)
- Human papillomavirus (HPV)
- Influenza vaccine (flu)

HPV vaccine was added to NIS-Teen in 2008 for females and in 2012 for males.

2. Health plans and provider groups reported quality performance metrics

To ensure accountable health care, the National Committee for Quality Assurance (NCQA) collects data annually from health plans and other health care organizations on their performance on select services and types of care they provide to their members. NCQA’s Healthcare Effectiveness Data and Information Set (HEDIS) measures are one of health care’s most widely used performance improvement tools. Health plans and other entities report NCQA measures or HEDIS data in California, such as managed care providers, health maintenance organizations (HMOs), preferred provider organizations (PPOs), and medical groups. NCQA-like measures are often included in other quality forums and pay-for-performance programs.

One of those measures is Immunizations for Adolescents (IMA), which assesses vaccination of adolescents with one dose of meningococcal vaccine (MCV), one dose of pertussis-containing vaccine (Tdap), and at least two doses of HPV vaccine by their 13th birthday (Combination 2, or IMA-2). For the annual NCQA audit, this is a hybrid measure requiring a random sample of eligible teens to be drawn from the total population.

When HPV-specific vaccination rate data is unavailable for analysis, IMA-2 performance data can be used as an approximator. Because the IMA-2 measure describes the percentage of teens compliant for all three vaccines, yet compliance for HPV vaccine is drastically lower than for MCV and Tdap vaccines, overall measure performance reflects that of the rate-limiting component – HPV vaccine. (See Table 3 in Results.)

a) California Department of Health Care Services (DHCS) reports of 13-year-olds in Medi-Cal managed care

The DHCS Managed Care Quality and Monitoring Division requires contracted Medi-Cal managed care health plans to report HEDIS immunization data annually [Figures 3 and 4]. Vaccination coverage may be calculated by reviewing administrative data, e.g., billing or encounter data, or by using a hybrid method, which includes administrative, medical record, and supplemental data, including California’s IIS, CAIR. Medi-Cal managed care health plans use the hybrid method to review vaccination data for a random sample drawn from eligible patients who have been continuously enrolled for at least 11 of the 12 months prior to and including their 13th birthday. In 2018, IMA-2 was based on 216,683 members who turned 13 years of age that year, representing 42% of the Department of Finance’s estimated total number of Californian’s in this age group.

b) Integrated Healthcare Association analysis of commercially insured 13-year-olds

Integrated Healthcare Association (IHA), a regional healthcare improvement collaborative operating in California, reports on commercial HMO performance on the IMA measure for all 13-year-old enrollees. In 2018, the dataset included 10 health plans and 200 physician organizations caring for 101,988 13-year-olds, which represents approximately 20% of 13-year-olds in California. IHA results are based on claims, encounters, and supplemental electronic health record (EHR) or IIS data, but do not include chart reviews. These 200 physician organizations participate in the IHA Align.Measure.Perform (AMP) program to harmonize measures used for provider incentive payments. Health plans participating in AMP comprise 95% of commercial HMO enrollment in CA.

c) State of California Office of the Patient Advocate reports of health plan and medical group performance

The Office of the Patient Advocate (OPA) rates health plans and medical groups using health care performance measures based on quality of medical care and patient experience. OPA provides information to help consumers compare health plans and medical groups, track consumer complaints and identify patient rights and health care resources. Report cards for health plans and medical groups are available at <https://www.opa.ca.gov/reportcards>.

OPA shares quality ratings data for the ten largest HMOs covering more than 90% of California HMO enrollees and the six largest PPOs in the state of California, including for IMA-2. The [IMA-2 measure data](#) were collected using administrative records in 2018; some health plans also use patient medical records, which are often more complete and result in higher scores. Noted limitations are that the separate HPV and Tdap vaccine components of the composite IMA-2 measure are not publicly reported, and that not all HMOs or PPOs report quality performance results. Report cards for 199 medical groups that have contracts with the commercial HMO health plans listed in OPA’s HMO Report Card are also available. A search may be conducted by medical group name or by one of the 39 counties with a reporting medical group.

3. California Immunization Registry (CAIR)

An IIS is a confidential, computerized database that stores immunization records. CAIR currently is made up of three distinct IIS. The largest is CAIR2 which is operated by the California Department of Public Health on behalf of 49 of the 58 California counties. Next in size is the San Diego Immunization Registry (SDIR) operating in San Diego county, and the smallest is the Healthy Futures (HF) registry that operates in 8 counties located in California’s Central Valley. All three registries will become connected in 2020 so that users of any of the three registries can access statewide data.

Currently, pharmacists are the only health care providers in California who are mandated by state regulation to report immunization doses to CAIR.^{xiii} In addition, DHCS contracts require Medi-Cal managed care health plans to ensure that member-specific immunization information is reported to the IIS.^{xiv} However, CDPH estimates that 34% of provider offices in the Vaccines for Children (VFC) program (all of whom serve Medi-Cal patients) in 49 counties were not entering any immunizations into CAIR as of December 2019. Additionally, among VFC providers rates of participation in CAIR2 vary with rates of participation about 20% higher in northern regions of the state (78%) than in the southern regions (58%). Without full provider participation, CAIR is not complete. According to the latest annual report in 2018, an estimated 72% of adolescents aged 11 to 17 years have at least two immunization doses recorded in CAIR.^{xv}

For this report, adolescent HPV vaccination coverage was assessed by each of the regional IIS (CAIR2, SDIR, HF) in CAIR separately, using the same methodology. Individuals with fewer than two immunization doses in CAIR and non-California residents were excluded from the analysis. The denominators included those who turned 13 years of age in 2018 and had at least two doses of any vaccine recorded in CAIR. The results were then aggregated to provide statewide and county-level estimates of HPV vaccine initiation (i.e., at least one dose of HPV vaccine) and HPV vaccine series completion for 13-year-olds in California. Data representing counties with small populations were combined to preserve patient confidentiality. Adolescents who received at least two doses of HPV vaccine were considered to have completed the series, although it is possible that some may have received the doses at a shorter interval than recommended thereby requiring a third dose of HPV vaccine per ACIP recommendations.^v

Geographic disparities for HPV vaccine initiation and completion in California were identified by classifying counties as urban or rural using CDC’s National Center for Health Statistics (NCHS) 2013 Urban-Rural Classification Scheme for Counties [Appendix E]. Documenting counties with low initiation or completion coverage may assist stakeholders in identifying areas of need around the state.

C. Number needed to vaccinate to avert cancer

Health economic analyses have been used to evaluate cost effectiveness and to inform policy considerations for vaccine program recommendations here in the U.S. As presented at the June 2019 ACIP meeting, the HPV-ADVISE model incorporated a wide range of HPV-related health outcomes, current medical cost estimates, herd effects, cervical cancer screening assumptions, and transmission dynamics to calculate the number needed to vaccinate (NNV) with the HPV vaccine to prevent one case of HPV-related disease.^{vii} Given the vaccination program in the U.S. in mid-2019—routine vaccination at ages 11-12 and catch up vaccination through age 26 for females and 21 years for males—the model projected the NNV with HPV vaccine to prevent one HPV-associated cancer. The model determined that if 202 adolescents were vaccinated, one case of HPV-associated cancer could be averted.

In this report, the NNV was applied to the populations of eligible adolescents reported for commercial HMOs and Medi-Cal managed care health plans to calculate how many HPV-associated cancers would be averted with their current HPV vaccine uptake and with the goal of 80% HPV vaccine uptake.

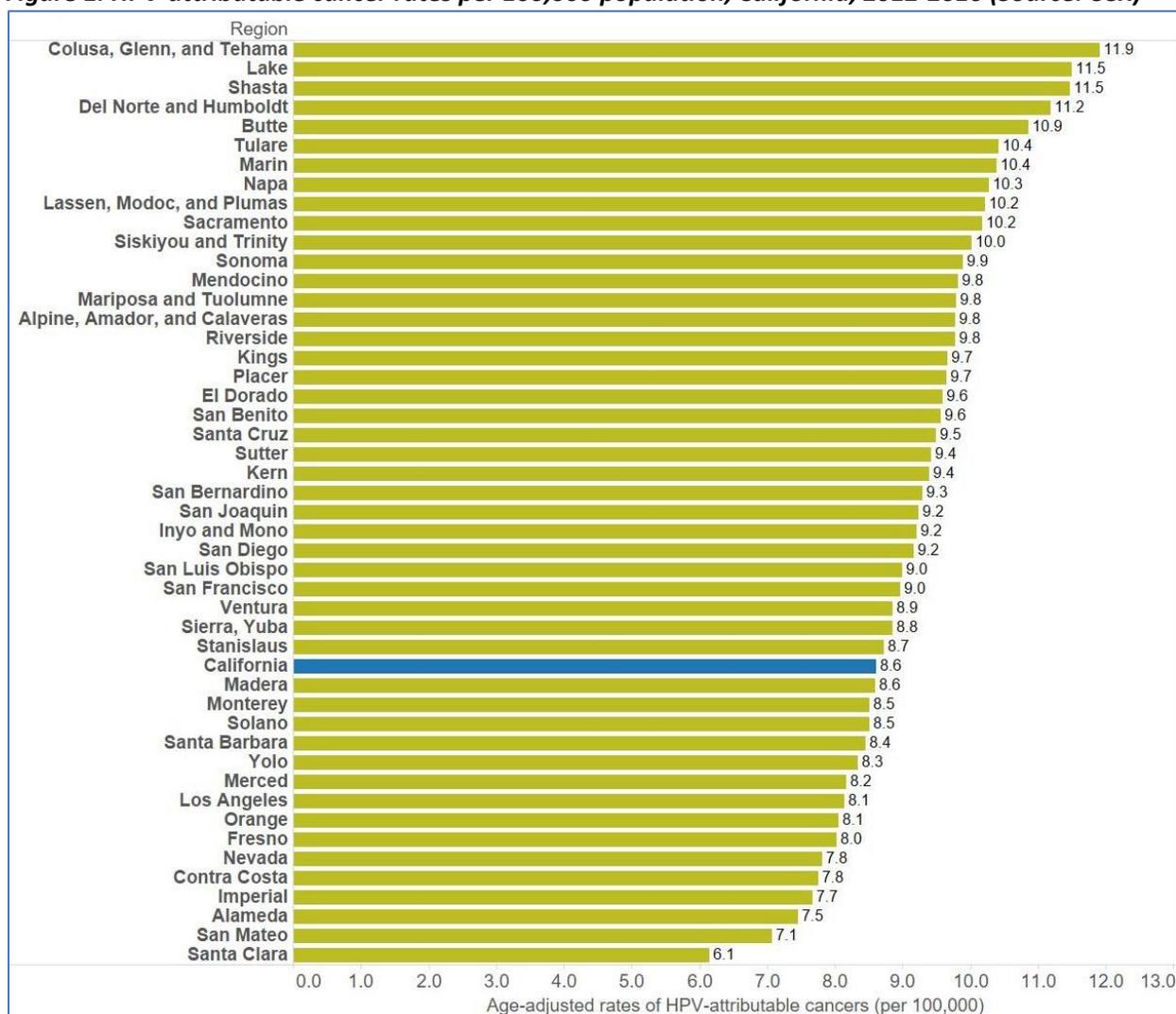
$$\text{Averted HPV – associated cancers} = \frac{(\# \text{ 13 year olds in Plan}) (\% \text{ HPV vaccine completion of Plan})}{\text{Number need to treat to prevent 1 HPV–associated cancer}}$$

V. RESULTS

A. HPV-attributable cancer incidence

HPV-attributable cancer incidence rates (2012-2016) by county or region are shown in Figure 1 below. See Appendix A for a detailed table of HPV-attributable cancers by county or region, including number of cancers, 5-year population, crude rate, and age-adjusted rate. (Also, in map format in Figure 9.)

