BURDEN OF CANCER AMONG CHILDREN AND ADOLESCENTS IN CALIFORNIA

UC DAVIS HEALTH | COMPREHENSIVE CANCER CENTER

CALIFORNIA CANCER REGISTRY

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EXECUTIVE SUMMARY

Pediatric cancer continues to pose a significant health burden for children across California. Analyzing current cancer incidence and survival trends in California supports efforts to address disparities and improve outcomes.

Age-Adjusted Incidence Rates

Age-adjusted incidence rates were calculated for two key age groups: children aged 0–14 years and adolescents aged 15–19 years, providing insight into cancer trends across these populations:

- The incidence rate of all cancers combined has decreased among children, but did not significantly change for adolescents.
- Acute lymphocytic leukemia (ALL) was the most common cancer among children, followed by astrocytoma, neuroblastoma, acute myeloid leukemia, and non-Hodgkin lymphoma (NHL).
- In children, reductions in incidence rates were observed for astrocytoma and acute myeloid leukemia (AML).
- Children had higher incidence rates of malignant brain cancer than adolescents while adolescents had higher incidence rates of benign brain cancer.
- Among children, incidence rates for malignant brain cancer overall have decreased since 2017; benign brain cancer incidence rates increased until 2015 and have not significantly changed since then.
- Hodgkin lymphoma was the most common among adolescents, followed by thyroid carcinoma, germ cell tumors, ALL, and NHL.
- Among adolescents, there were no significant changes in incidence rates for the five most common cancers over the study period.
- Among adolescents, incidence rates for malignant brain cancer overall did not significantly change over the study period; incidence rates for benign brain cancers increased until 2012 and have not significantly changed since then.

- ALL was the most common cancer for males and females 0 to 19 years; astrocytomas and germ cell tumors were the next most common for males, while thyroid carcinoma and Hodgkin lymphoma were the next most common for females.
- Among males 0 to 19 years, there were no significant changes in incidence rates for the five most common cancers over the study period; among females, incidence rates for astrocytoma decreased since 2015.
- Incidence rates for all cancers combined were highest for non-Hispanic White followed by Hispanic, Asian/Pacific Islander, and non-Hispanic Black children and adolescents.
- Among all four racial/ethnic groups, the most common cancer was ALL. Hispanic children and adolescents had the highest incidence rates of ALL.
- Trends for the five most common cancers by race/ethnicity did not significantly change for most cancer types, except astrocytoma among non-Hispanic White children and adolescents (incidence rates decreased during 2013-2021) and thyroid carcinoma among Hispanic children and adolescents (incidence increased during 2007-2021).

Five-Year Relative Survival

Five-year relative survival rates were calculated by sex and age group, race/ethnicity, and time period to assess long-term outcomes.

- Children and adolescents with thyroid carcinoma, germ cell tumors, and Hodgkin lymphoma had the highest survival.
- Children with embryonal tumors and AML had the lowest survival, while for adolescents, those with hepatic tumors and rhabdomyosarcoma had the lowest survival.
- In children, males had higher survival rates than females for rhabdomyosarcoma.
- In adolescents, females had higher survival rates than males for neuroblastoma, hepatic tumors, and rhabdomyosarcoma; males had better survival than females for Ewing sarcoma.

- Adolescent females had the highest five-year relative survival, overall.
- Five-year relative survival was lowest among Black children and adolescents, overall.
- Five-year relative survival improved for most cancer types, especially Ewing sarcoma, hepatic tumors, neuroblastoma, embryonal tumors, ependymomas, NHL, and AML.
- No improvements in five-year relative survival were observed for children and adolescents with astrocytoma. Likewise, no increases in five-year relative survival were observed for children and adolescents with melanoma or retinoblastoma, but survival for these cancer types was high.

Findings from this report continue to highlight differences in the burden of cancer among children and adolescents across age group, sex, and race/ethnicity.

INTRODUCTION

In 2025, an estimated 14,690 children and adolescents in the United States (US) will be diagnosed with cancer and 1,650 will die from it.[1] Cancer in children (0 to14 years) and adolescents (15 to 19 years) is the second and fourth most common cause of death, respectively, in these age groups.[1] Overall incidence rate trends for childhood and adolescent cancer have decreased in recent years in the US.[2] Survival has improved since the 1970s and now more than 85% survive at least 5 years.[3,4] Understanding current incidence and survival trends in California can help monitor progress in the burden of cancer among children and adolescents as well as identify sociodemographic disparities. This information can be used to target groups that may need better access to care and clinical trials, guidance with health literacy, or help with healthcare navigation.

This report describes cancer incidence and survival from 2007 to 2021 among children and adolescents in California, highlighting differences by age group, sex, and race/ethnicity. We hope the information provided in this report can be used by members of the public to understand cancer trends and the current burden of cancer among children and adolescents in California. Additionally, that it will be used by researchers, health care

providers, public health professionals, and policy makers to address the research needs of this group and develop strategies to address the highlighted inequities.

Data in this report came from the California Cancer Registry (CCR). CCR was established to monitor the burden of cancer in California. It is a comprehensive, statewide, cancer surveillance system enacted into law in 1985 (Health & Safety Code Sections 103875-103885) and is a program of the California Department of Public Health (CDPH), Chronic Disease Surveillance and Research Branch (CDSRB). CCR's mission is to serve the public by collecting timely, standardized, statewide data across the cancer continuum that can be used to describe cancer trends in the state, identify disparities, and inform policy decisions. High quality data is the essential and indispensable first step in understanding the cancer burden in California and where to focus efforts to reduce it. CCR is recognized for its high-quality data and routinely meets the standards of the Centers for Disease Control and Prevention's National Program of Cancer Registries (NPCR) and the North American Association of Central Cancer Registries (NAACCR). Since 2012, CCR has partnered with the California Cancer Reporting and Epidemiologic Surveillance (CalCARES) Program at UC Davis Comprehensive Cancer Center/UC Davis Health to manage the day-to-day operations of CCR.

METHODS AND TECHNICAL NOTES

COHORT

The cohort evaluated for this report consists of children (ages 0 to 14 years) and adolescents (ages 15 to 19 years) diagnosed with cancer 2007 to 2021 identified in the California Cancer Registry. Only cases diagnosed among California residents were included in this report. Individuals who were treated for cancer in California, but were residents of another state or country, were excluded from the report.

CANCER TYPE

This report includes 17 cancer sites based on the International Classification of Childhood Cancer (ICCC, based on ICD-0-3/WHO 2008) (https://seer.cancer.gov/iccc/). This classification is based on the form and structure of the tumor (commonly referred to as tumor morphology) and primary site, with an emphasis on morphology. Invasive cancers from the following sites were included (abbreviation used throughout this report in parentheses):

1. Lymphoid leukemia (mostly composed of acute lymphocytic leukemia (ALL))
2. Acute myeloid leukemia (AML)
3. Hodgkin lymphoma
4. Non-Hodgkin lymphoma, excluding Burkitt lymphoma (NHL)
5. Ependymoma and choroid plexus tumor (ependymoma)
6. Astrocytoma
7. Intracranial and intraspinal embryonal tumors (embryonal tumor)
8. Neuroblastoma and ganglioneuroblastoma (neuroblastoma)
9. Retinoblastoma
10. Nephroblastoma
11. Hepatic tumors
12. Osteosarcoma
13. Ewing tumor and related sarcomas of bone (Ewing sarcoma)
14. Rhabdomyosarcoma
15. Gonadal germ cell tumors (germ cell tumor)
16. Thyroid carcinoma
17. Melanoma

This report also includes an overall assessment of brain cancer, with both malignant and benign cases selected from the CNS (central nervous system) and miscellaneous intracranial and intraspinal neoplasms category. This overall assessment contains all subcategories including ependymomas, astrocytomas, and embryonal tumors, which are also reported separately in other sections of this report. Except for the overall assessment of brain cancers, the individual cancer types presented in this report do not overlap.

INCIDENCE

A “case” is defined as a new primary cancer (incidence). Tumors that result from the spread, or metastasis, of a primary cancer to another organ are not considered new cases.

Regional registries covering the entire state report cancer incidence data to CCR, Chronic Disease Surveillance and Research Branch of CDPH. Standards for data abstracting, collection, and reporting are specified by CCR.

AGE-ADJUSTED INCIDENCE RATES

Rates were calculated as the number of new cases (incidence) in specific age groups per 1,000,000 persons each year and were age-adjusted to the 2000 United States standard population. Age-adjusted incidence rates (AAIR) are weighted averages of age-specific rates, where the weights represent the age distribution of a standard population. Such adjustment eliminates differences in rates due to changes in the age of a population over time or differences in the age distribution between population groups. Rates in this report were calculated using SEER*Stat software. Due to the small number of cases per year, incidence rates were calculated over the most recent five-year period when reporting overall rates. Incidence rates are not shown for any sites with fewer than 20 cases during the five-year period. This method provides more statistically stable results and the best current picture of the disease. Incidence trends over time were reported for the entire 15-year time period from 2007 to 2021. Age-adjusted incidence rates are shown by age group, sex, and race/ethnicity. Rates by sex and race/ethnicity were not stratified by age.

JOINPOINT ANALYSIS OF TRENDS – ANNUAL PERCENT CHANGE

Joinpoint linear regression was used to determine trends in cancer incidence over the 15-year period of 2007 to 2021. In this analysis, a statistical algorithm detects joinpoints, or points in time where the slope of the regression line significantly changes. Thus, the model describes trends during different time segments, with the annual percent change (APC) estimated for each segment. When joinpoints were detected, we report APCs for that time segment. APCs were not calculated if case counts were <8 for any 1 year. For this reason, trends were not calculated for Black children and adolescents. Joinpoint software version 5.3.0 was used for all the trend analyses in this report.

RELATIVE SURVIVAL

The measure of cancer survival used in this report is relative survival, which represents survival in the absence of other causes of death. Studies have shown that relative survival estimates are very similar to cause-specific survival rates (which are calculated taking the cause of death into account). Relative survival is a net survival measure that estimates the probability of avoiding death due to a particular cancer. It is defined as the ratio of the observed survival rate among those who have cancer divided by the expected survival rate for people of the same sex, race/ethnicity, and age who do not have cancer, and is expressed as a percentage. Relative survival compares the survival of people who have the cancer of interest with those that do not. A relative survival of 100 percent does not mean that everyone will survive the disease but can be interpreted as cancer patients in that specific group are just as likely to survive during that time-period as persons in the general population of the same sex, race/ethnicity, and age. SEER*Stat software was used to calculate relative survival in this report. Estimates of relative survival were not calculated if case counts were <20.

STATISTICAL SIGNIFICANCE

The statistical significance of APCs was determined using Joinpoint software. APCs were considered significantly different from 0 at $p < 0.05$.

RACE/ETHNICITY CLASSIFICATION

Race codes were self-reported by patients and obtained through medical records. If no race was stated in the medical record, additional documentation including nursing and physician notes was reviewed for a statement of a race category. When the patient's race was reported differently by two or more sources within the medical record, priority was given to the patient's self-declared identification. Death certificate information was used when race was unknown in the patient record. The North American Association of Central Cancer Registries' Hispanic and Asian/Pacific Islander Identification Algorithm (NHAPIIA) was applied to identify Hispanic and Asian and Pacific Islander persons. Race and ethnicity were categorized as non-Hispanic White (White), non-Hispanic Black (Black),

Hispanic, and Asian or Pacific Islander (Asian/PI). We excluded American Indian children and adolescents from analyses because of small counts (n=205, 2007-2021). The abbreviations listed here will be used throughout this report.