Figure 1. HPV-attributable cancer rates per 100,000 population, California, 2012-2016 (Source: CCR)



B. HPV vaccination coverage

Estimates for HPV vaccine series completion in California among 13-year-olds in 2018 was similar for teens enrolled in commercial (50%) and Medi-Cal managed care health plans (45%). These rates apply to 62% of the state’s estimated 517,000 13-year-olds in 2018. By contrast, the CAIR analysis yielded a lower estimate (28%) [Table 2]. (See limitations in Discussion section.) More detailed results are described below by data source.

Table 2. HPV vaccine series completion among 13-year-olds, 2018

Region	United States	California		
Data Source	NIS-Teen*	Commercial HMOs††	Medi-Cal†	CAIR**
Proportion up to date	40% (95% CI, 37.0-42.9)	50%	45%	28%
# of 13-year-old Californians to whom these estimates are generalizable***	Not applicable	101,988 commercially insured members	216,683 Medi-Cal managed care members	unknown**

*Based on 3,852 individuals randomly sampled in the national survey who were 13 years of age at the time of interview in 2018^{xvi}

†Based on approximately 400 patients randomly sampled for each of 53 reporting units (see Figure 5) of Medi-Cal managed care health plans from a total eligible population of 216,683 members who turned 13 years of age in 2018

**The 558,480 patients who turned 13 years of age in 2018 with 2 or more immunizations in CAIR were used as the denominator in this CAIR calculation.

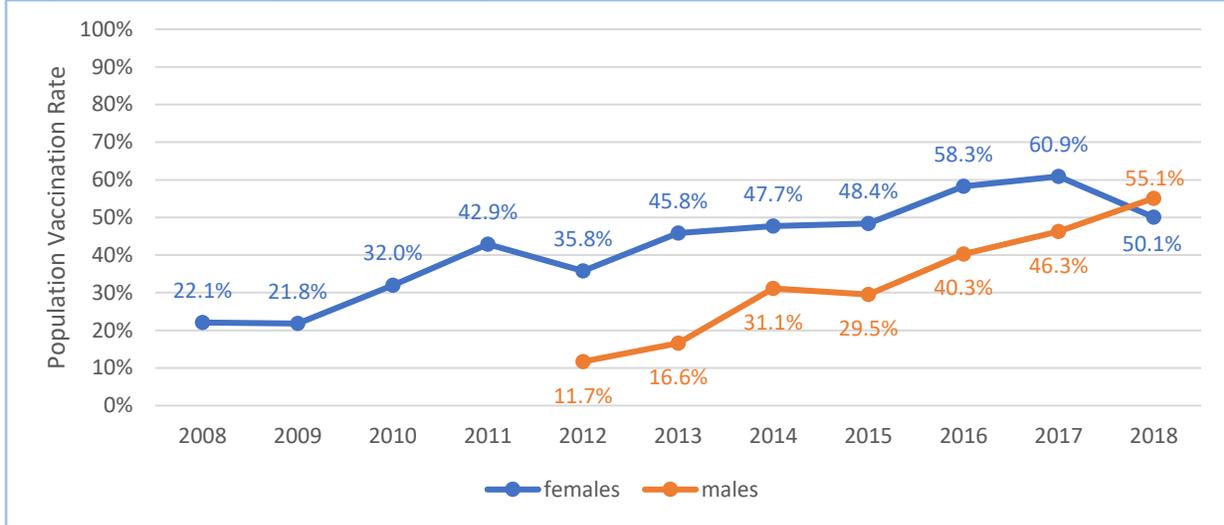
††HPV immunization status was ascertained for all 101,988 commercial HMO 13-year-old enrollees whose 200 physician organizations in 10 health plans participate in the IHA Align.Measure.Perform (AMP) program.

***Note: The CA Department of Finance estimates there were a total of 517,301 13-year-olds in California in 2018.^{xvii}

1. Statewide data using National Immunization Surveys (NIS)

NIS-Teen provides a population-based estimate of HPV vaccination over time, with HPV vaccine being added to NIS-Teen in 2008 for females and in 2012 for males. The graph below [Figure 2] shows HPV vaccine series completion among females and males 13-17 years in California from 2008-2018. For all 13-17-year-old females and males combined in 2018, 74% had started the HPV vaccine series, and 53% were up to date having received either two or three valid doses, depending on age at initiation. The small sample size (n=356) used to assess coverage of adolescent vaccination in California results in wide confidence intervals and potentially unstable estimates for those teens starting the series ($\pm 6.4\%$, 95% CI) and for those with complete coverage ($\pm 7.2\%$, 95% CI). The sampling design does not permit coverage estimates at the county level.

Figure 2. Proportion with HPV vaccine series completion among females and males 13-17 years, California, 2008-2018 (Source: NIS-Teen) *



*Series completion defined as follows: 2008-2015 ≥ 3 doses, 2016-2018 includes those with ≥ 3 doses and those with 2 doses when the first HPV vaccine dose was initiated at age < 15 years.

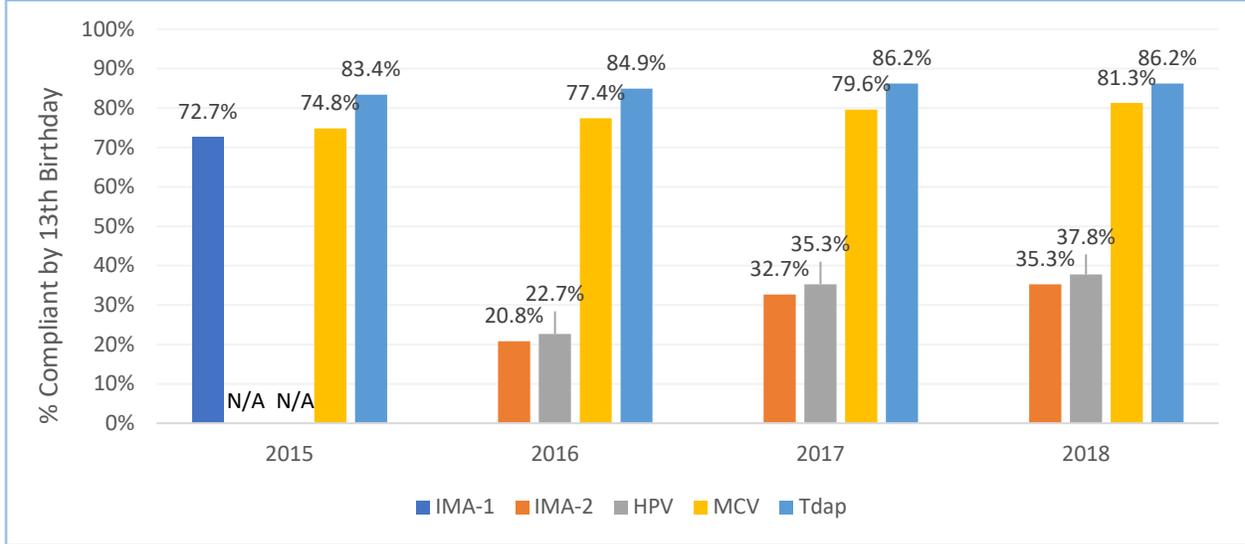
Nationally, the 2018 NIS-Teen survey found that adolescents in rural areas had lower HPV vaccination coverage compared to those in urban areas, and that adolescents with private health insurance had lower HPV vaccination coverage than those with Medicaid (known as Medi-Cal in California). It is also important to note that NIS-Teen estimates coverage for adolescents 13-17 years of age, which allows four additional years of life for teens to catch up on immunizations and therefore results in higher estimates. NIS teen reports include a cohort assessed at the 13th birthday only at the national level (data not available at the state level). When surveyed in 2018, 40% of 13-year-olds nationwide were up to date for HPV, compared to 51% of adolescents aged 13-17 years.

2. Health plans and provider groups reported quality performance metrics

National HEDIS data reported an average performance of the Combination 1 measure (Tdap and MCV) to be 72.7% for Medicaid Health Maintenance Organization (HMO) plans in measurement year 2015. The following year, performance dropped to 20.8% when the NCQA added three doses of HPV vaccine to the measure (IMA-2). In 2017, IMA-2 was modified to require only two doses of HPV vaccine to reflect the change to the HPV vaccination schedule by ACIP, and compliance moved upward to 32.7%. In 2018, national compliance for the IMA-2 measure reached 35.3%. Table 3 shows national Medicaid HMO IMA and individual component (HPV, MCV, Tdap) performance over time, and illustrates how IMA performance data can be used to approximate HPV vaccination. These graphs also illustrate the large gap between HPV vaccination completion when compared to Tdap and MCV.

Performance data is also available at the national level for HMO, PPO, and Medicaid health plans overall by individual vaccine type including HPV vaccine since 2016. Of note, at the national level, Medicaid HMO plans have a higher HPV vaccination rate (35%) than do Commercial HMO (26%) or PPO plans (22%). (See <https://www.ncqa.org/hedis/measures/immunizations-for-adolescents>.)

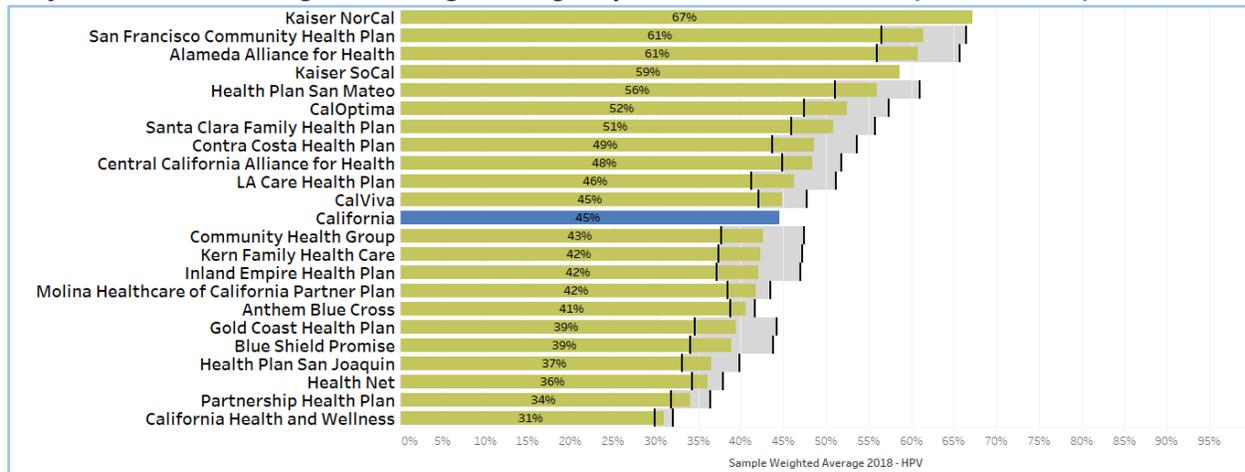
Table 3. Proportion of 13-year-old members of Medicaid HMO plans in compliance with IMA measure and vaccine component, United States, 2015-2018 (Source: NCQA)



a) California Department of Health Care Services (DHCS) reports of 13-year-olds in Medi-Cal managed care

In 2018, the statewide weighted average rate of adolescents who had completed the HPV vaccine series by their 13th birthday was 45% [Figures 3 and 4]. Figure 3 provides a summary of HPV vaccine series completion by each Medi-Cal managed care health plan overall. While no Medi-Cal managed care health plan has yet reached the 80% target, there is wide variability indicating opportunity for improvement. Medi-Cal managed care health plans performing below the state average (defined as having upper 95% confidence intervals below the statewide weighted average) are Molina Healthcare and all health plans ranking below it.

Figure 3. Proportion with HPV vaccine series completion by Medi-Cal managed care health plan and California statewide weighted average among 13-year-old members, 2018 (Source: DHCS)*

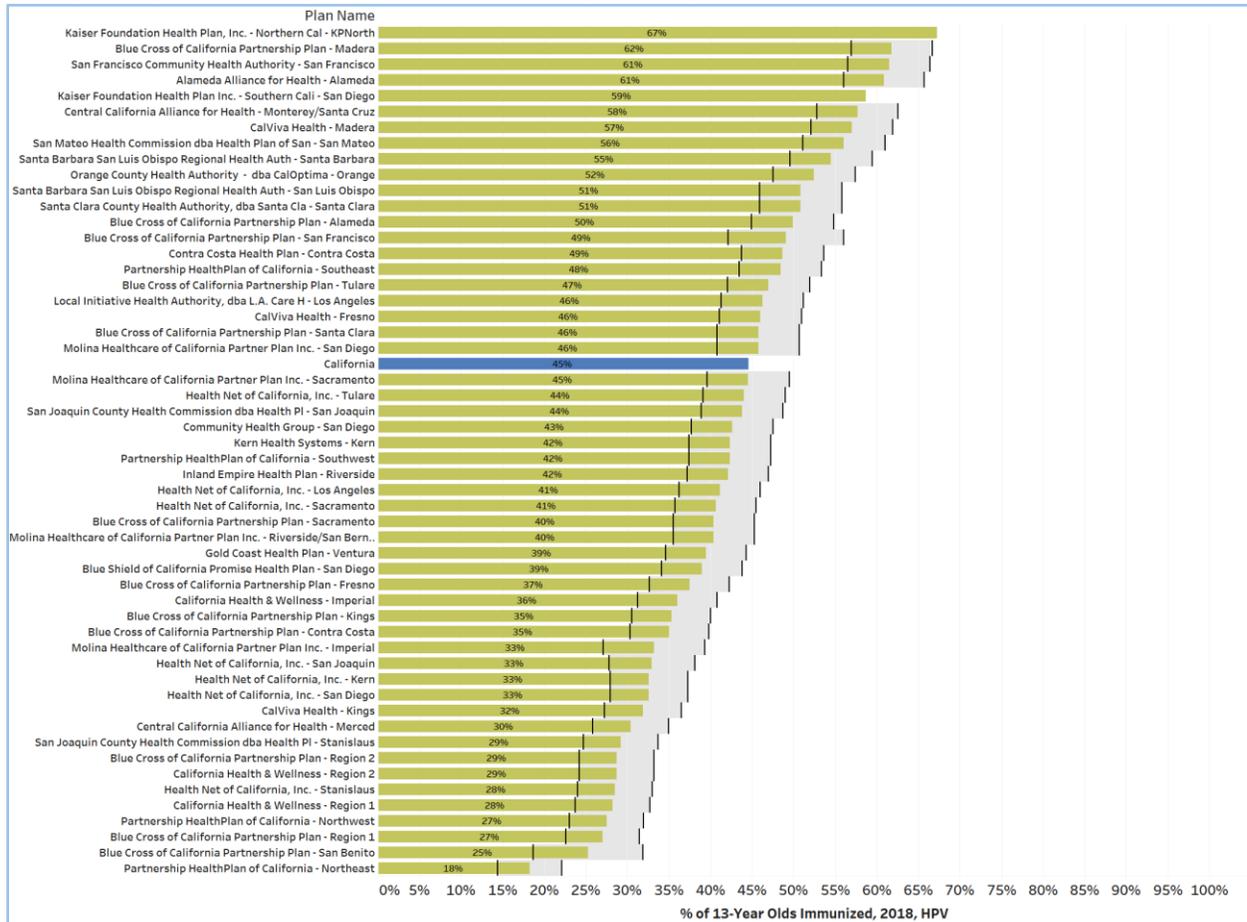


* Colored bars represent the HPV immunization rate in the sampled members. The grey shaded area bracketed by lines indicates the 95% confidence interval for sampled immunization rates. Kaiser uses its entire population to determine

immunization rates; since no sampling is performed, no confidence interval is calculated. No reporting from Aetna Sacramento, Aetna San Diego, or United San Diego.

Figure 4 further breaks down Medi-Cal managed care health plans into 53 reporting units DHCS has designated based on counties or regions of these health plans. Health plans performing below the state average (defined as having upper 95% confidence intervals below the statewide weighted average) include Gold Coast Health Plan of Ventura County and all health plans ranking below it.

Figure 4. Proportion with HPV vaccine series completion by Medi-Cal managed care health plan and county or region and California statewide average among 13-year-old members, 2018 (Source: DHCS)*



* Colored bars represent the HPV immunization rate in the sampled members. The grey shaded area bracketed by lines indicates the 95% confidence interval for sampled immunization rates.

Region 1: Butte, Colusa, Glenn, Plumas, Sierra, Sutter, and Tehama

Region 2: Alpine, Amador, Calaveras, El Dorado, Inyo, Mariposa, Mono, Nevada, Placer, Tuolumne, and Yuba

Partnership Health Plan Northeast: Lassen, Modoc, Shasta, Siskiyou, and Trinity

Partnership Health Plan Northwest: Del Norte and Humboldt

Partnership Health Plan Southwest: Lake, Marin, Mendocino, and Sonoma

Partnership Health Plan Southeast: Napa, Solano, and Yolo

Multiple health plans† subcontract with Kaiser. Members subcontracted to Kaiser NorCal and Kaiser SoCal are included in the contracting health plan’s data and are not included in Kaiser’s data. Kaiser NorCal data includes members from Sacramento, El Dorado, Amador, and Placer counties. Kaiser SoCal data includes members from San Diego County only. Kaiser uses its entire population to determine immunization rates; since no sampling is performed, no confidence interval is calculated.

† Alameda Alliance for Health, CalOptima, CalViva, Contra Costa Health Plan, Gold Coast Health Plan, Health Plan of San Mateo, Inland Empire Health Plan, Kern Family Health, LA Care Partnership Health Plan, San Francisco Community Health Plan, Santa Clara Family Health Plan

Figure 4 illustrates wide variation between health plan within the same county (e.g., San Diego ranging from 59% HPV vaccination coverage with Kaiser to 33% with HealthNet). Some of this variation between health plans within the same county or region may be due to closed provider networks (e.g. Kaiser and HealthNet do not share clinics in San Diego).

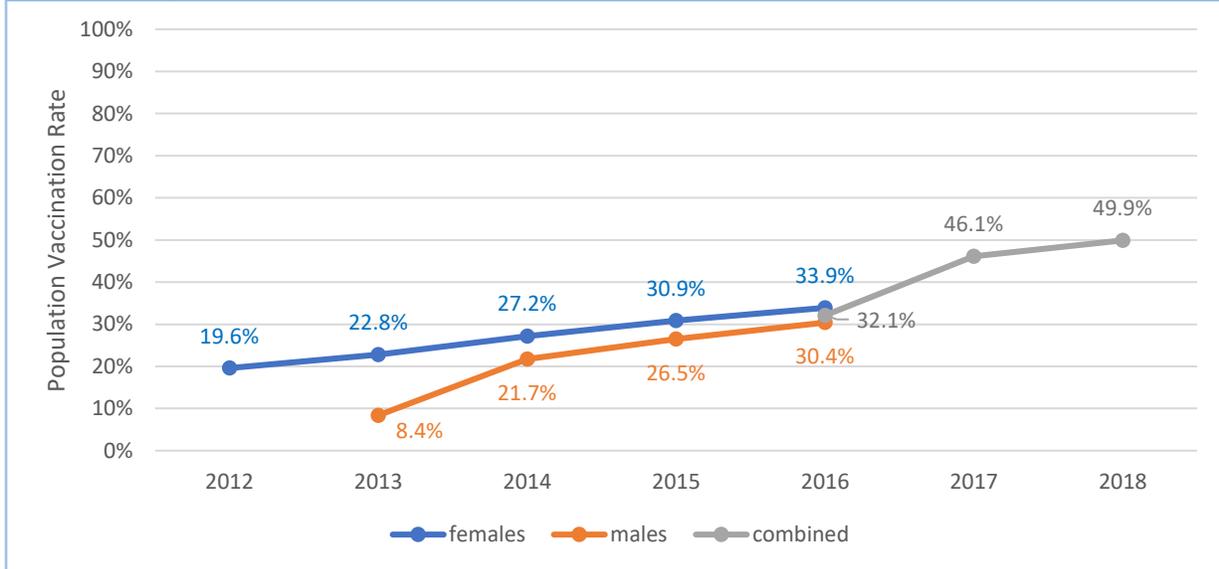
The graph also shows wide variation within the same health plan operating in different counties (e.g., Blue Cross in Madera with 62% coverage to Blue Cross in San Benito with 25% coverage). (Of note, a Federally Qualified Health Center in Madera County serving most of that area's Medi-Cal Managed Care members received an intervention targeting HPV vaccination as part of the American Cancer Society's HPV VACs pilot.^{xviii}) Variation was also seen within Partnership HealthPlan which covers 14 counties in Northern California. Partnership's highest performing region (Southeast) included counties in the San Francisco Bay area, while its lowest performing regions (Northwest and Northeast) included some of the state's most remote areas. It seems that despite similar resources within a health plan, the local healthcare system and additional factors (e.g., attitudes toward vaccination) may strongly influence quality outcomes like HPV vaccination.

Overall, many of the highest performing counties are in the San Francisco Bay Area, though exceptions like Madera County were observed. Western California had higher coverage than Eastern, and urban regions generally had higher coverage than rural.

b) Integrated Healthcare Association analysis of commercially insured 13-year-olds

In measurement year 2018, 49.94% of the commercial HMO 13-year-old enrollees completed their HPV vaccine series by their 13th birthday. The figure below shows HPV vaccine series completion among 13-year-old HMO enrollees from 2012-2018.

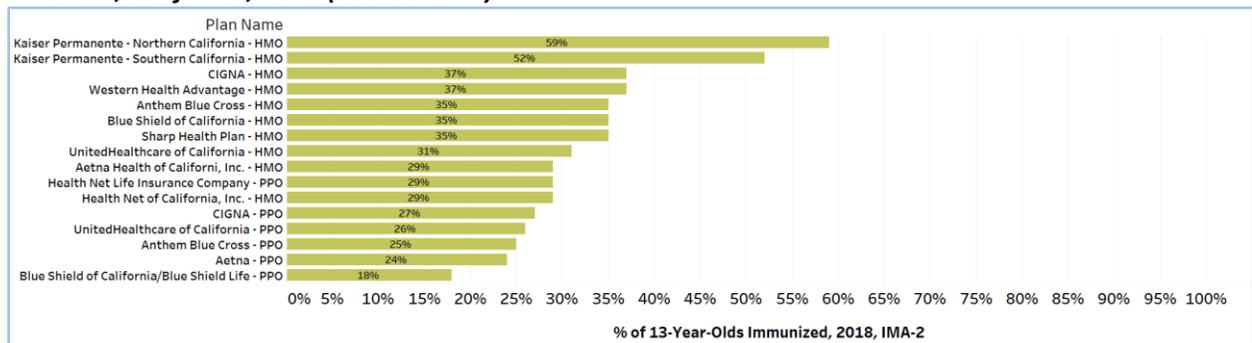
Figure 5. Proportion with HPV vaccine series completion among 13-year-old commercial HMO enrollees, California, 2012-2018 (Source: IHA)



c) *State of California Office of the Patient Advocate reports of health plan and medical group performance*

The 16 HMO and PPO plans in California reported adolescent vaccination coverage that ranged from 18-59%. (See [Immunizations for Early Teens](#) ratings.) The major limitation to using this data is that the HPV vaccine is bundled with the other two vaccines and is not available separately; however as discussed previously, IMA-2 performance approximates HPV vaccination rates.