RESULTS

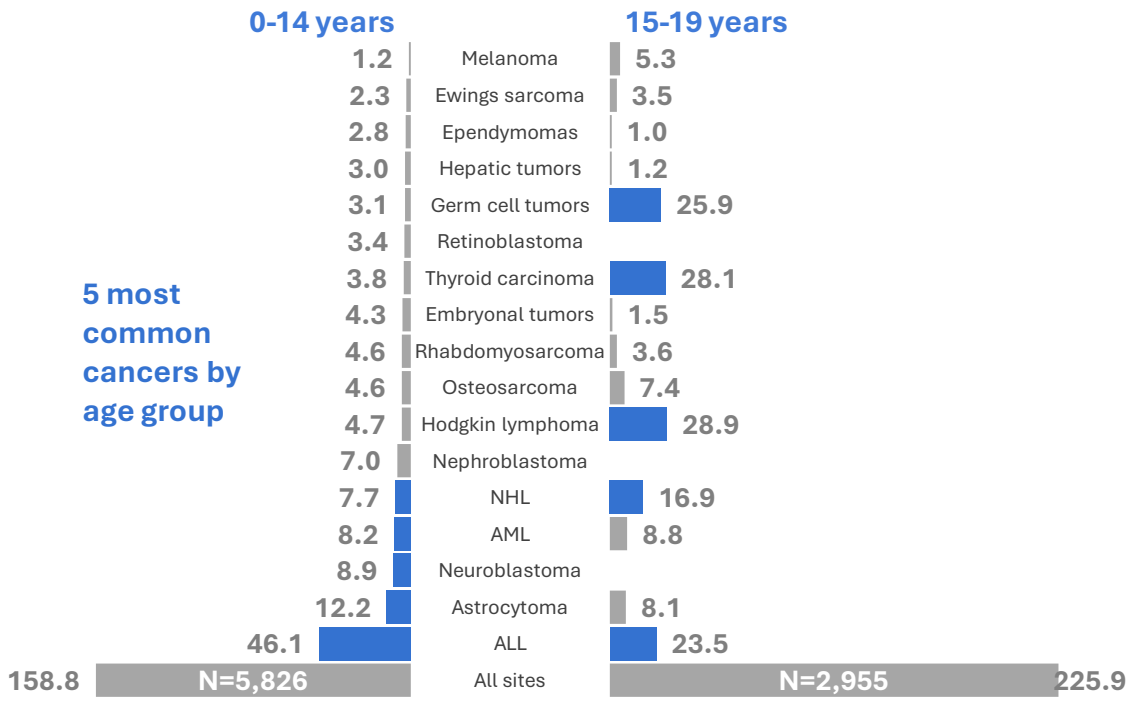
AGE-ADJUSTED INCIDENCE RATES (AAIR) BY TYPE AND AGE GROUP

From 2017 to 2021, 5,826 children ages 0 to 14 years and 2,955 adolescents ages 15 to 19 years were diagnosed with cancer in California. Overall, adolescents had higher AAIRs (225.9) than children (158.8).

CANCER INCIDENCE RATES FOR CHILDREN DECREASED BUT REMAINED UNCHANGED FOR ADOLESCENTS

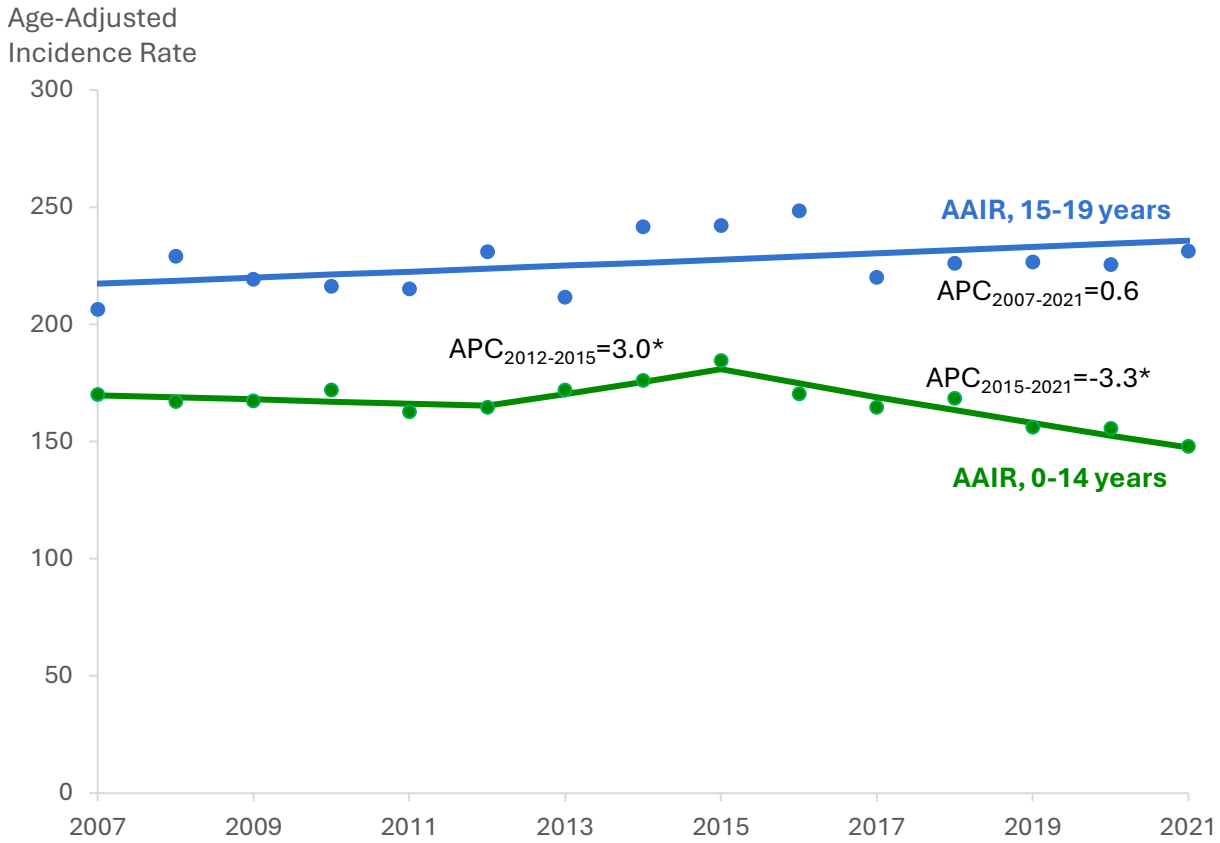
- The five most common cancers among children were ALL, astrocytoma, neuroblastoma, AML, and NHL (Figure 1).
- The five most common cancers among adolescents were Hodgkin lymphoma, thyroid carcinoma, germ cell tumors, ALL, and NHL.
- AAIRs for adolescents did not significantly change from 2007 to 2021. Among children, AAIRs increased from 2012 to 2015 and then decreased after 2015 (Figure 2).
- Among children, AAIRs for astrocytoma and AML decreased in recent years (Figure 3). Among adolescents, there were no significant changes in the five most common cancers over the study period (Figure 4).
- AAIRs for embryonal tumors, ependymomas, retinoblastoma, rhabdomyosarcoma, and Hodgkin lymphoma decreased for children over the study period while melanoma decreased for adolescents. AAIRs for thyroid carcinoma in children and AML in adolescents increased over the study period (Appendix Table A1).

Figure 1. Age-Adjusted Incidence Rates (AAIR) Among Children and Adolescents Ages 0-19, by Type‡ and Age Group, California, 2017-2021



Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
‡*AAIRs are not shown for any sites with fewer than 20 cases during the time period.*
Abbreviations: NHL, non-Hodgkin lymphoma; AML, acute myeloid leukemia; ALL, acute lymphocytic leukemia
Excludes benign brain cancers.

Figure 2. Trends in Age-Adjusted Incidence Rates (AAIR) Among Children and Adolescents Ages 0-19, by Age Group, All Types, California, 2007-2021.

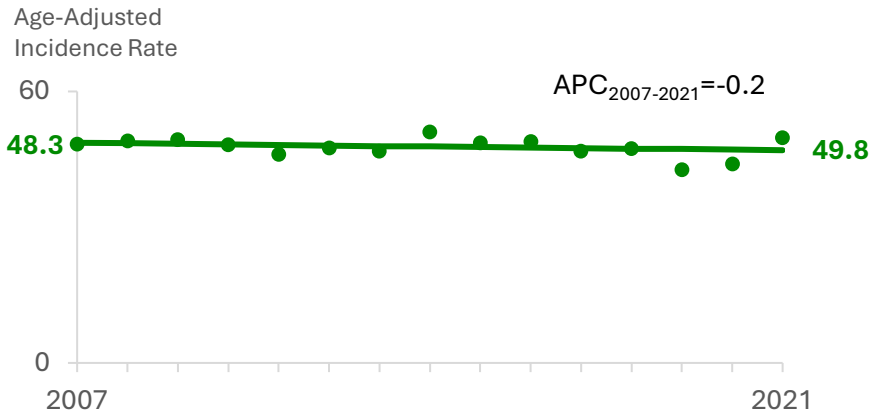


Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at $p < 0.05$.*
Excludes benign brain cancers.

Figure 3. Trends in Age-Adjusted Incidence Rates (AAIR) for the 5 Most Common Cancers Among Children 0 to 14 Years Old, California, 2007-2021

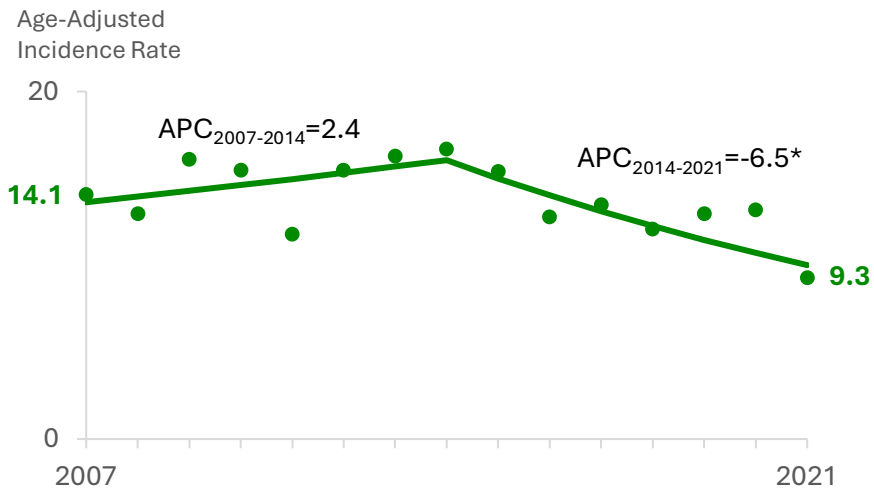
Acute Lymphocytic Leukemia

The AAIRs for ALL remained stable from 2007 to 2021.



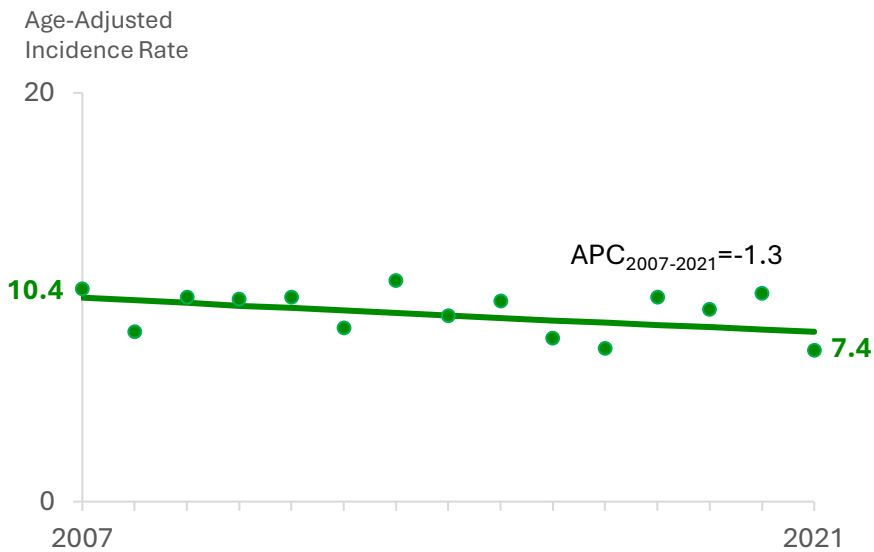
Astrocytoma

From 2007 to 2014 AAIRs for astrocytoma did not significantly change but from 2014 to 2021, the AAIRs decreased by more than 6% a year.