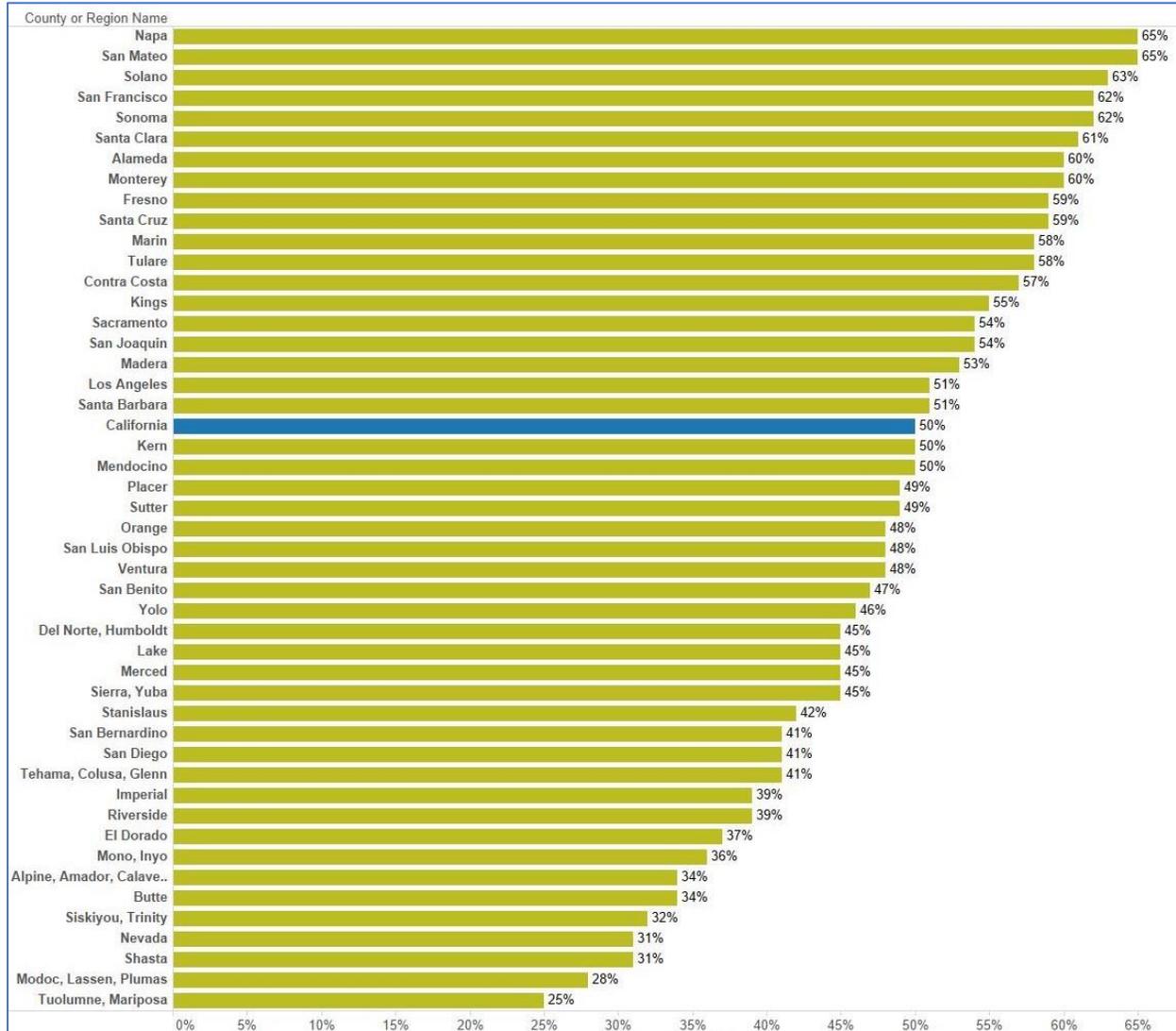
Figure 6. Proportion with HPV vaccine series completion among 13-year-old commercial HMO and PPO enrollees, California, 2018 (Source: OPA)



3. California Immunization Registry (CAIR)

In 2018, 50% of 13-year-olds in the CAIR analysis had initiated the HPV vaccine series and 28% had completed the series before their 13th birthday [Figures 7 and 8, Appendix B]. Among 13-year-olds, HPV vaccine initiation ranged from 25-65% by county [Figure 7, Appendix B], while vaccine completion rates ranged from 9-42% by county [Figures 8 and 9, Appendix B].

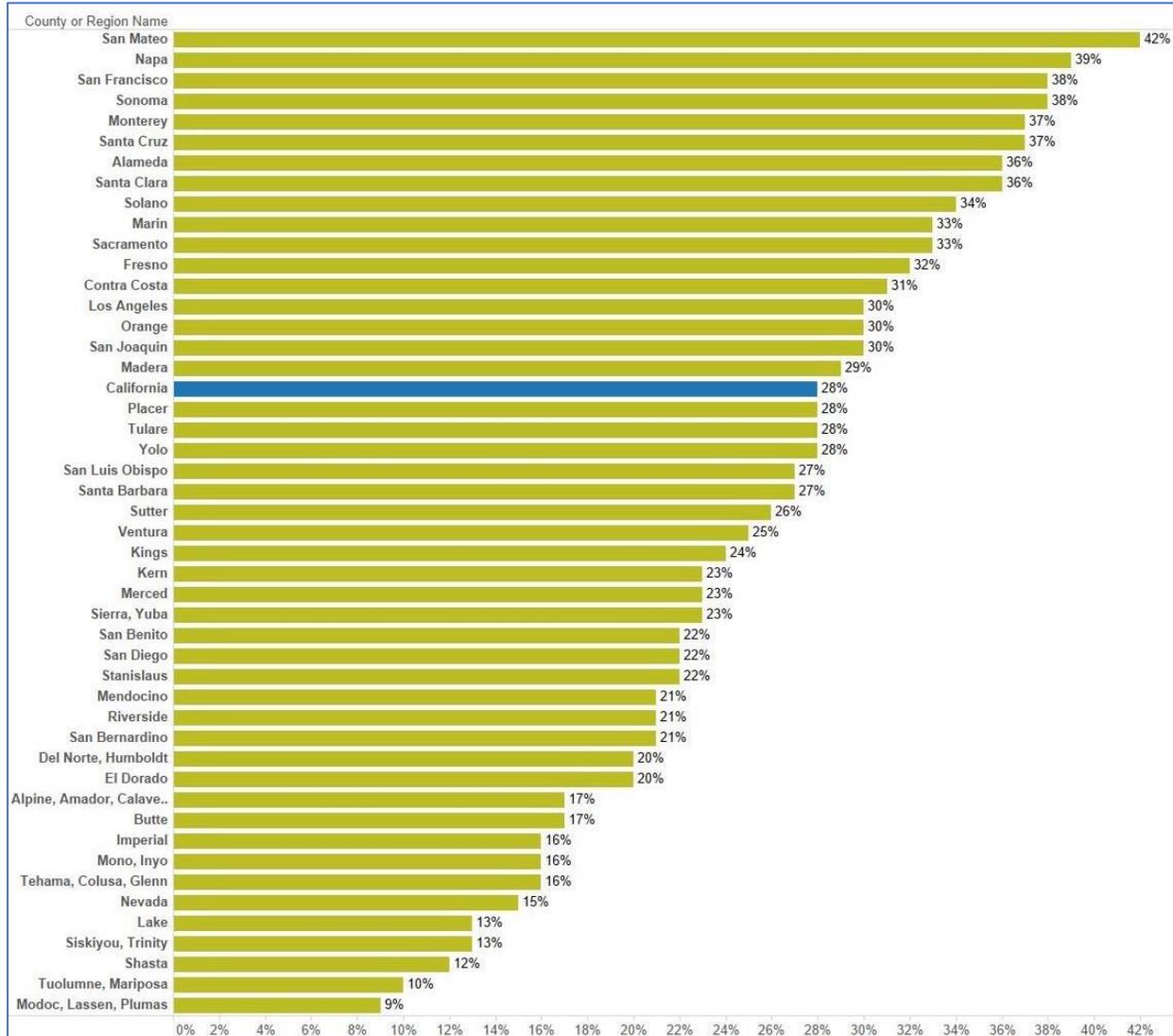
Figure 7. Proportion of 13-year-olds with 1 dose of HPV vaccine recorded in CAIR by county, California, 2018 (Source: CAIR)*



* Among 13-year-olds with two or more doses of any vaccine in CAIR. County rates are individual rates except in the cases of these following groupings: Alpine, Amador, and Calaveras; Del Norte and Humboldt; Lassen, Modoc and Plumas; Inyo and Mono; Sierra and Yuba; Siskiyou and Trinity; Colusa, Glenn, and Tehama; and Mariposa and Tuolumne.

Rural and urban geographic disparities are also apparent. Initiation of the HPV vaccine series in 13-year-olds was as low as 16% in one rural county and up to 65% in two urban counties [Figure 7 and Appendix B]. Completion of the series was as low as 8% in three rural counties and as high as 42% in an urban county [Figures 8 and 9, and Appendix B]. In geographic areas with small populations, coverage can fluctuate. For both series initiation and completion, lower coverage was observed in the northern and eastern parts of the state. There was little difference in statewide coverage observed across females and males, with 51% series initiation and 29% series completion for girls versus 50% series initiation and 27% series completion for boys [Appendix C].

Figure 8. Proportion of 13-year-olds with HPV vaccine series completion recorded in CAIR by county, California, 2018 (Source: CAIR)*



*Among 13-year-olds with two or more doses of any vaccine in CAIR. County rates are individual rates except in the cases of these following groupings: Alpine, Amador, and Calaveras; Del Norte and Humboldt; Lassen, Modoc and Plumas; Inyo and Mono; Sierra and Yuba; Siskiyou and Trinity; Colusa, Glenn, and Tehama; and Mariposa and Tuolumne.

C. Geographic mapping of HPV-attributable cancer and HPV vaccination coverage

The maps below [Figures 9 and 10] present regional findings and highlight HPV vulnerable regions where the greatest opportunities exist to expand efforts to protect our communities. However, even in the counties with the highest vaccination completion coverage (42%), observed coverage fell far below the target of 80%.

Figure 9. Rate of HPV vaccine series completion among 13-year-olds by county, California, 2018
 (Source: CAIR)

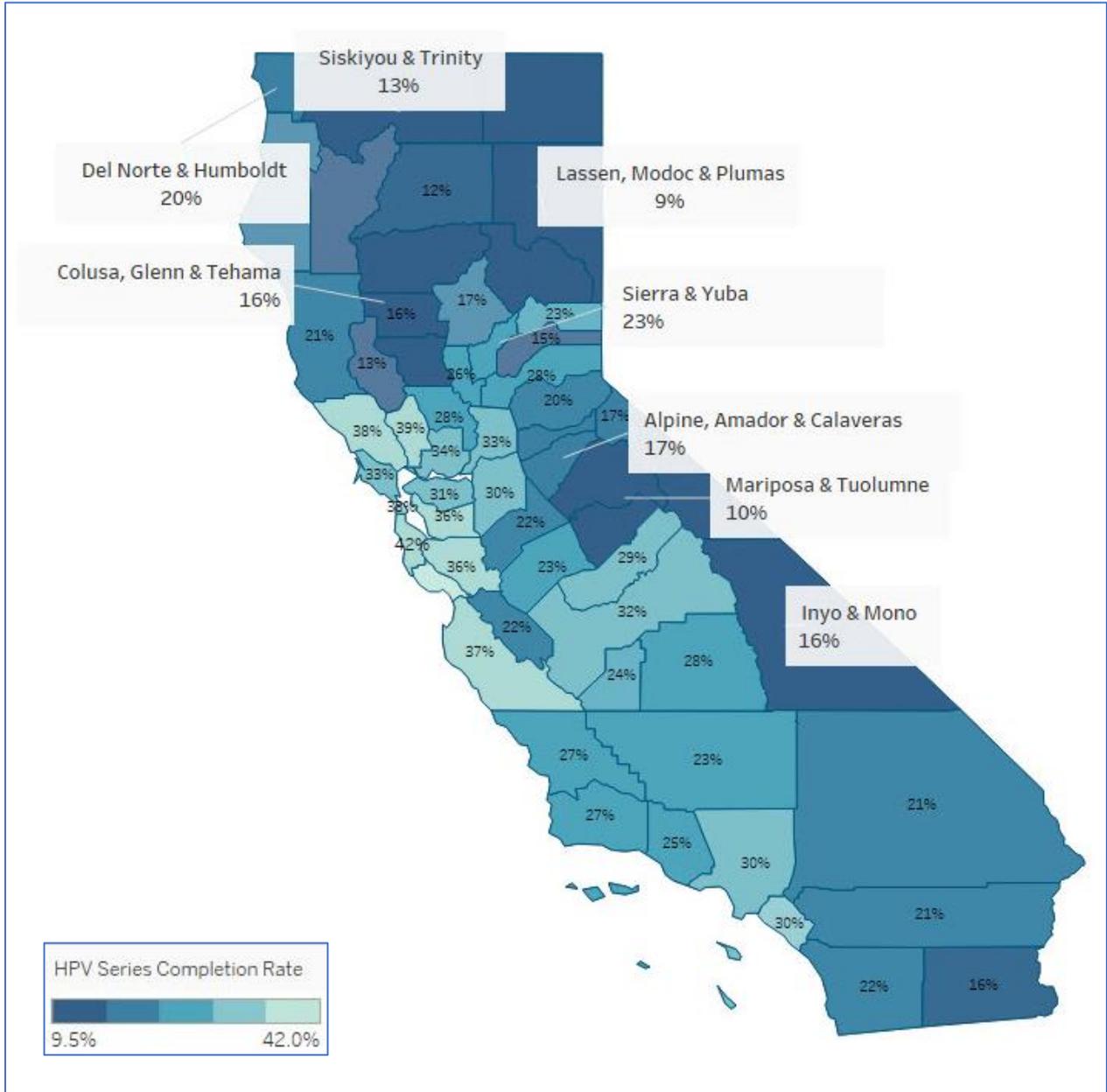
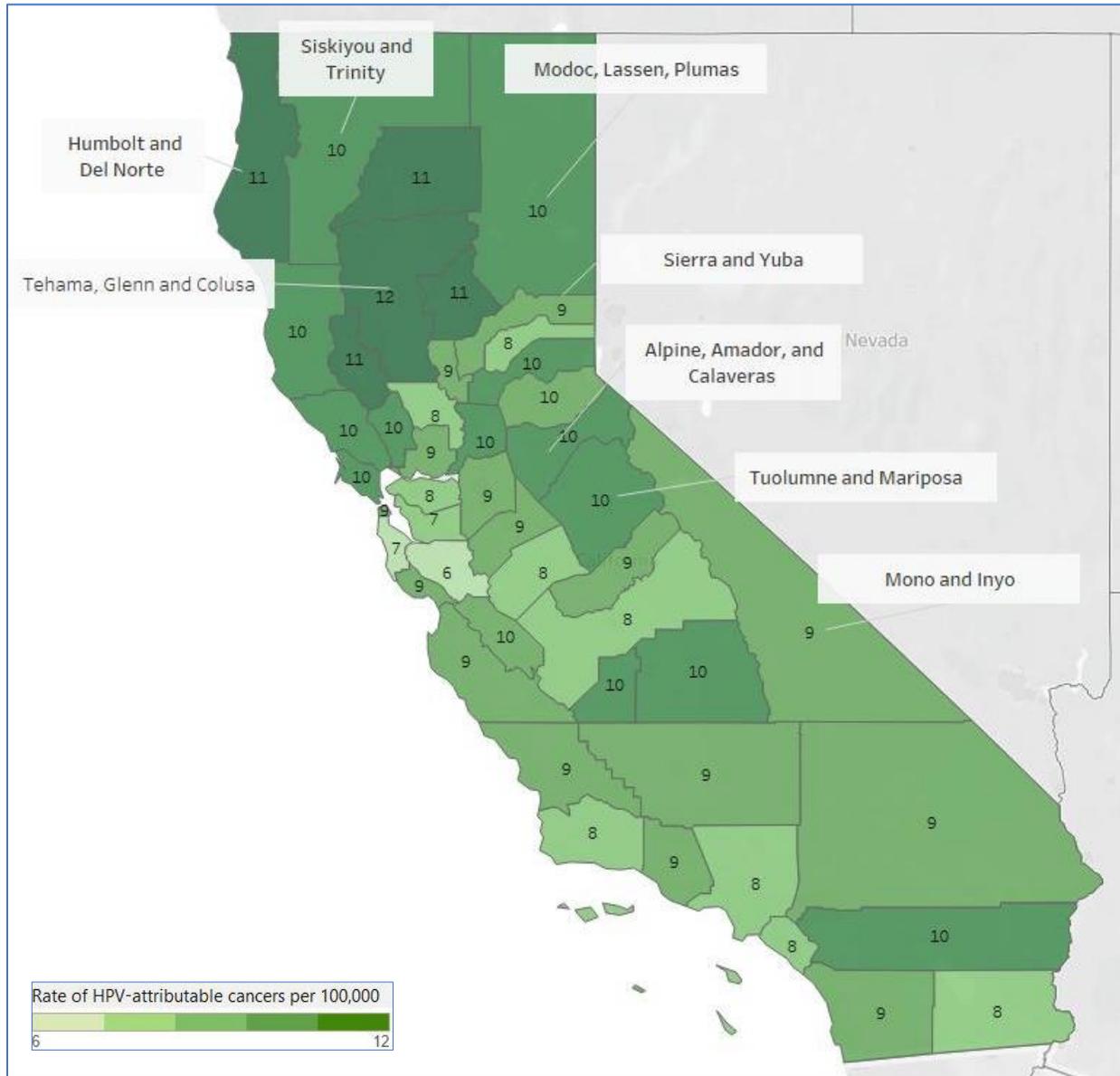
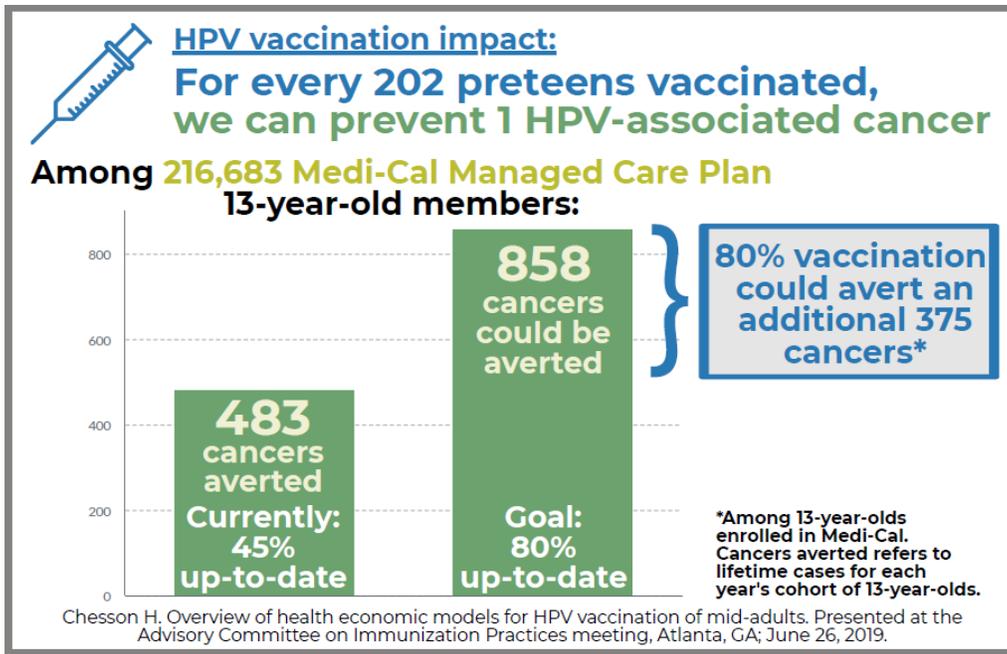


Figure 10. HPV-attributable age-adjusted cancer rate per 100,000 population, California, 2012-2016
 (Source: CCR)

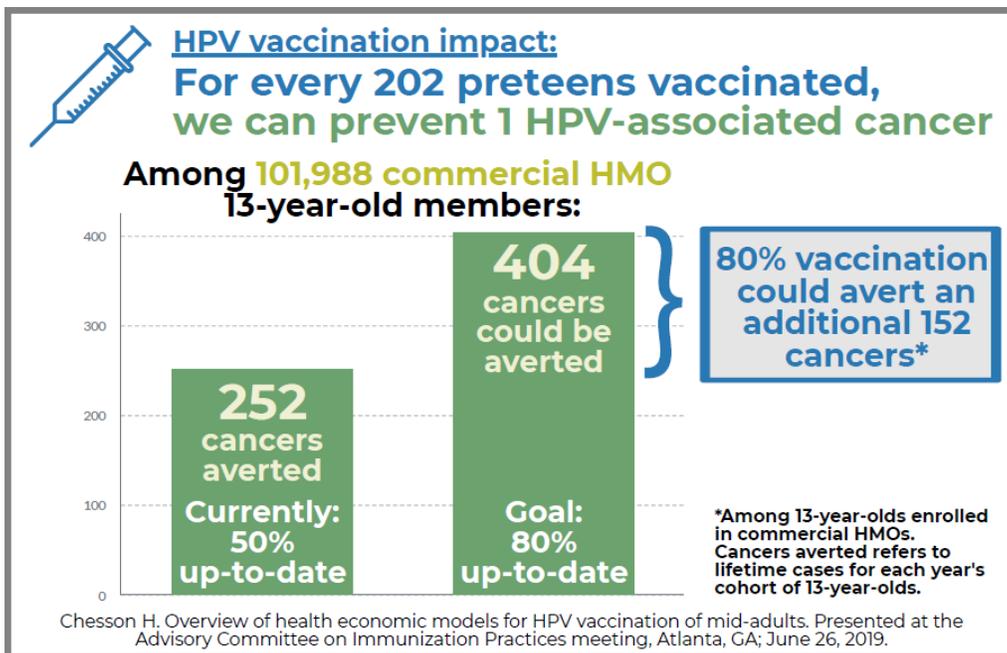


D. Number needed to vaccinate to avert cancer

Using the population of 13-year-olds enrolled in Medi-Cal managed care health plans and the percent of 13-year-olds reported by Medi-Cal with completed HPV vaccine series, 483 HPV-associated cancers will be averted. If Medi-Cal’s managed care health plans reach the goal of 80% vaccine series completion, a total of 858 future HPV-associated cancers could be averted.



Using the population of 13-year-olds in IHA’s commercial HMO dataset and the percent of 13-year-olds with completed HPV vaccine series, 252 HPV-associated cancers have been averted. If the commercial HMO plans reach the goal of 80% vaccine series completion, an additional 152 future HPV-associated cancers could be averted.



VI. DISCUSSION

A. Strengths and limitations of HPV-attributable cancer data

The California Cancer Registry (CCR) collects information about nearly all cancers diagnosed in California, and state law requires all cancers diagnosed in California to be reported. CCR has been collecting cancer data for over 30 years and meets all the National Program of Cancer Registries (NPCR) and SEER high data standards for quality, timeliness, and completeness. Additionally, CCR is Gold Certified by the North American Association of Central Cancer Registries (NAACCR).

CCR considers the following limitations and considerations when referencing data on HPV-attributable cancers:

- CCR does not collect data on cervical carcinoma in-situ.
- It can be difficult to differentiate between cervical and endometrial primaries, and thus there may be misclassification within cancer registries. The 91% of cervical cancers estimated to be attributable to HPV may be based partially on HPV-negative endometrial cancers.
- Case-level data on other risk factors for HPV-attributable cancers, such as smoking and high parity, are not available from CCR data.
- The migration of patients in and out of SEER registry geographic catchment areas is an important limitation, especially about the investigation of second malignancies. This limitation may lead to unrecorded cases, and therefore, a relative undercounting of second malignancies.

B. Strengths and limitations of HPV vaccination data

The HPV vaccination data that are currently available have both strengths and limitations. NIS-Teen is administered in all states and select local and territorial jurisdictions using the same standard methodology, and the vaccination data are verified by providers. However, coverage estimates are derived from a small statewide sample resulting in large confidence intervals and unstable estimates. At the state level, this makes it harder to detect year-to-year changes or to make comparisons by urbanicity or insurance status.