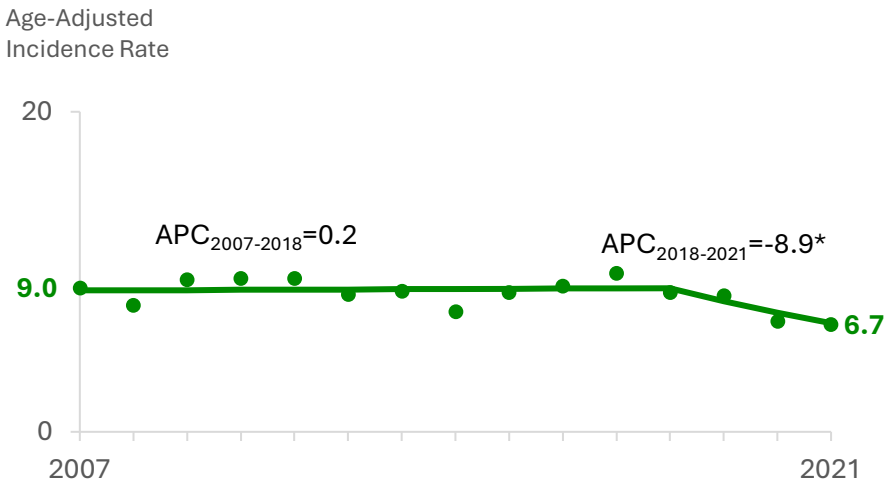
Neuroblastoma

Over the study period, the AAIR for neuroblastoma did not signifiacntly change.



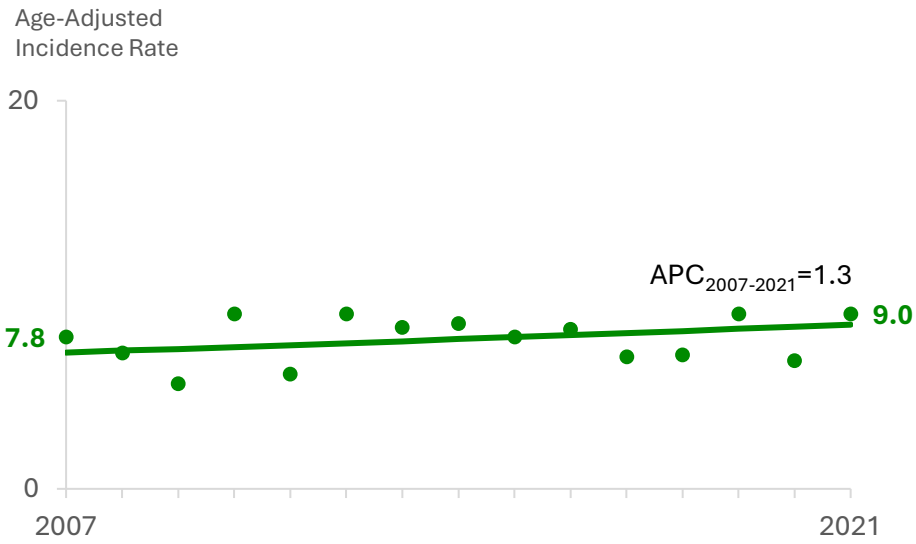
Acute Myeloid Leukemia

During the first part of the study period the AAIRs for AML remained stable, but decreased by nearly 9% a year starting in 2018.



Non-Hodgkin Lymphoma

The AAIRs for NHL did not significantly change during the study period.

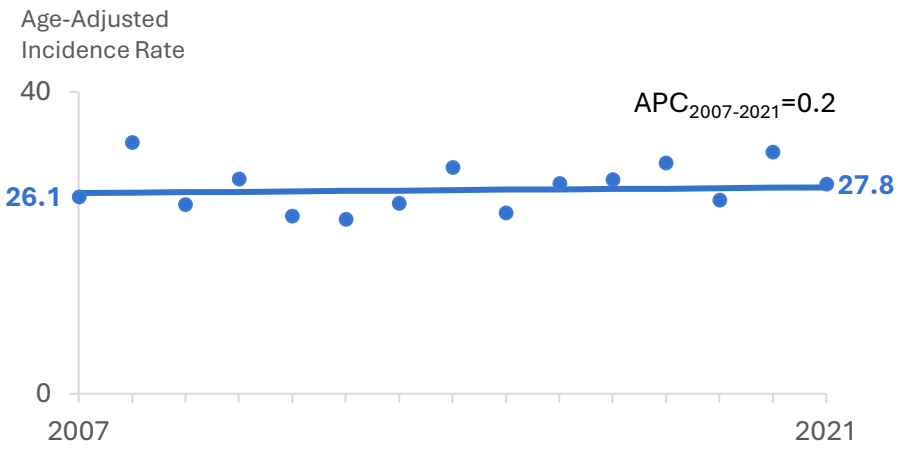


Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at $p < 0.05$.*
AAIR, age-adjusted incidence rate; APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.

Figure 4. Trends in Age-Adjusted Incidence Rates (AAIR) for the 5 Most Common Cancers Among Adolescents 15 to 19 Years Old, California, 2007-2021

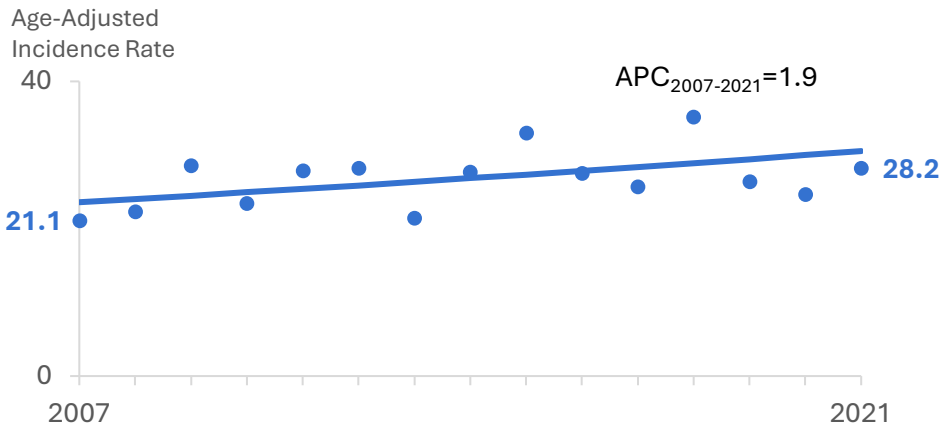
Hodgkin Lymphoma

The AAIRs for Hodgkin lymphoma remained stable from 2007 to 2021.



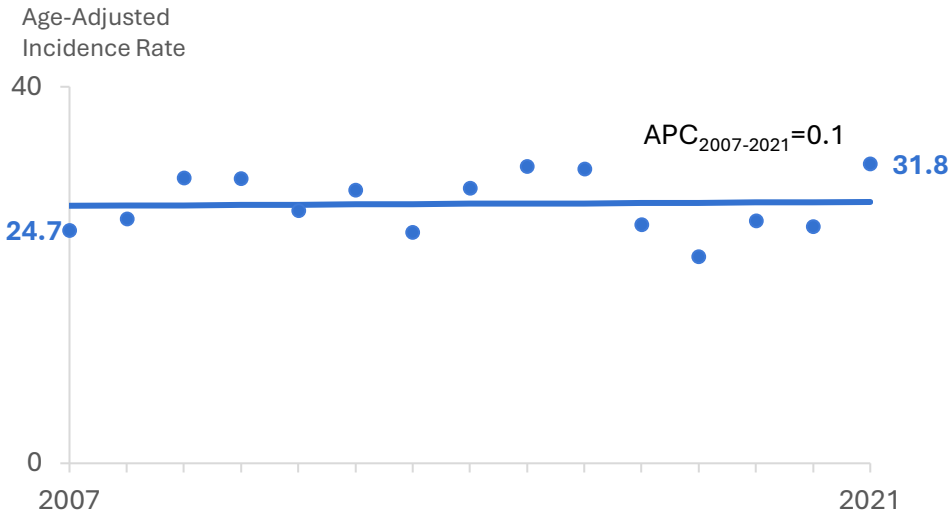
Thyroid Carcinoma

From 2007 to 2021 there were no significant changes in the AAIRs for thyroid cancer.



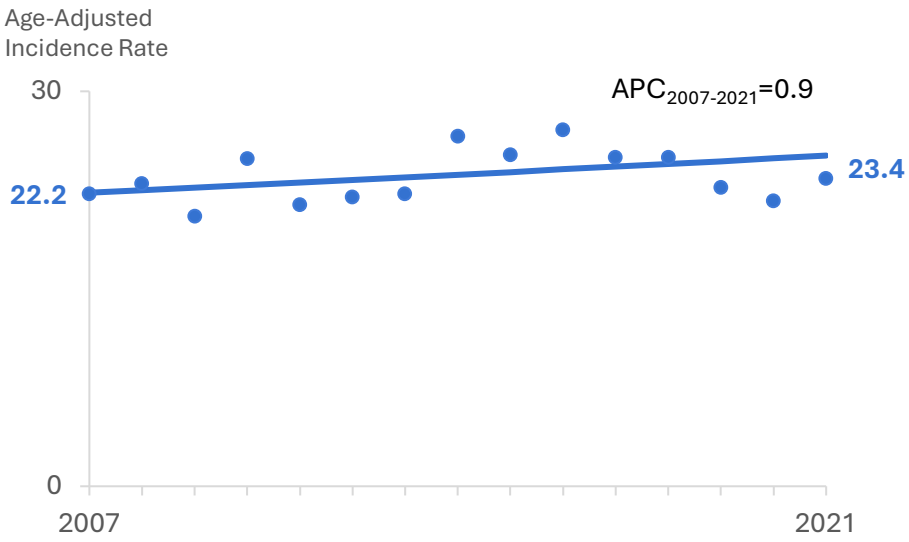
Germ Cell Tumors

The AAIRs for germ cell tumors remained stable from 2007 to 2021.



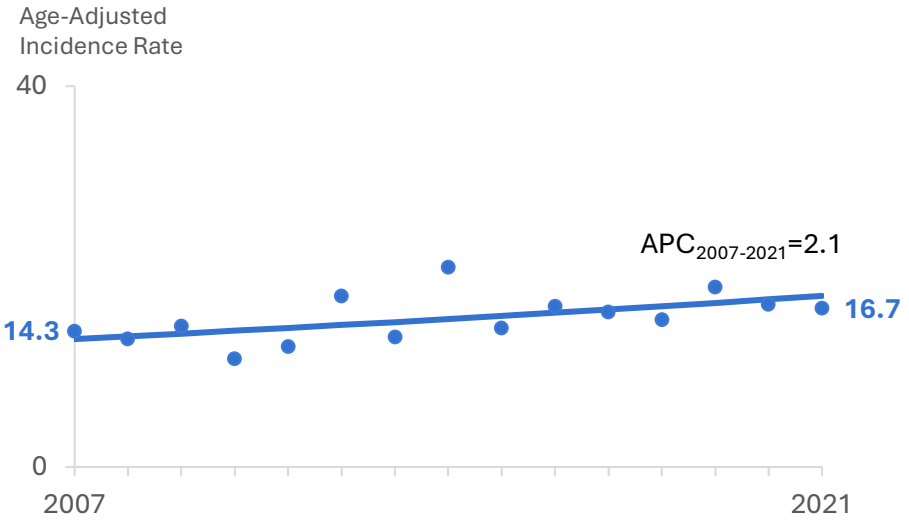
Acute Lymphocytic Leukemia

The AAIRs for ALL did not significantly change from 2007 to 2021.