The data in this report on Medi-Cal and commercially insured patients have the advantages of representing a cohort of active patients currently enrolled in health plans, and thus have more reliable denominators. Together, these two data sources describe HPV vaccination status of 62% of all 13-year-olds in the state and use standard data collection methods and procedures that are externally audited. Furthermore, the physician organizations and health plans are currently held accountable for IMA-2 as one of the measures for healthcare quality improvement, creating a lever for vaccine coverage improvement. The disadvantages are that some of the Medi-Cal managed care health plan reporting units may cover several counties, so data are combined making county-based comparisons difficult. However, separate from producing HEDIS reports, Medi-Cal managed care health plans typically analyze their own patient databases in much more detail (to the county or provider practice levels) and may be interested in collaborating with partners to use this more granular data to focus quality improvement methods.

While managed care health plans report only on their members, CAIR is a population-based registry. One of the strengths of an IIS is the consolidation of all vaccination data into one place, but it can only compile records from providers who have entered their patients' immunization data into CAIR.

Participation in CAIR is not mandated for all health care providers so we know CAIR doesn't yet capture all immunizations given in the state. In addition to incomplete data, the accuracy of CAIR-based coverage estimates can be affected by individuals who have moved out of the state or are no longer participating in the IIS but are retained in the denominator. For example, CAIR creates new records for all newborns in California using birth certificate data. Some of these infants may either move out of California or seek care with providers not participating in CAIR, but if they remain as active patients in CAIR, their vaccination records will appear as incomplete. Furthermore, information on patients who move or change providers may not always be up to date in the IIS, resulting in duplicate reporting or inaccurate classification of jurisdiction. There is currently no data exchange between CAIR2 and the two smaller regional IISs (SDIR and HF) and no assessment has been done to determine the degree to which duplicate patient records may exist across registries. The two remaining regional IIS will begin full data sharing with CAIR2 later in 2020, and this should help resolve any potential cross-registry patient duplication. Combined, the three regional IIS reported 558,480 13-year-olds with at least two recorded doses in the IIS as of 2018, which exceeds the Department of Finance population estimate for the state (517,301). It is difficult to determine the extent to which the IIS denominator data accurately represent 13-year-olds residing in California, versus how many of the records are partial or duplicate records inflating the denominator. An inflated denominator can result in an underrepresentation of true vaccination coverage. In order to adjust for these factors, individuals with fewer than two total recorded vaccine doses in the IIS were excluded from this analysis. However, the denominator could still include patients who no longer live in California but are marked as active patients in the IIS. Adjusting the denominator to exclude individuals with fewer than two vaccine doses in CAIR may also inadvertently exclude unvaccinated children. Any vaccination coverage rates calculated using the IIS denominator could be an underrepresentation of true vaccination coverage.

CAIR provides an opportunity to assess vaccination coverage at the county level, however coverage estimates at geographic levels more granular than state level should be interpreted with caution. In addition to the possibility of fragmented or duplicate records in multiple jurisdictions, counties with smaller populations may see greater fluctuations in coverage because smaller changes can more significantly impact rate calculations. Differences between groups/regions and trends over time in vaccination coverage will be difficult to interpret until the IIS matures, more providers participate, duplicates/fragmented records are resolved, and data quality improves. In addition, the county data are based on where people live, and not necessarily where they receive health care. This report does not include a more detailed analysis of other sociodemographic factors that may affect differences in vaccine coverage.

C. Strengths and limitations of mapping data

Spatial visualization, like the statewide maps of HPV-attributable cancer incidence and HPV vaccination coverage, may help illuminate geographic patterns and trends and provide context for resource allocation, decision-making, and policy. An important limitation is that individuals in the cancer data may not have had the opportunity for HPV vaccination in that same geographic area, if they moved after they were teenagers. This limitation means HPV vaccination data of current 13-year-olds in a region may not reflect the immunization status of the current residents with HPV-associated cancers.

D. Conclusion

With a statewide and national focus on increasing HPV vaccine uptake, there is a need for public health practitioners, researchers, policymakers, and health systems to have access to HPV vaccination uptake estimates for adolescents in their communities. Such data may be used to measure and improve HPV vaccination rates.

While NIS-Teen estimates are based on standard methodology using provider-verified vaccination data, the sample sizes are small and county level data are not available. HEDIS data are obtained from administrative claims/encounter data, medical records, and IIS data, and are a reliable tool for comparing health plans; however, health plans often cover multiple jurisdictions, making it difficult to assess coverage by county. The population-based IIS in California, CAIR, contains individual-level, provider-reported immunizations that can be defined at the county level by age. While limitations remain, efforts underway to increase provider reporting and link registries demonstrate the potential for future improvement. Thus, the Data Workgroup encourages stakeholders to consider the benefits and limitations of all available data sources when reading this report and planning interventions.

Primary prevention in the form of HPV vaccination will be critical to lower incidence of HPV-attributable cancers, for which the majority have no available screening test. Mapping HPV-attributable cancer incidence and HPV vaccine uptake may assist the identification of regions needing additional engagement and support, like in the northern regions of the state where the HPV-attributable cancer rates are highest (12 per 100,000 population), and the communities have some of the lowest vaccination coverage. However, it is important to consider the impact of interventions in regions or counties with small adolescent populations versus those with large adolescent populations where greater numbers of HPV infections and cancers could be prevented by even incremental improvements in vaccination coverage.

Data quality and completeness will continue to improve as CAIR matures and provider participation increases. The use and promotion of CAIR, a critical community and public health resource, will ensure quality data is available to represent the state's adolescent population. There remains tremendous opportunity for all regions to improve HPV vaccination coverage. The data highlights opportunities for community engagement and healthcare systems improvement. The Data Workgroup supports the next steps and recommendations described in the following section.

VII. Next Steps/ Recommendations

The Roundtable asks that stakeholders consider taking the steps below to assess adolescent HPV immunization coverage in your jurisdiction, facility, or health plan, and to improve the quality of these data. Then, use the results as your baseline for future interventions aimed at protecting California adolescents now from HPV cancers in the future. By taking the steps below, HPV immunization coverage data can be used to help achieve 80% HPV vaccination coverage in California adolescents by 2026.

Steps for health plans (commercial and Medi-Cal):

1. Assess your health plan's current performance on the HEDIS adolescent immunization measure (IMA-2) and HPV single antigen coverage.

- a. Look at patient-level data to highlight missed opportunities during routine office visits, especially when other routinely recommended vaccines such as Tdap were administered at a visit but HPV vaccine was not.
 - b. Assess which providers or clinics have higher vaccination coverage and identify their best practices. Disseminate findings to all clinics, possibly as provider-to-provider coaching, by offering quality improvement support, provider workshops, or talking points shared with clinics.
 - c. Identify clinics in your network performing below the 50th percentile and rank them highest to lowest for number of unvaccinated adolescents. Identify sites that are amenable to support and quality improvement efforts and assist accordingly.
 - i. Provide support implementing evidence-based interventions to raise HPV immunization levels as outlined in step 11 below.
 - ii. Ensure that sites have workflows that support call backs from patients to make vaccination appointments.
 - iii. Help sites reconcile EHR and CAIR records. Encourage them to enter historical records for more accurate forecasting.
 - iv. Ensure that EHR is set up to provide alerts for HPV vaccination.
 - v. Provide coaching for providers on making a strong recommendation for HPV vaccination and how to address common questions.
 - d. Showcase positive results and best practices to demonstrate that change is possible.
2. Add on-time HPV vaccination or IMA-2 performance to Value Based Payment programs to incentivize provider performance.
 3. Use CAIR and claims data to routinely generate lists of your health plan's members who will turn 13 years of age but have not yet completed the HPV vaccine series. Outreach directly to these families and/or request the providers do so to invite them to the office to be immunized.
 4. Establish routine data exchanges between your health plan and CAIR. (See <http://cairweb.org/hedis/>.)
 5. Identify pediatric and family medicine providers in your network who are not yet uploading immunization data to CAIR, and work with them to begin to use CAIR. Note: DHCS [requires](#) Medi-Cal managed care health plans to ensure its providers use CAIR.

Steps for local immunization coalitions and health departments:

6. Reference the OPA website (<https://www.opa.ca.gov/>) to identify medical groups in your jurisdiction where immunizations for teens are lagging, and work with those medical groups to implement strategies to improve HPV vaccination. This builds on the observation that in 2017 and 2018, IMA-2 is a close approximation of HPV vaccine series completion [Table 3].
7. Ask the Medi-Cal managed care health plans in your jurisdiction to take steps 1-5 above and report back to you.
 - a. Ask your Medi-Cal managed care plans about adding IMA-2 to their Pay for Performance programs if they haven't already. See #2 above.
8. Use results to discuss how you can support Medi-Cal managed care health plans and adolescent care providers in your jurisdiction to raise adolescent immunization coverage.

Steps for medical groups, healthcare facilities, health systems and individual health care providers:

9. Assess the HPV vaccination rate for adolescent patients seen in your group or health system using your EHR system. [Request immunizations](#) recorded in CAIR that were provided to your patients, so you can assemble the most complete record possible.
10. Establish [bidirectional data exchange](#) with CAIR so your EHR is populated with immunizations given outside your practice, to better guide clinical decision making, avoid duplicate vaccination, and efficiently routinize clinic workflow.
11. Implement recommended and proven strategies to improve HPV vaccination in your group or health system. (Reference ACS' [Clinician and Health Systems Action Guides](#).)
 - a. Ensure senior leadership understand the performance gap and business rationale supporting HPV vaccination. (See "[Why Prioritize HPV Vaccination?](#)")
 - b. Commit to an organizational goal to vaccinate achieve 80% HPV vaccination of your patients by age 13 years and create an action plan.
 - c. Create a pro-immunization environment in your practice and ensure every staff member understands and can communicate the importance of HPV vaccination as cancer prevention.
 - d. Empower an HPV Vaccination Champion to galvanize support across system/site roles and lead outreach to leadership.
 - e. Reduce missed opportunities by vaccinating at every visit.
 - f. Consistently analyze and report vaccination rates by provider, location, and/or system.
 - g. Implement evidence-based interventions in all clinic locations. These include presumptive recommendations, standing orders, provider prompts, vaccine-only appointments, patient reminder/recall systems, provider and staff education.
12. Contact the quality improvement department at the health plans you work with to take steps 1-5 above.

Steps for state and federal agencies:

California Department of Public Health (CDPH)

13. Recruit remaining 34% of pediatric Medi-Cal providers in the Vaccines for Children program who are not yet using CAIR.
14. Implement and enforce a mandate for Vaccines for Children (VFC) providers to enter all immunizations administered into CAIR.
15. While implementing Immunization Quality Improvement for Providers (IQIP) in the VFC program, target provider practices with low HPV vaccination levels with additional quality improvement activities focusing on HPV vaccination.
16. As part of IQIP, assess baseline performance of each provider using CAIR data (including 13-year-old HPV vaccination coverage) and assist practices in optimizing their use of CAIR.
17. Work with DHCS to routinely import Medi-Cal data into CAIR, including fields such as patient demographics, Medi-Cal identification number, vaccine administration, and eligibility.
18. Include National Provider Identifier (NPI) numbers as a field in CAIR to assist health systems and health plans target quality improvement efforts. Create reports in CAIR that provide coverage levels by provider or clinical setting.
19. Allow health plans to submit immunization data from claims and other sources.

Department of Health Care Services (DHCS)

20. Each year continue to provide HPV vaccine specific results of IMA-2 to the Roundtable and other stakeholders, to allow separate tracking of HPV vaccination.
21. Consider adding IMA-2 to the Medi-Cal managed care [Value Based Payment](#) program.
22. Use existing venues (performance improvement plans, Quality Conference, meetings of the health plan health educators or medical directors) to better understand how the highest performing health plans (and specific reporting units) achieved their successes. Once best practices are identified, share them so lower performing health plans (and reporting units) can replicate them.
23. Promote and optimize CAIR use.
 - a. Help health plans assist their providers in signing up to use CAIR. Enforce contract requirement that immunizations be entered into CAIR.^{xv}
 - b. Include [CAIR disclosure notice](#) in Medi-Cal enrollment materials and routine notifications to members, so that DHCS can share data routinely for importation into CAIR.

Centers for Disease Control and Prevention (CDC)

24. Make a business case for raising HPV vaccination. Given providers need only vaccinate about 200 preteens to avert one case of cancer, estimate the cost effectiveness of expanding HPV vaccination coverage to help motivate a particular payer or health system.
25. Adjust the NIS methods to collect and display state-level data for on-time immunization, i.e. HPV vaccine series completion at the time of the child's 13th birthday.

Steps for all stakeholders:

Reference CAIR, HEDIS, and CCR data to identify priority regions with low immunization coverage and high cancer rates and/or areas with high adolescent populations to drive corrective action by stakeholders.

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VIII. Appendices

Appendix A. Total number of HPV-attributable cancers, 5-year population, crude rate, and age-adjusted rate by county or county groupings, California, 2012-2016
(Source: CCR)

County	Total number of HPV-attributable cancers, 2012-2016	Total 5-year population, 2012-2016	Crude rate of HPV-attributable cancers (per 100,000)	Age-adjusted rate of HPV-attributable cancers (per 100,000)
Alpine, Amador, and Calaveras	63	414,920	15.1	9.8
Colusa, Glenn, Tehama	79	561,966	14.1	11.9
Del Norte, Humboldt	110	813,234	13.5	11.2
Inyo, Mono	20	161,690	12.1	9.2
Lassen, Modoc, Plumas	40	299,662	13.2	10.2
Mariposa, Tuolumne	52	358,099	14.6	9.8
Sierra, Yuba	36	384,054	9.4	8.9
Siskiyou, Trinity	46	283,834	16.3	10.0
Alameda	651	8,041,533	8.1	7.5
Butte	144	1,117,709	12.9	10.9
Contra Costa	502	5,550,046	9.0	7.8
El Dorado	121	916,768	13.2	9.6
Fresno	357	4,815,675	7.4	8.0
Imperial	65	894,195	7.2	7.7
Kern	375	4,355,839	8.6	9.4
Kings	63	752,081	8.4	9.7
Lake	52	320,233	16.3	11.5
Los Angeles	4,263	50,321,257	8.5	8.2
Madera	63	767,211	8.3	8.6
Marin	191	1,299,494	14.7	10.4
Mendocino	58	436,842	13.3	9.8
Merced	97	1,325,684	7.3	8.2
Monterey	185	2,154,029	8.6	8.5
Napa	93	702,928	13.2	10.3
Nevada	69	492,547	13.9	7.8
Orange	1,374	15,674,064	8.8	8.1
Placer	226	1,849,329	12.2	9.7
Riverside	1,173	11,616,550	10.1	9.8
Sacramento	794	7,392,971	10.8	10.2
San Benito	30	289,744	10.3	9.6
San Bernardino	926	10,525,296	8.8	9.3
San Diego	1,569	16,260,439	9.7	9.2
San Francisco	445	4,267,357	10.4	9.0
San Joaquin	325	3,576,297	9.1	9.2
San Luis Obispo	158	1,391,569	11.3	9.0
San Mateo	318	3,786,485	8.4	7.1
Santa Barbara	198	2,197,658	9.0	8.5
Santa Clara	623	9,459,844	6.6	6.2
Santa Cruz	146	1,357,213	10.8	9.5
Shasta	129	892,591	14.4	11.5
Solano	205	2,149,713	9.5	8.5
Sonoma	313	2,491,239	12.6	9.9
Stanislaus	231	2,651,871	8.7	8.7
Sutter	48	475,609	10.2	9.4
Tulare	210	2,280,330	9.2	10.4
Ventura	407	4,220,088	9.7	8.9
Yolo	80	1,048,800	7.6	8.3
All California	17,721	193,396,587	9.2	8.6

Appendix B. HPV vaccine series initiation and completion for 13-year-olds by county or county groupings, California, 2018 (Source: CAIR)

County name	# of 13-year-olds with 2 or more doses in CAIR	# initiating HPV vaccine series	HPV vaccine series initiation rate (%)	# completing HPV vaccine series	HPV vaccine series completion rate (%)
Alpine, Amador, Calaveras	1,104	380	34.4%	191	17.3%
Colusa, Glenn, Tehama	1,724	700	40.6%	270	15.7%
Del Norte, Humboldt	2,079	943	45.4%	410	19.7%
Inyo, Mono	470	169	36.0%	73	15.5%
Lassen, Modoc, Plumas	592	163	27.5%	56	9.5%
Mariposa, Tuolumne	697	174	25.0%	71	10.2%
Sierra, Yuba	1,486	675	45.4%	347	23.4%
Siskiyou, Trinity	656	212	32.3%	86	13.1%
Alameda	23,803	14,221	59.7%	8,663	36.4%
Butte	1,531	519	33.9%	253	16.5%
Contra Costa	17,126	9,797	57.2%	5,362	31.3%
El Dorado	2,419	893	36.9%	475	19.6%
Fresno	15,888	9,390	59.1%	5,130	32.3%
Imperial	4,168	1,606	38.5%	649	15.6%
Kern	17,209	8,568	49.8%	3,873	22.5%
Kings	2,541	1,387	54.6%	613	24.1%
Lake	789	357	45.3%	106	13.4%
Los Angeles	121,256	62,503	51.6%	36,430	30.0%
Madera	2,737	1,443	52.7%	800	29.2%
Marin	3,385	1,960	57.9%	1,111	32.8%
Mendocino	1,062	526	49.5%	225	21.2%
Merced	4,644	2,105	45.3%	1,052	22.7%
Monterey	7,440	4,479	60.2%	2,781	37.4%
Napa	1,969	1,287	65.4%	769	39.1%
Nevada	1,067	330	30.9%	162	15.2%
Orange	42,494	20,411	48.0%	12,657	29.8%
Placer	5,096	2,495	49.0%	1,407	27.6%
Plumas	151	39	25.8%	12	8.0%
Riverside	37,099	14,293	38.5%	7,732	20.8%
Sacramento	21,031	11,438	54.4%	6,907	32.8%
San Benito	968	457	47.2%	210	21.7%
San Bernardino	34,582	14,311	41.4%	7,399	21.4%
San Diego	64,519	26,318	40.8%	14,011	21.7%
San Francisco	6,329	3,909	61.8%	2417	38.2%
San Joaquin	13,481	7,218	53.5%	4,088	30.3%
San Luis Obispo	3,447	1,655	48.0%	919	26.7%
San Mateo	9,015	5,890	65.3%	3,786	42.0%
Santa Barbara	5,755	2,943	51.1%	1,526	26.5%
Santa Clara	23,739	14,509	61.1%	8,471	35.7%
Santa Cruz	3,680	2,155	58.6%	1,362	37.0%
Shasta	2,262	699	30.9%	267	11.8%
Solano	5,580	3,501	62.7%	1,904	34.1%
Sonoma	6,331	3,904	61.7%	2,424	38.3%
Stanislaus	10,568	4,464	42.2%	2,286	21.6%
Sutter	1,744	863	49.5%	453	26.0%
Tulare	9,055	5,251	58.0%	2,562	28.3%
Ventura	11,245	5,430	48.3%	2,858	25.4%
Yolo	2,618	1,210	46.2%	732	28.0%
All California	558,480	278,111	49.8%	156,336	28.0%

Appendix C. HPV vaccine series initiation and completion for 13-year-olds by gender, California, 2018 (Source: CAIR)

Gender	# of 13-year-olds with 2 or more doses in CAIR	# initiating HPV vaccine series	HPV vaccine series initiation rate (%)	# completing HPV vaccine series	HPV vaccine series completion rate (%)
Female	270,899	137,435	50.7%	79,043	29.2%
Male	282,404	140,265	49.7%	77,130	27.3%
Other	246	33	13.4%	12	4.9%
Unknown	4,931	378	7.7%	151	3.1%
All California	558,480	278,111	49.8%	156,336	28.0%

Appendix D. HPV vaccine series initiation and completion for 13-year-olds by county or county groupings and gender, California, 2018 (Source: CAIR)

County/gender	# of 13-year-olds with 2 or more doses in CAIR	# initiating HPV vaccine series	HPV vaccine series initiation rate (%)	# completing HPV vaccine series	HPV vaccine series completion rate (%)
Alpine, Amador, Calaveras	1,104	380	34.4%	191	17.3%
F	559	186	33.3%	96	17.2%
M	501	186	37.1%	95	19.0%
Colusa, Glenn, Tehama	1,724	700	40.6%	270	15.7%
F	857	355	41.4%	140	16.3%
M	866	345	39.8%	130	15.0%
Del Norte, Humboldt	2,079	942	45.3%	410	19.7%
F	1,065	490	46.0%	215	20.2%
M	1,013	452	44.6%	194	19.2%
Inyo, Mono	470	169	36.0%	73	15.5%
F	217	82	37.8%	39	18.0%
M	249	87	34.9%	34	13.7%
Lassen, Modoc, Plumas	592	163	27.5%	56	9.5%
F	295	90	30.5%	37	12.5%
M	297	73	24.6%	19	6.4%
Mariposa, Tuolumne	697	174	25.0%	71	10.2%
F	333	91	27.3%	43	12.9%
M	360	83	23.1%	28	7.8%
Sierra, Yuba	1,486	675	45.4%	347	23.4%
F	709	314	44.3%	166	23.4%
M	776	361	46.5%	181	23.3%
Siskiyou, Trinity	656	212	32.3%	86	13.1%
F	323	114	35.3%	45	13.9%
M	333	98	29.4%	41	12.3%
Alameda	23,803	14,221	59.7%	8,663	36.4%
F	11,527	6,987	60.6%	4,354	37.8%
M	12,265	7,234	59.0%	4,309	35.1%
Butte	1,531	519	33.9%	253	16.5%
F	769	274	35.6%	142	18.5%
M	762	245	32.2%	111	14.6%
Contra Costa	17,126	9,796	57.2%	5,362	31.3%
F	8,473	4,865	57.4%	2,729	32.2%
M	8,638	4,931	57.1%	2,632	30.5%
El Dorado	2,419	893	36.9%	475	19.6%
F	1,192	433	36.3%	226	19.0%
M	1,218	460	37.8%	249	20.4%
Fresno	15,888	9,389	59.1%	5,130	32.3%
F	7,730	4,639	60.0%	2,609	33.8%
M	8,157	4,750	58.2%	2,521	30.9%
Imperial	4,168	1,606	38.5%	649	15.6%
F	2,082	837	40.2%	374	18.0%
M	2,086	769	36.9%	275	13.2%