Non-Hodgkin Lymphoma

There were no significant changes in the AAIRs for NHL from 2007 to 2021.



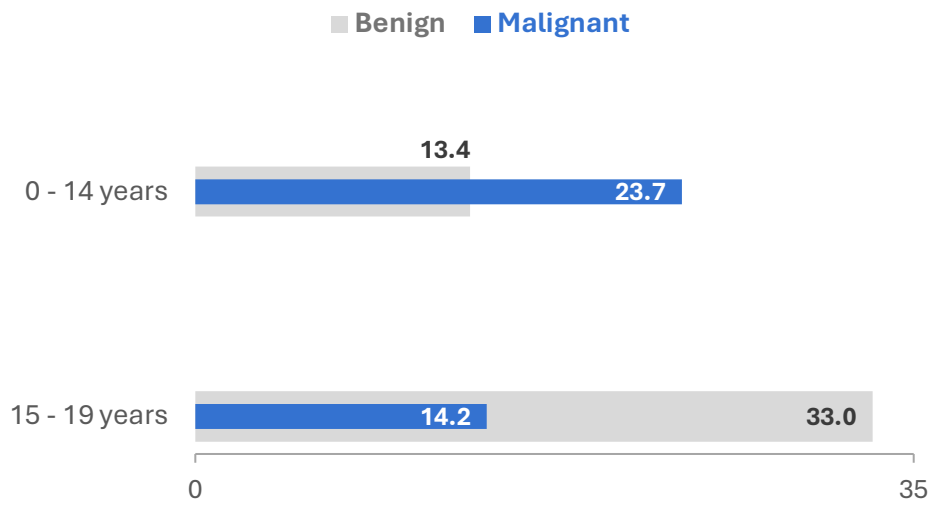
Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at p < 0.05.*
AAIR, age-adjusted incidence rate; APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.

Age-adjusted Incidence Rates (AAIR) by Age Group for Brain Cancer

- Children had higher incidence rates of malignant brain cancer (23.7 vs. 14.2) while adolescents had higher incidence rates of benign brain tumors (33.0 vs. 13.4) (Figure 5).
- The AAIRs for malignant brain cancer among children decreased since 2017 but remained unchanged for adolescents. After increases for both age groups in benign brain cancer in earlier years, AAIRs have remained unchanged in recent years (Figure 6).

CHILDREN HAVE MORE MALIGNANT BRAIN CANCER WHILE ADOLESCENTS HAVE MORE BENIGN

Figure 5. Age-Adjusted Incidence Rates (AAIR) For Brain Cancer Among Children and Adolescents Ages 0-19, by Age Group, California, 2017-2021



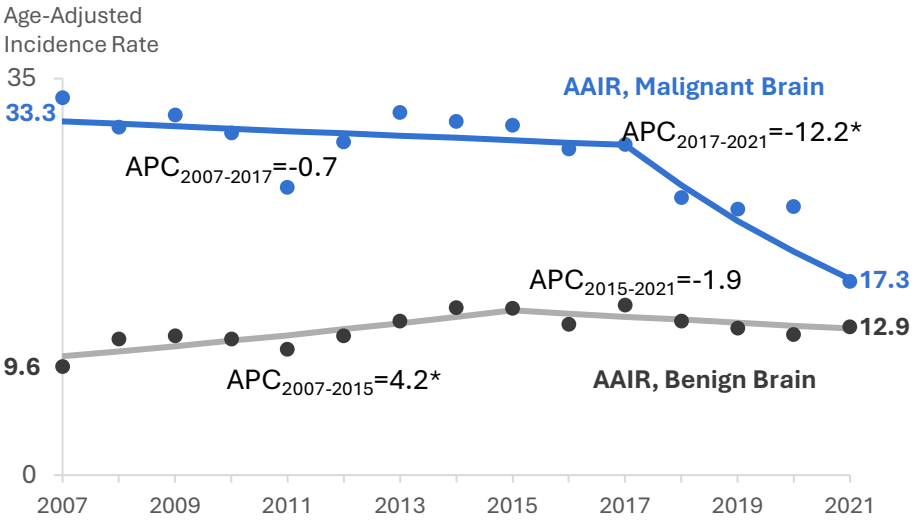
Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.

MALIGNANT BRAIN CANCER INCIDENCE DECREASED FOR CHILDREN BUT REMAINED UNCHANGED FOR ADOLESCENTS

Figure 6. Trends in Age-Adjusted Incidence Rates (AAIR) for Brain Cancer Among Children and Adolescents Ages 0-19, by Age Group, California, 2007-2021

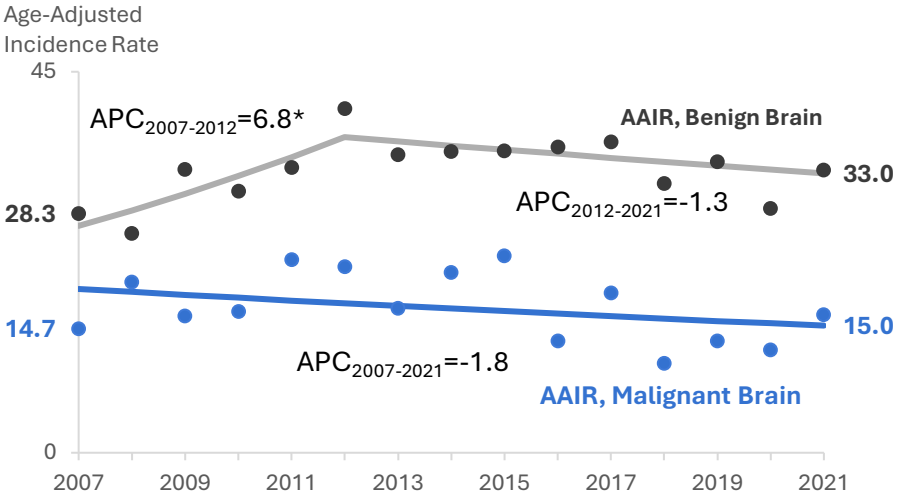
Children

The AAIRs for malignant brain cancer have decreased since 2017. AAIRs for benign brain cancer increased until 2015 and have not significantly changed since then.



Adoloescents

Since 2012, both benign and malignant brain cancers have not significantly changed.



Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at p < 0.05.*
AAIR, age-adjusted incidence rate; APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.

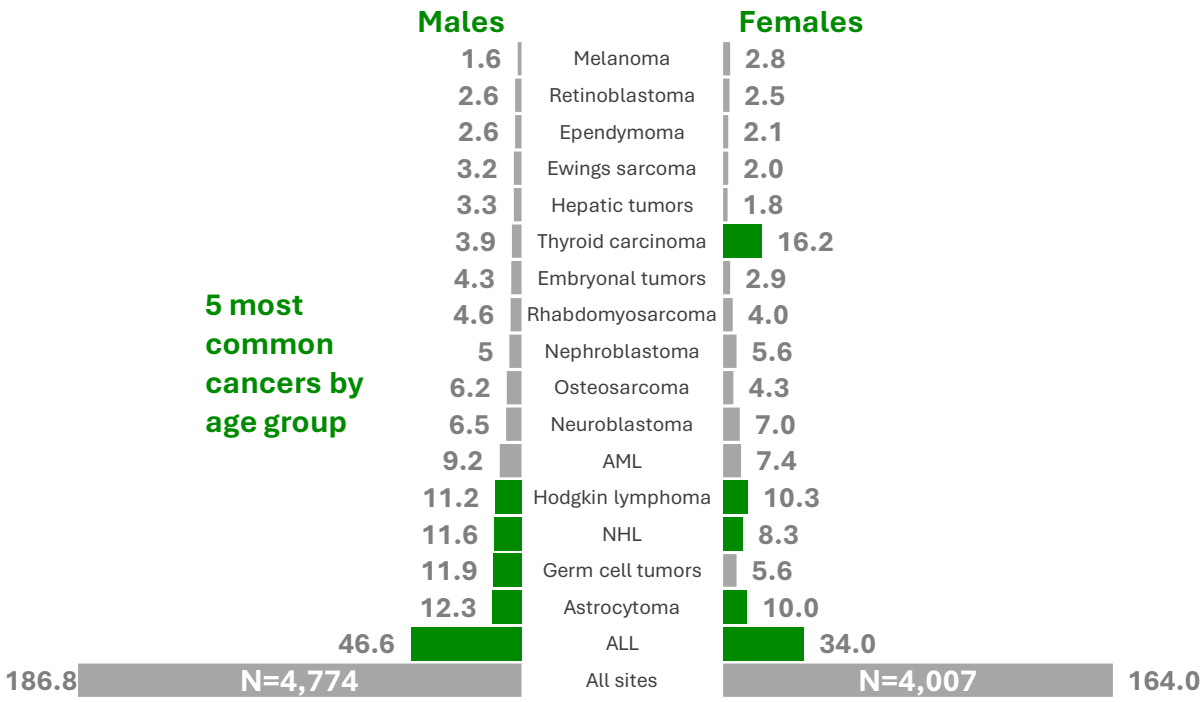
Age-adjusted Incidence Rates (AAIR) by Type and Sex

From 2017 to 2021, 4,744 males and 4,007 females ages 0 to 19 years were diagnosed with cancer in California. Overall, males had higher AAIRs (186.8) than females (164.0).

- The five most common cancers among males were ALL, astrocytoma, germ cell tumors, NHL, and Hodgkin lymphoma (Figure 7).
- The five most common cancers among females were ALL, astrocytoma, NHL, Hodgkin lymphoma, and thyroid carcinoma.
- From 2007 to 2015 AAIRs for both males and females increased followed by decreases from 2015 to 2021 (Figure 8).
- Among males, the AAIRs for the 5 most common cancers did not significantly change over the study period (Figure 9).
- Among females, the AAIRs for astrocytoma decreased since 2015 while the AAIRs for the other most common cancer sites did not significantly change (Figure 10).
- AAIRs for embryonal tumors decreased for both males and females over the study period (Appendix Table A2).

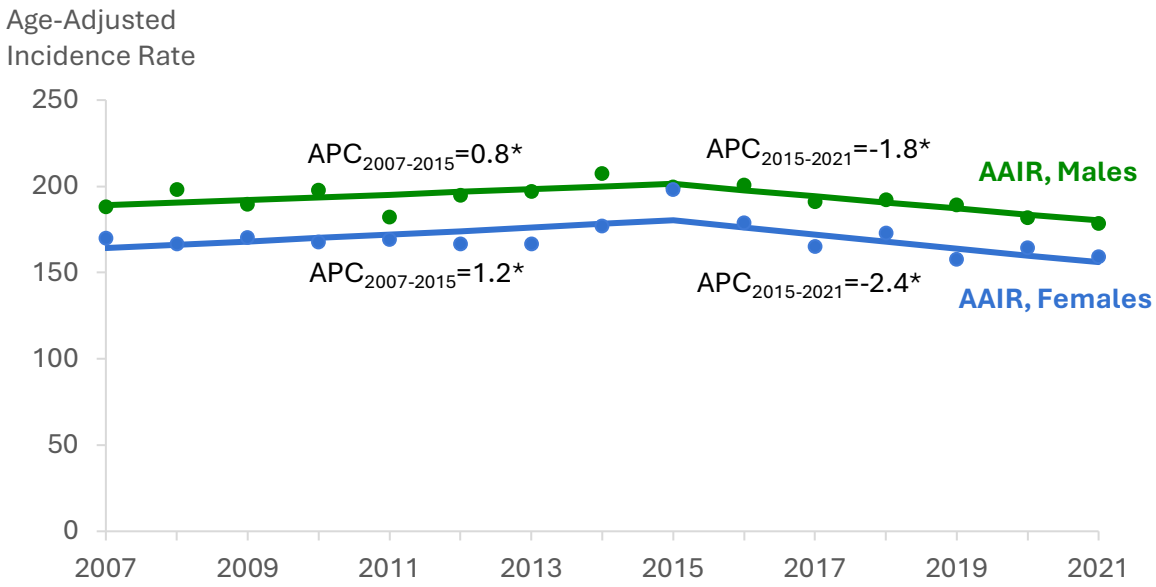
CANCER INCIDENCE DECREASED FOR BOTH MALE AND FEMALE CHILDREN AND ADOLESCENTS

Figure 7. Age-Adjusted Incidence Rates (AAIR) Among Children and Adolescents Ages 0-19, by Type and Sex, California, 2017-2021



Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
Abbreviations: NHL, non-Hodgkin lymphoma; AML, acute myeloid leukemia; ALL, acute lymphocytic leukemia
Excludes benign brain cancers.