County/gender	# of 13-year-olds with 2 or more doses in CAIR	# initiating HPV vaccine series	HPV vaccine series initiation rate (%)	# completing HPV vaccine series	HPV vaccine series completion rate (%)
Kern	17,209	8,568	49.8%	3,873	22.5%
F	8,459	4,251	50.3%	1,946	23.0%
M	8,748	4,317	49.4%	1,927	22.0%
Kings	2,541	1,387	54.6%	613	24.1%
F	1,276	725	56.8%	342	26.8%
M	1,265	662	52.3%	271	21.4%
Lake	789	357	45.3%	106	13.4%
F	369	154	41.7%	56	15.2%
M	418	203	48.6%	50	12.0%
Los Angeles	121,256	62,503	51.6%	36,430	30.0%
F	59,371	30,947	52.1%	18,477	31.1%
M	61,845	31,545	51.0%	17,948	29.0%
Madera	2,737	1,442	52.7%	800	29.2%
F	1,358	714	52.6%	398	29.3%
M	1,378	728	52.8%	401	29.1%
Marin	3,385	1,960	57.9%	1,111	32.8%
F	1,614	960	59.5%	581	36.0%
M	1,766	1,000	56.6%	530	30.0%
Mendocino	1,062	526	49.5%	225	21.2%
F	530	276	52.1%	120	22.6%
M	532	250	47.0%	105	19.7%
Merced	4,644	2,105	45.3%	1,052	22.7%
F	2,282	1,073	47.0%	549	24.1%
M	2,331	1,029	44.1%	501	21.5%
Monterey	7,440	4,479	60.2%	2,781	37.4%
F	3,675	2,229	60.7%	1,413	38.5%
M	3,763	2,250	59.8%	1,368	36.4%
Napa	1,969	1,287	65.4%	769	39.1%
F	942	623	66.1%	381	40.5%
M	1,027	664	64.7%	388	37.8%
Nevada	1,067	330	30.9%	162	15.2%
F	536	160	29.9%	73	13.6%
M	526	170	32.3%	89	16.9%
Orange	42,494	20,408	48.0%	12,657	29.8%
F	20,606	9,992	48.5%	6,246	30.3%
M	21,883	10,416	47.6%	6,410	29.3%
Placer	5,096	2,494	48.9%	1,407	27.6%
F	2,503	1,260	50.3%	712	28.5%
M	2,591	1,234	47.6%	695	26.8%
Riverside	37,099	14,292	38.5%	7,732	20.8%
F	18,246	7,058	38.7%	3,902	21.4%
M	18,850	7,234	38.4%	3,830	20.3%
Sacramento	21,031	11,435	54.4%	6,907	32.8%
F	10,224	5,516	54.0%	3,352	32.8%
M	10,790	5,919	54.9%	3,554	32.9%
San Benito	968	457	47.2%	210	21.7%
F	492	238	48.4%	117	23.8%
M	476	219	46.0%	93	19.5%
San Bernardino	34,573	14,309	41.4%	7,398	21.4%
F	16,937	7,093	41.9%	3,782	22.3%
M	17,636	7,216	40.9%	3,616	20.5%
San Diego	64,519	26,318	40.8%	14,011	21.7%
F	29,335	12,835	43.8%	7,061	24.1%
M	30,425	13,135	43.2%	6,814	22.4%
U**	4,759	348	7.3%	136	2.9%
San Francisco	6,329	3,909	61.8%	2,417	38.2%
F	3,123	1,956	62.6%	1,249	40.0%
M	3,206	1,953	60.9%	1,168	36.4%

County/gender	# of 13-year-olds with 2 or more doses in CAIR	# initiating HPV vaccine series	HPV vaccine series initiation rate (%)	# completing HPV vaccine series	HPV vaccine series completion rate (%)
San Joaquin	13,481	7,218	53.5%	4,088	30.3%
F	6,589	3,558	54.0%	2,049	31.1%
M	6,857	3,653	53.3%	2,037	29.7%
San Luis Obispo	3,447	1,655	48.0%	919	26.7%
F	1,740	883	50.8%	490	28.2%
M	1,707	772	45.2%	429	25.1%
San Mateo	9,015	5,888	65.3%	3,786	42.0%
F	4,450	2,961	66.5%	1,927	43.3%
M	4,561	2,927	64.2%	1,857	40.7%
Santa Barbara	5,755	2,943	51.1%	1,526	26.5%
F	2,820	1,444	51.2%	763	27.1%
M	2,934	1,499	51.1%	763	26.0%
Santa Clara	23,739	14,509	61.1%	8,471	35.7%
F	11,635	7,197	61.9%	4,286	36.8%
M	12,085	7,309	60.5%	4,183	34.6%
Santa Cruz	3,680	2,155	58.6%	1,362	37.0%
F	1,841	1,099	59.7%	695	37.8%
M	1,839	1,056	57.4%	667	36.3%
Shasta	2,262	699	30.9%	267	11.8%
F	1,089	342	31.4%	123	11.3%
M	1,173	357	30.4%	144	12.3%
Solano	5,580	3,500	62.7%	1,904	34.1%
F	2,671	1,718	64.3%	983	36.8%
M	2,906	1,782	61.3%	921	31.7%
Sonoma	6,331	3,904	61.7%	2,424	38.3%
F	3,071	1,907	62.1%	1,205	39.2%
M	3,260	1,997	61.3%	1,219	37.4%
Stanislaus	10,568	4,464	42.2%	2,286	21.6%
F	5,070	2,202	43.4%	1,173	23.1%
M	5,368	2,248	41.9%	1,105	20.6%
Sutter	1,744	863	49.5%	453	26.0%
F	832	421	50.6%	238	28.6%
M	911	442	48.5%	215	23.6%
Tulare	9,055	5,251	58.0%	2,562	28.3%
F	4,340	2,570	59.2%	1,288	29.7%
M	4,714	2,681	56.9%	1,274	27.0%
Ventura	11,245	5,430	48.3%	2,858	25.4%
F	5,457	2,710	49.7%	1,455	26.7%
M	5,779	2,720	47.1%	1,403	24.3%
Yolo	2,618	1,210	46.2%	732	28.0%
F	1,285	606	47.2%	396	30.8%
M	1,333	604	45.3%	336	25.2%

*To address potential confidentiality concerns with small numbers, some data are suppressed.

**U = unidentified



Appendix E. Urbanicity classifications*

County	Urbanicity classification
Alameda	urban
Alpine	rural
Amador	rural
Butte	urban
Calaveras	rural
Colusa	rural
Contra Costa	urban
Del Norte	rural
El Dorado	urban
Fresno	urban
Glenn	rural
Humboldt	rural
Imperial	urban
Inyo	rural
Kern	urban
Kings	urban
Lake	rural
Lassen	rural
Los Angeles	urban
Madera	urban
Marin	urban
Mariposa	rural
Mendocino	rural
Merced	urban
Modoc	rural
Mono	rural
Monterey	urban
Napa	urban
Nevada	rural
Orange	urban
Placer	urban
Plumas	rural
Riverside	urban
Sacramento	urban
San Benito	urban
San Bernardino	urban
San Diego	urban
San Francisco	urban
San Joaquin	urban
San Luis Obispo	urban
San Mateo	urban
Santa Barbara	urban
Santa Clara	urban
Santa Cruz	urban
Shasta	urban
Sierra	rural
Solano	rural
Sonoma	urban
Stanislaus	urban
Sutter	urban
Tehama	urban
Trinity	rural
Tulare	rural
Tuolumne	urban
Ventura	rural
Yolo	urban
Yuba	urban

*By CDC's "[National Center for Health Statistics \(NCHS\) 2013 Urban-Rural Classification Scheme for Counties](#)"

Appendix F. Resources

- American Academy of Pediatrics: <https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/immunizations/Pages/HPV-Resources.aspx>
- American Cancer Society: <https://www.cancer.org/health-care-professionals/hpv-vaccination-information-for-health-professionals/hpv-vaccination-resources-for-health-professionals.html>
- American College of Obstetricians and Gynecologists: <https://www.acog.org/Womens-Health/Human-Papillomavirus-HPV?IsMobileSet=false>
- Centers for Disease Control and Prevention: <https://www.cdc.gov/hpv/hcp/educational-materials.html>
- Immunization Action Coalition: <https://www.immunize.org/handouts/hpv-vaccines.asp>
- National Foundation for Infectious Diseases: <https://www.nfid.org/infectious-diseases/hpv-resource-center/>
- National HPV Roundtable: <https://hpvroundtable.org/resource-library/>

Appendix G. Acronyms

ACIP – Advisory Committee on Immunization Practices
AMP – Align.Measure.Perform. program
CAIR – California Immunization Registry
CCR – California Cancer Registry
CDC – Centers for Disease Control and Prevention
CDPH – California Department of Public Health
DHCS – Department of Healthcare Services
EHR – electronic health record
HEDIS - Healthcare Effectiveness Data and Information Set
HF – Healthy Futures immunization registry
HMO – Health Maintenance Organization
IHA – Integrated Healthcare Association
IIS – immunization information system
IMA – Immunizations for Adolescents
IQIP – Immunization Quality Improvement for Providers
HPV – human papillomavirus
MCV – meningococcal conjugate vaccine
NCHS – National Center for Health Statistics
NCIRD - National Center for Immunization and Respiratory Diseases
NCQA - National Committee for Quality Assurance
NIS – National Immunization Survey
OPA – Office of the Patient Advocate
PPO – Preferred Provider Organization
SDIR – San Diego Immunization Registry
Tdap – tetanus, diphtheria, and acellular pertussis vaccine
UDS – Uniform Data Systems
VFC – Vaccines for Children program

Appendix F. References

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- ⁱⁱ How many Cancers are Linked with HPV each Year? <https://www.cdc.gov/cancer/hpv/statistics/cases.htm>
- ⁱⁱⁱ Meites E, Szilagyi PG, Chesson HW, et al. Human Papillomavirus Vaccination for Adults: Updated Recommendations of the Advisory Committee on Immunization Practices. MMWR Morb Mortal Wkly Rep 2019;68:698–702.
- ^{iv} Petroksy E, Bocchini JA Jr, Hariri S, Chesson H, Curtis, CR, Saraiya M, Unger ER, Markowitz LE. Use of 9-valent human papillomavirus (HPV) vaccine: updated HPV vaccination recommendations of the advisory committee on immunization practices. MMWR Morb Mortal Wkly Rep 2015;64(11):300-4.
- ^v Meites E, Kempe A, Markowitz LE. Use of a 2-Dose Schedule for Human Papillomavirus Vaccination — Updated Recommendations of the Advisory Committee on Immunization Practices. MMWR Morb Mortal Wkly Rep 2016;65:1405–1408. DOI: <http://dx.doi.org/10.15585/mmwr.mm6549a5>
- ^{vi} TeenVaxView as published by the Centers for Disease Control and Prevention. <https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/hpv/trend/index.html>
- ^{vii} Chesson H. Overview of Health Economic Models for HPV Vaccinations of Mid-Adults. Advisory Committee on Immunization Practices. June 26, 2019. <https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2019-06/HPV-4-Chesson-508.pdf>
- ^{viii} Baughan EB, Keizur EM and Damico CA, et al. Excess Cancer Cases and Medical Costs Due to Suboptimal Human Papillomavirus Vaccination Coverage in California. Sexually Transmitted Diseases 2019 (46) 8:527-31.
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- ^x Watson M, Saraiya M, Ahmed, F, et al. Using population-based cancer registry data to assess the burden of human papillomavirus-associated cancers in the United States: Overview of methods. Cancer 2008(113): 2841-2854.
- ^x Saraiya M, Unger ER, Thompson TD, et al. US assessment of HPV types in cancers: implications for current and 9-valent HPV vaccines. J Natl Cancer Inst. 2015;107(6):djv086.
- ^{xii} SEER is supported by the Surveillance Research Program (SRP) in NCI's Division of Cancer Control and Population Sciences (DCCPS). SRP provides national leadership in the science of cancer surveillance as well as analytical tools and methodological expertise in collecting, analyzing, interpreting, and disseminating reliable population-based statistics.
- ^{xiii} Title 16 CCR, Section 1746.4 (e) can be found at: [https://govt.westlaw.com/calregs/Document/IOEF38BB6B4F34546910A96146A8FB786?viewType=FullText&origin=attributionContext=documenttoc&transitionType=CategoryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Document/IOEF38BB6B4F34546910A96146A8FB786?viewType=FullText&origin=attributionContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default))
- ^{xiv} ALL MEDI-CAL MANAGED CARE HEALTH PLANS: IMMUNIZATION REQUIREMENTS (APL 18-004). January 31, 2018. <https://www.dhcs.ca.gov/formsandpubs/Documents/MMCDAPLsandPolicyLetters/APL2018/APL18-004.pdf>
- ^{xv} <https://www.cdc.gov/IISDashboard/Query.aspx>
- ^{xvi} Senkomago V, Henley SJ, Thomas CC et al. Human Papillomavirus–Attributable Cancers — United States, 2012–2016. MMWR Morb Mortal Wkly Rep 2019;68(No.3): 724-8.
- ^{xvii} State of California, Department of Finance, *State and County Population Projections by Race/Ethnicity, Sex, and Age 2010-2060*, Sacramento, California, December 2014.
- ^{xviii} Fisher-Borne M, Preiss AJ, Black M, Roberts K, and Saslow D. Early Outcomes of a Multilevel Human Papillomavirus Vaccination Pilot Intervention in Federally Qualified Health Centers. American Pediatrics 2018 (18)2:S79-S84.