Figure 8. Trends in the Age-Adjusted Incidence Rates (AAIR) Among Children and Adolescents Ages 0-19, by Sex, All Types, California, 2007-2021

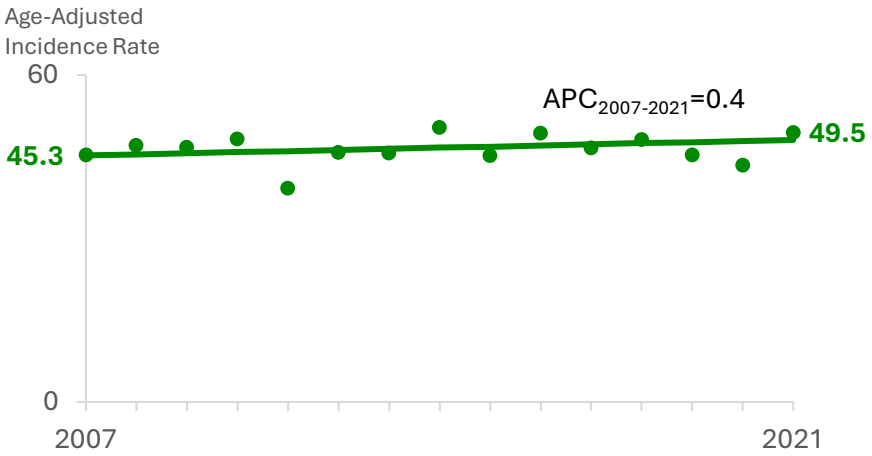


Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
Excludes benign brain cancers.
**Significantly different from zero at $p < 0.05$.*
APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.

Figure 9. Trends in Age-Adjusted Incidence Rates (AAIR) for the 5 Most Common Cancers Among Male Children and Adolescents Ages 0-19, California, 2007-2021

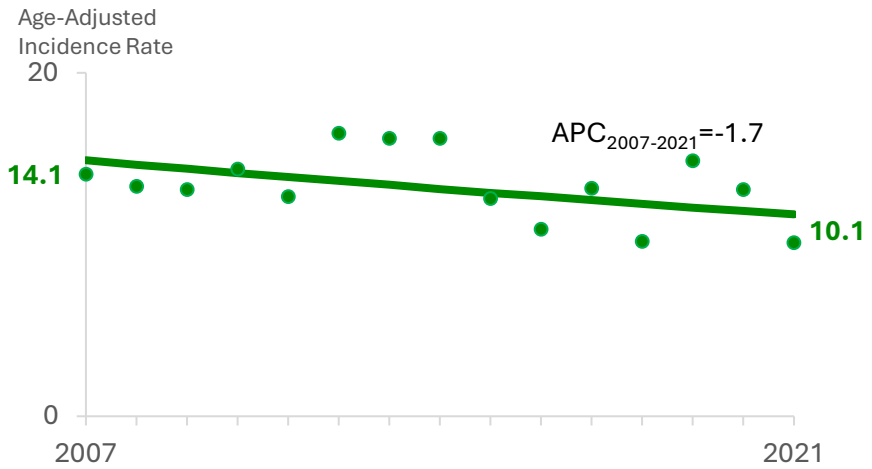
Acute Lymphocytic Leukemia

The AAIRs for ALL remained stable from 2007 to 2021.



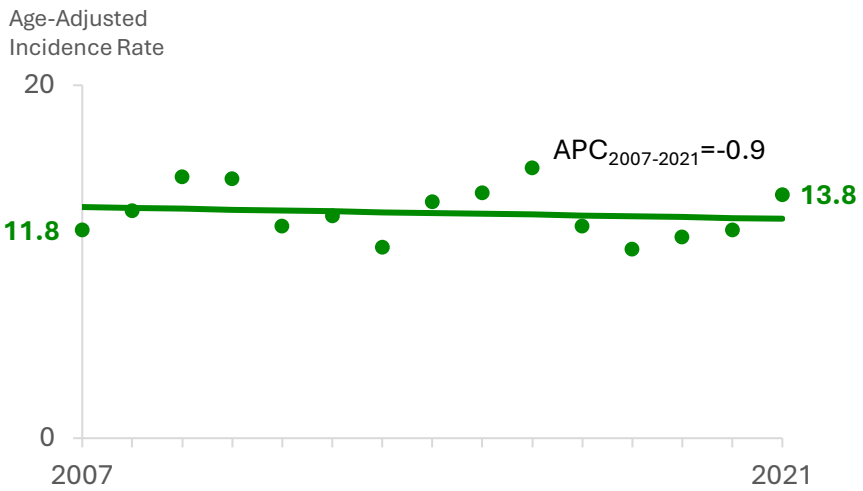
Astrocytoma

AAIRs for astrocytoma have not significantly changed since 2007.



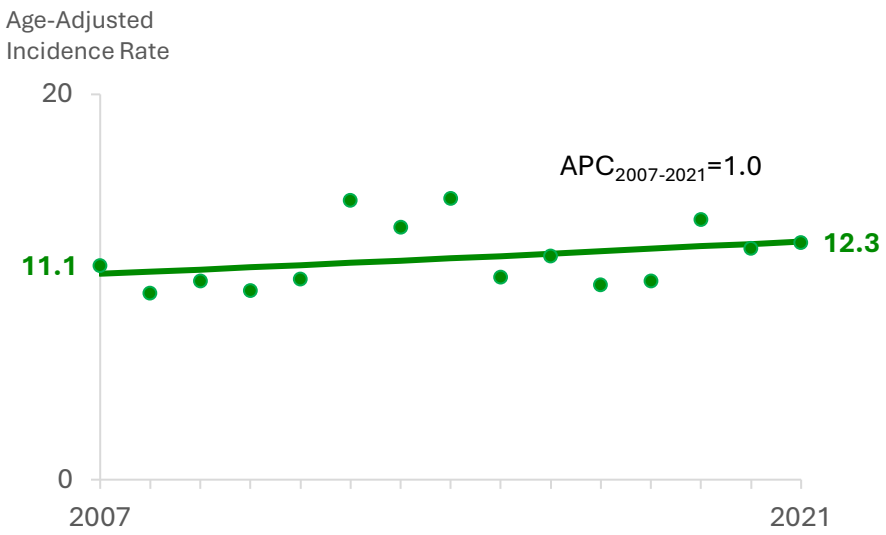
Germ Cell Tumors

Over the study period, the AAIRs for germ cell tumors did not significantly change.



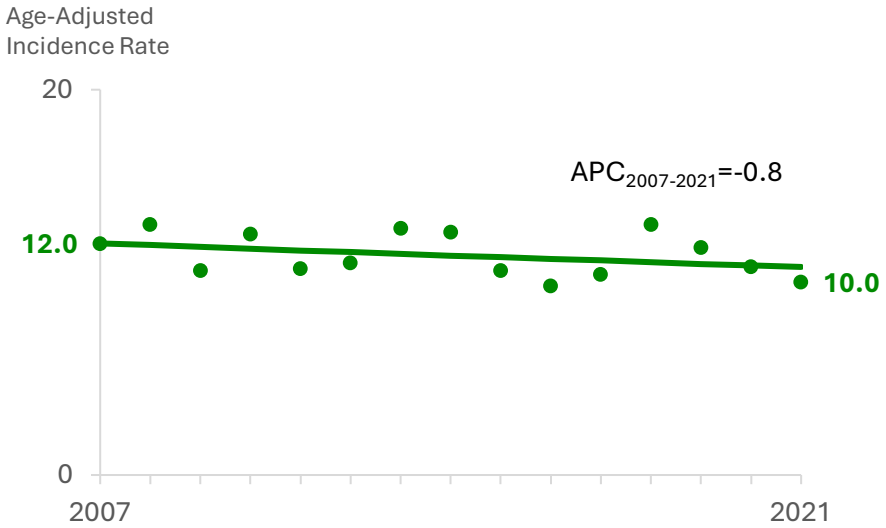
Non-Hodgkin Lymphoma

AAIRs for NHL did not significantly change over the study period.



Hodgkin Lymphoma

The AAIRs for Hodgkin lymphoma did not significantly change during the study period.

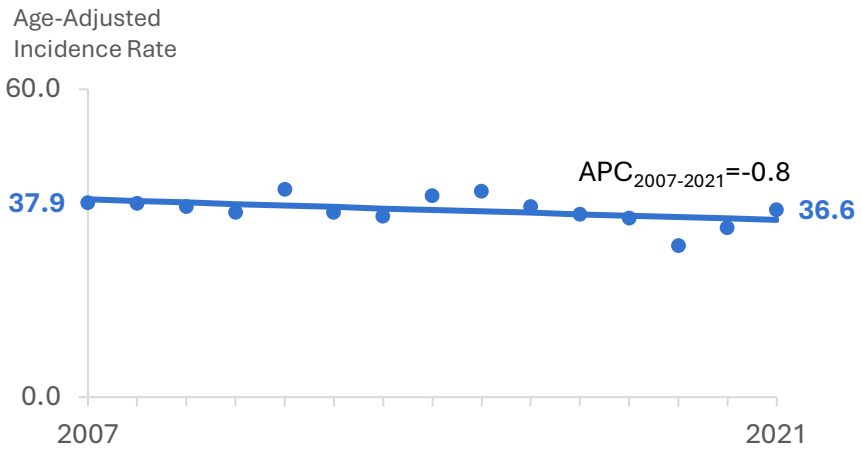


Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at $p < 0.05$.*
APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.

Figure10. Trends in Age-Adjusted Incidence Rates (AAIR) for the 5 Most Common Cancers Among Female Children and Adolescents Ages 0-19, California, 2007-2021

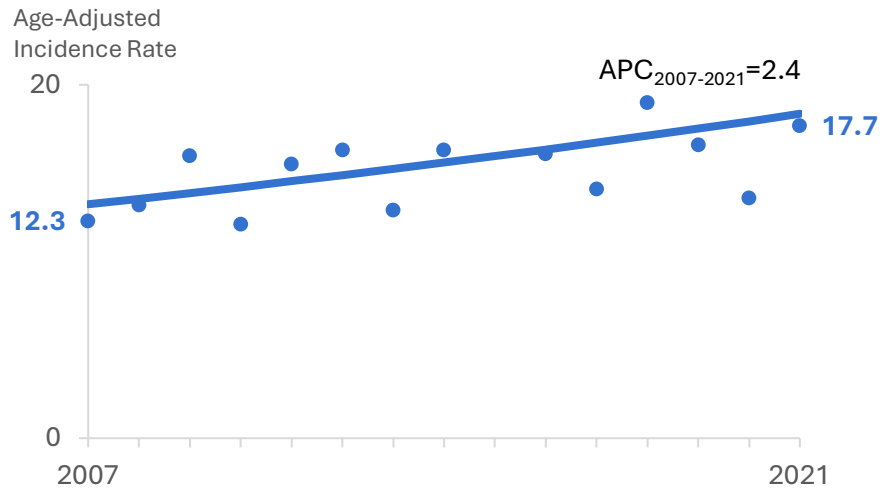
Acute Lymphocytic Leukemia

The AAIRs for ALL did not significantly change from 2007 to 2021.



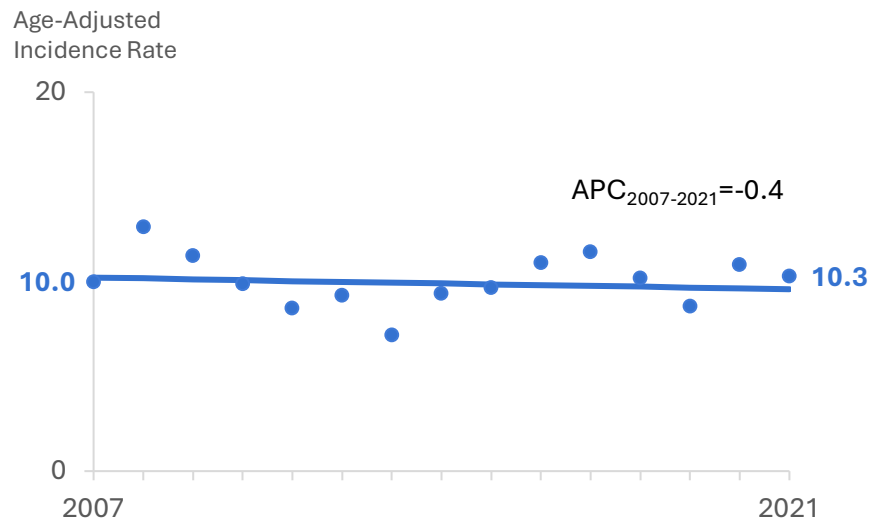
Thyroid Carcinoma

The AAIRs for thyroid cancer did not significantly change during the study period.



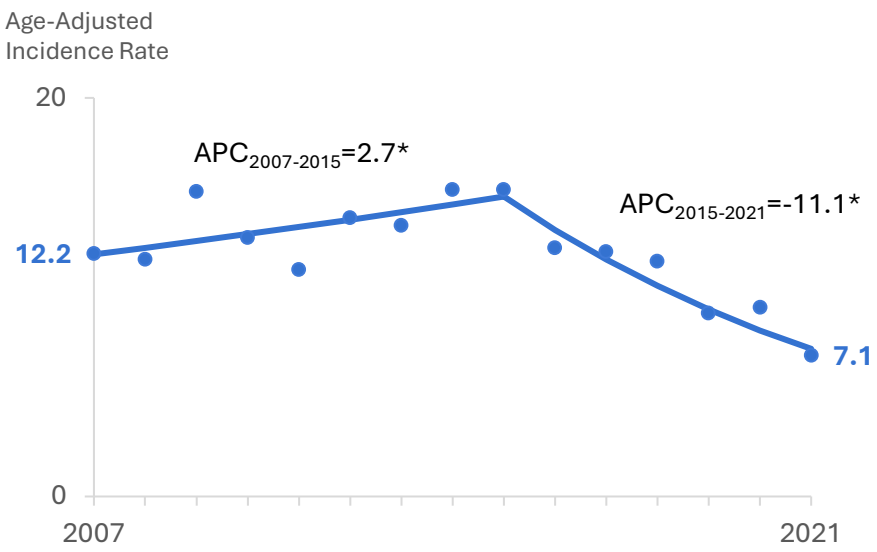
Hodgkin Lymphoma

The AAIRs for Hodgkin lymphoma remained stable from 2007 to 2021.



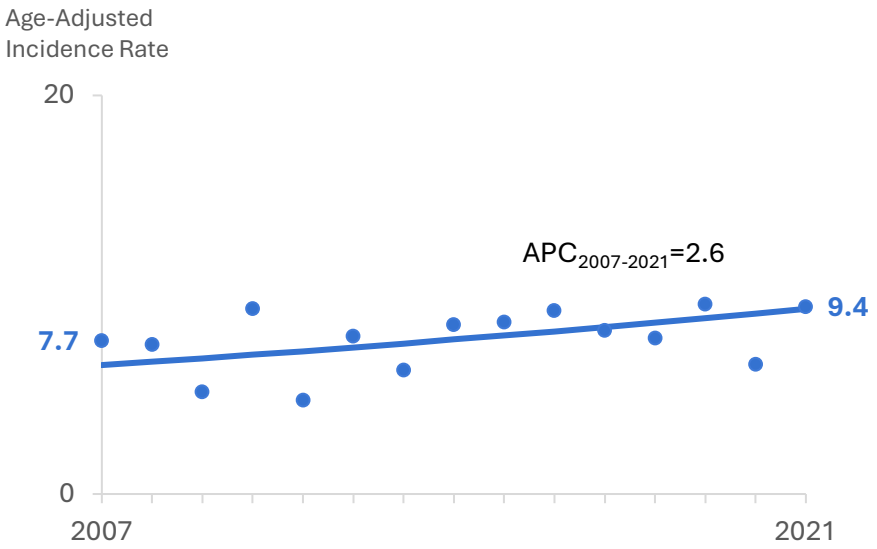
Astrocytoma

The AAIRs for astrocytoma increased roughly 3% from 2007 to 2015 and then decreased by 11% per year.



Non-Hodgkin Lymphoma

The AAIRs for NHL did not significantly change from 2007 to 2021.



Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at $p < 0.05$.*
APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.

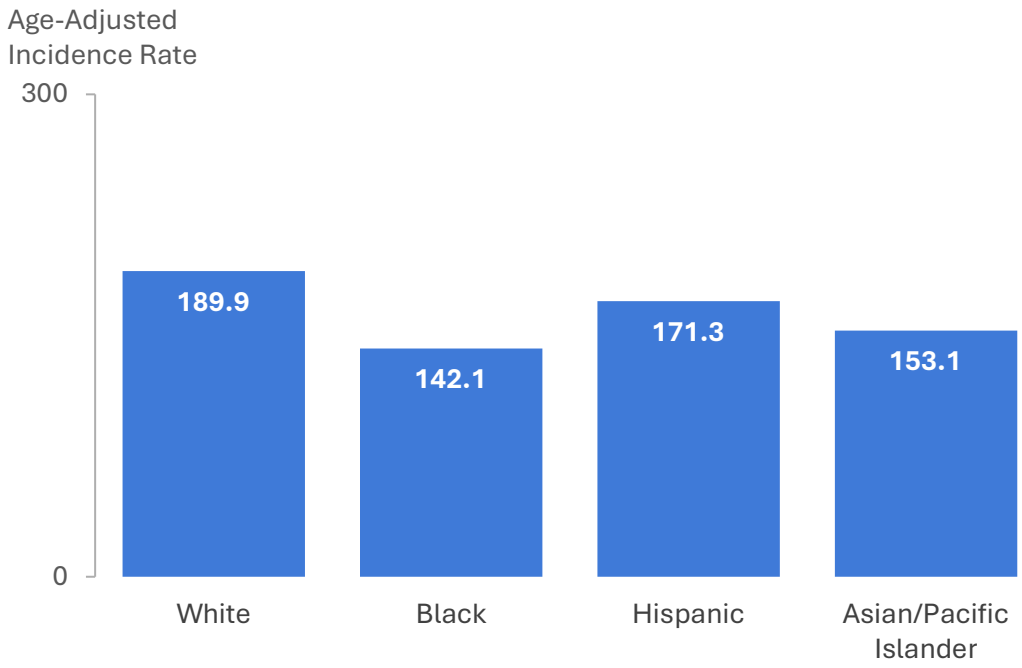
Age-adjusted Incidence Rates by Type and Race/Ethnicity

From 2017 to 2021, 2,656 White, 439 Black, 4,395 Hispanic, and 1,076 Asian/Pacific Islander children and adolescents ages 0 to 19 years were diagnosed with cancer in California. AAIRs were highest for White, followed by Hispanic, Asian/Pacific Islander, and Black children and adolescents (Figure 11).

- Among all four racial/ethnic groups, the most common cancer was ALL. Hispanic children and adolescents had the highest AAIR of ALL and White children and adolescents had the second highest (Figure 12).
- There was variability in the other four most common cancers by racial/ethnic group.
- Trends for the five most common cancers by race/ethnicity did not significantly change for most sites except astrocytoma among White children and adolescents (incidence rates decreased during 2013-2021) and thyroid carcinoma among Hispanic children and adolescents (incidence increased during 2007-2021) (Figures 13-15).
- Among White children and adolescents, AAIRs for melanoma and AML decreased (Appendix Table A3).

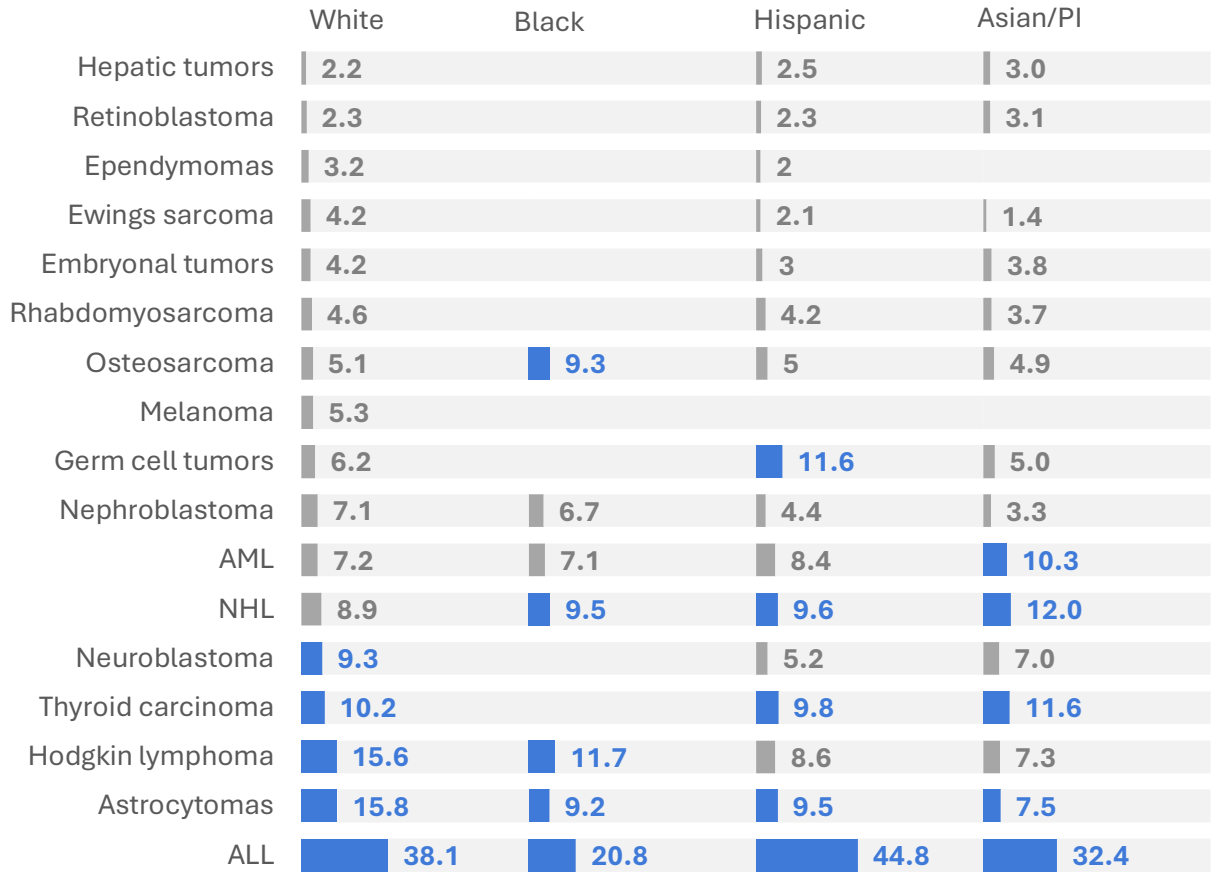
HISPANIC CHILDREN AND ADOLESCENTS HAD THE HIGHEST INCIDENCE OF ACUTE LYMPHOCYTIC LEUKEMIA

Figure 11. Age-Adjusted Incidence Rates (AAIR) Among Children and Adolescents Ages 0-19, by Race/Ethnicity*, All Types, California, 2017-2021



Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
Excludes benign brain cancers.
**non-Hispanic White (White), non-Hispanic Black (Black), Hispanic, Asian or Pacific Islander (Asian/Pacific Islander)*

Figure 12. Age-Adjusted Incidence Rates (AAIR) Among Children and Adolescents Ages 0-19, by Type‡ and Race/Ethnicity*, California, 2017-2021



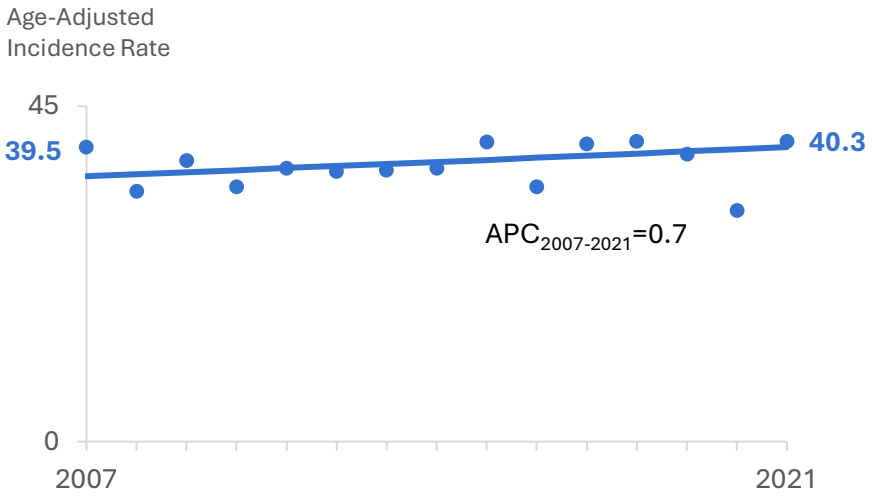
5 most common cancers by race/ethnicity

Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
‡AAIRs are not shown for any sites with fewer than 20 cases during the time period.
Abbreviations: NHL, non-Hodgkin lymphoma; AML, acute myeloid leukemia; ALL, acute lymphocytic leukemia
Excludes benign brain cancers.
**non-Hispanic White (White), non-Hispanic Black (Black), Hispanic, Asian or Pacific Islander (Asian/PI)*

Figure 13. Trends in Age-Adjusted Incidence Rates (AAIR) for the 5 Most Common Cancers Among Non-Hispanic White Children and Adolescents Ages 0-19, California, 2007 to 2021

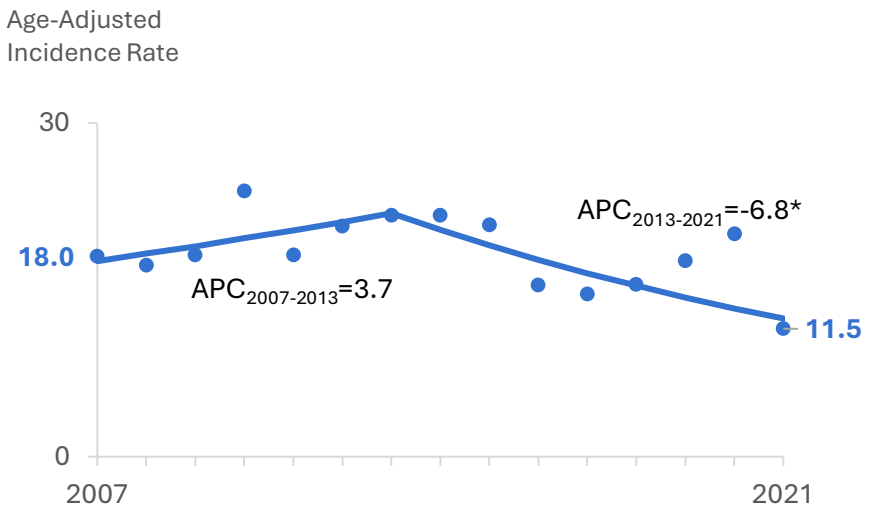
Acute Lymphocytic Leukemia

The AAIRs for ALL did not significantly change from 2007 to 2021.



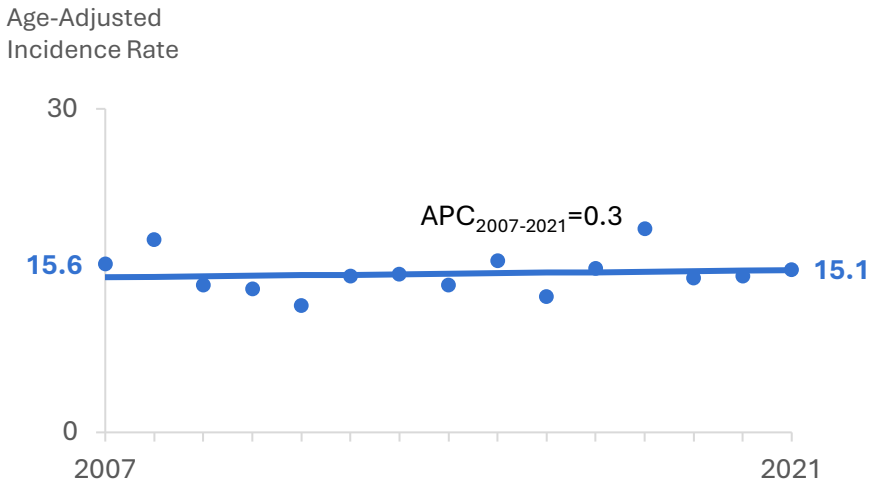
Astrocytoma

From 2013 to 2021, AAIRs for astrocytoma decreased nearly 7% per year.



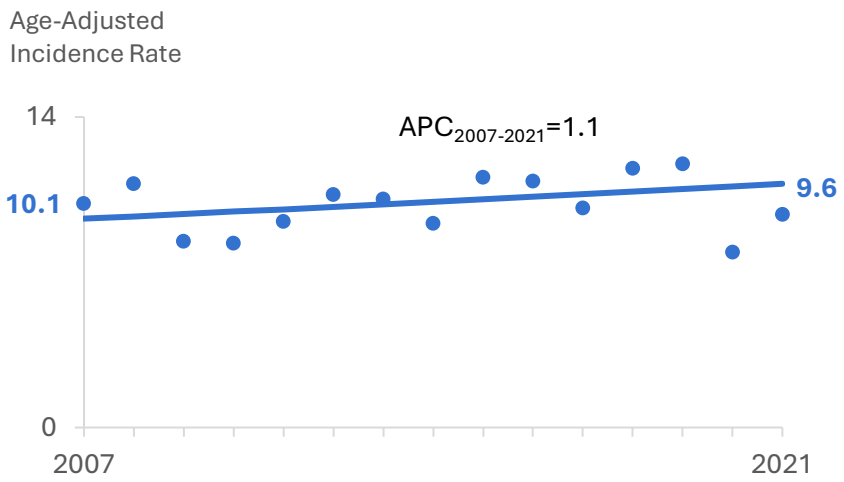
Hodgkin Lymphoma

The AAIRs for Hodgkin lymphoma remained stable from 2007 to 2021.



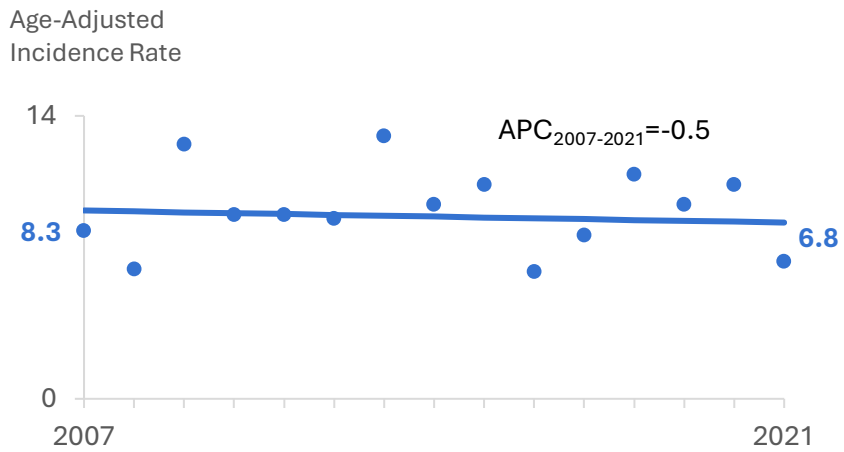
Thyroid Carcinoma

The AAIRs for thyroid carcinoma did not significantly change from 2007 to 2021.



Neuroblastoma

The AAIRs for neuroblastoma did not significantly change from 2007 to 2021.

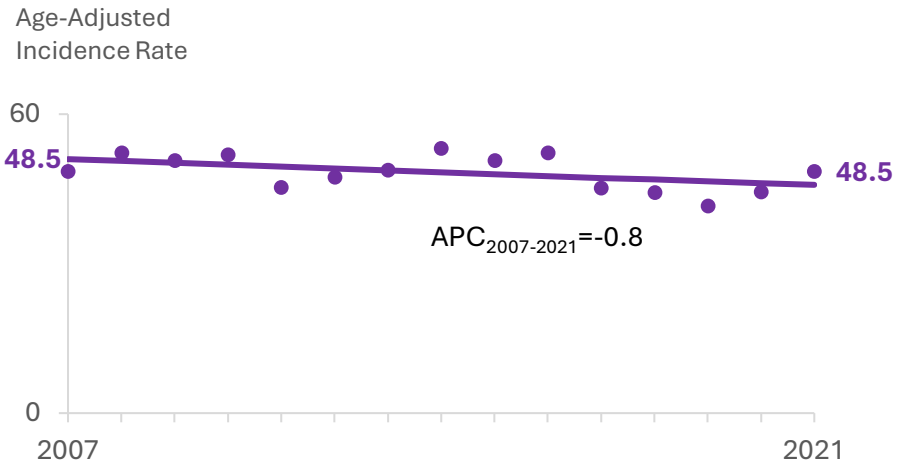


Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at $p < 0.05$.*
APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.

Figure 14. Trends in Age-Adjusted Incidence Rates (AAIR) for the 5 Most Common Cancers Among Hispanic Children and Adolescents Ages 0-19, California, 2007 to 2021

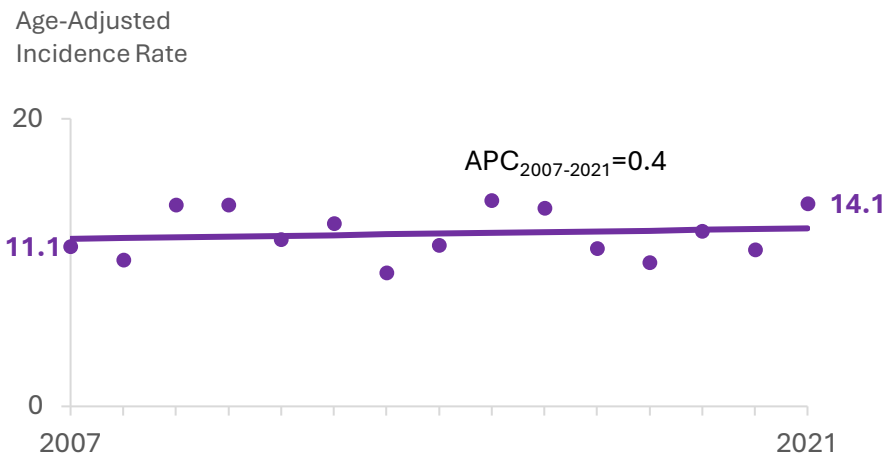
Acute Lymphocytic Leukemia

The AAIRs for ALL did not significantly change from 2007 to 2021.



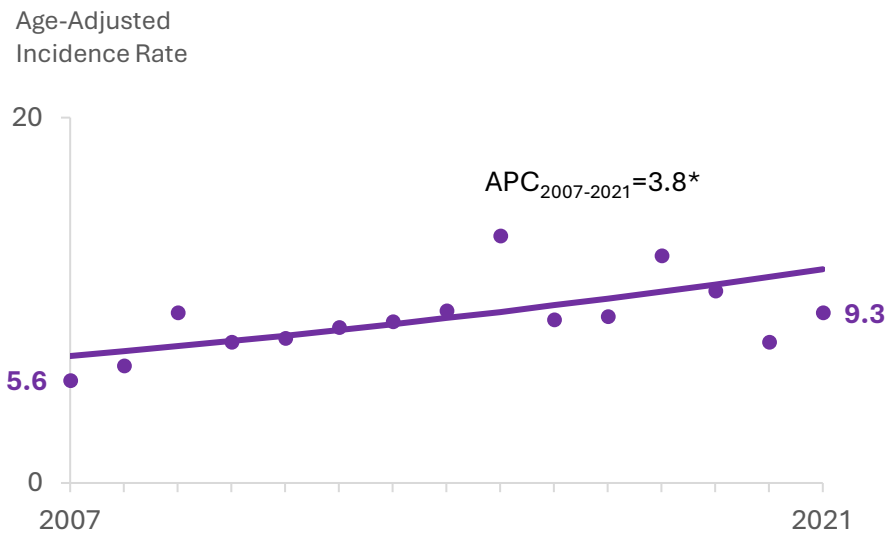
Germ Cell Tumors

The AAIRs for germ cell tumors remained stable from 2007 to 2021.



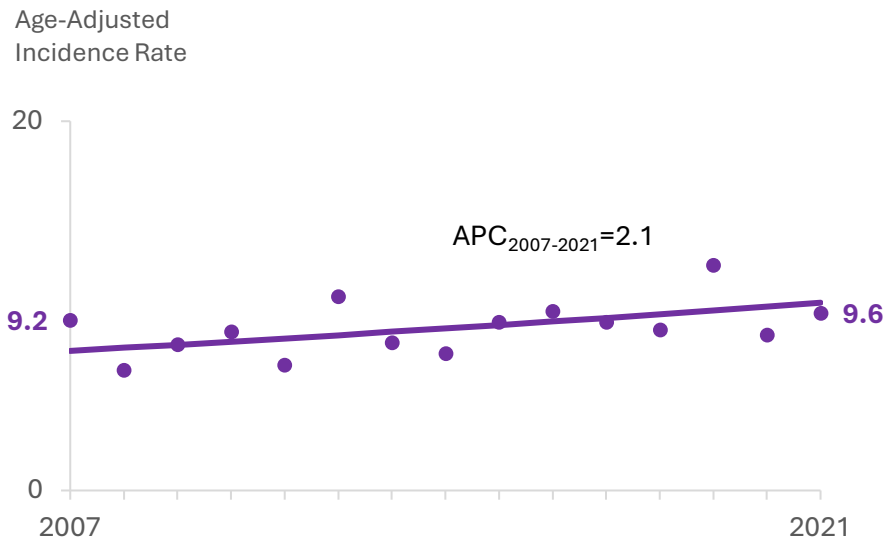
Thyroid Carcinoma

AAIRs for thyroid carcinoma increased nearly 4% per year from 2007 to 2021.



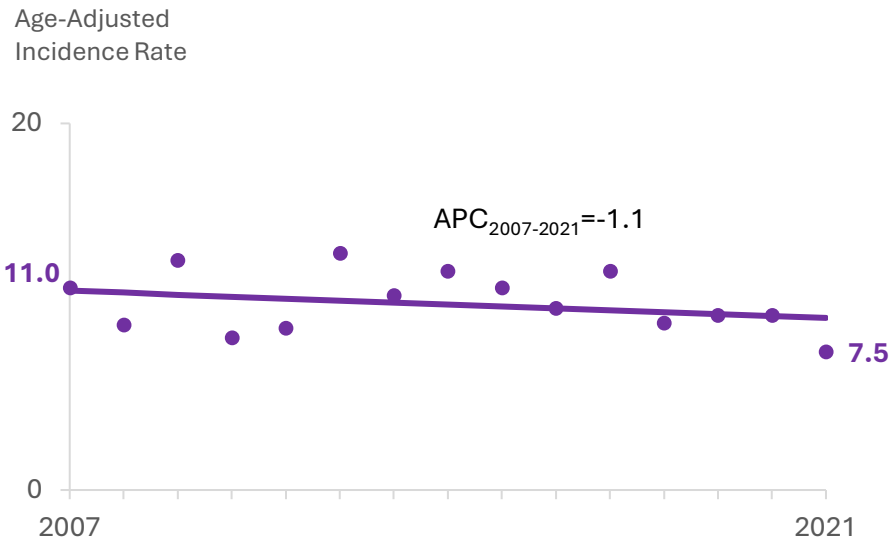
Non-Hodgkin Lymphoma

The AAIRs for NHL did not significantly change from 2007 to 2021.



Astrocytoma

The AAIRs for astrocytoma did not significantly change from 2007 to 2021.

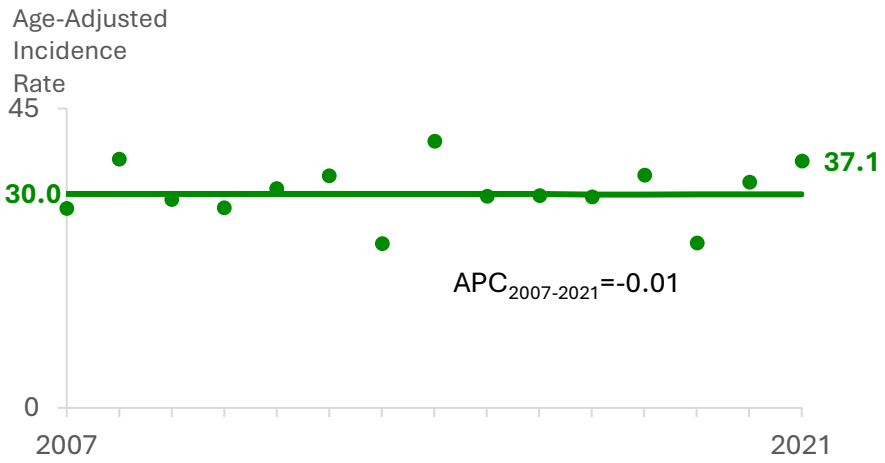


Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at $p < 0.05$.*
APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.

Figure 15. Trends in Age-Adjusted Incidence Rates (AAIR)** for the 5 Most Common Cancers Among Asian/Pacific Islander Children and Adolescents Ages 0-19, California, 2007 to 2021

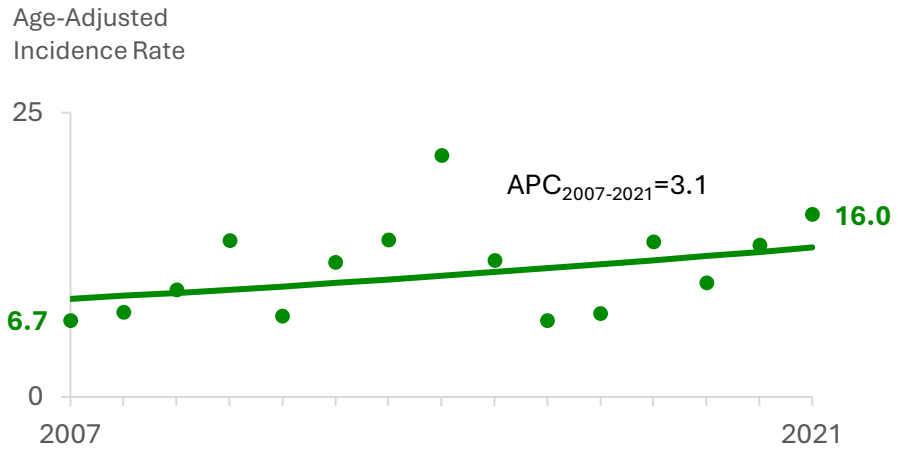
Acute Lymphocytic Leukemia

The AAIRs for ALL remained stable from 2007 to 2021.



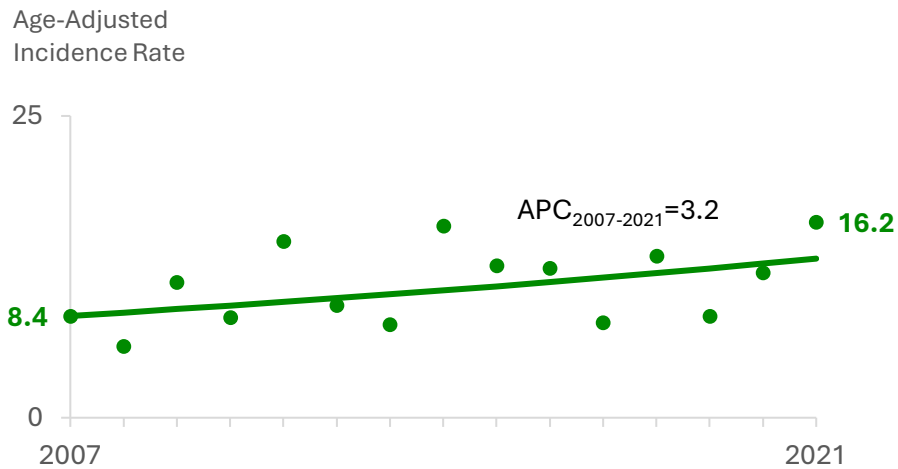
Non-Hodgkin Lymphoma

The AAIRs for NHL did not significantly change from 2007 to 2021.



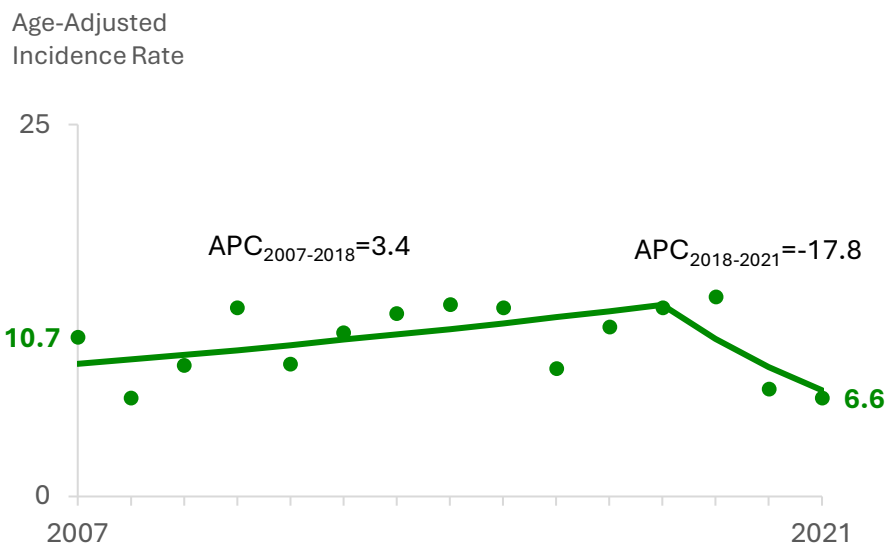
Thyroid Carcinoma

The AAIRs for thyroid carcinoma did not significantly change from 2007 to 2021.



Acute Myeloid Leukemia

The AAIRs for AML did not significantly change over the study period.



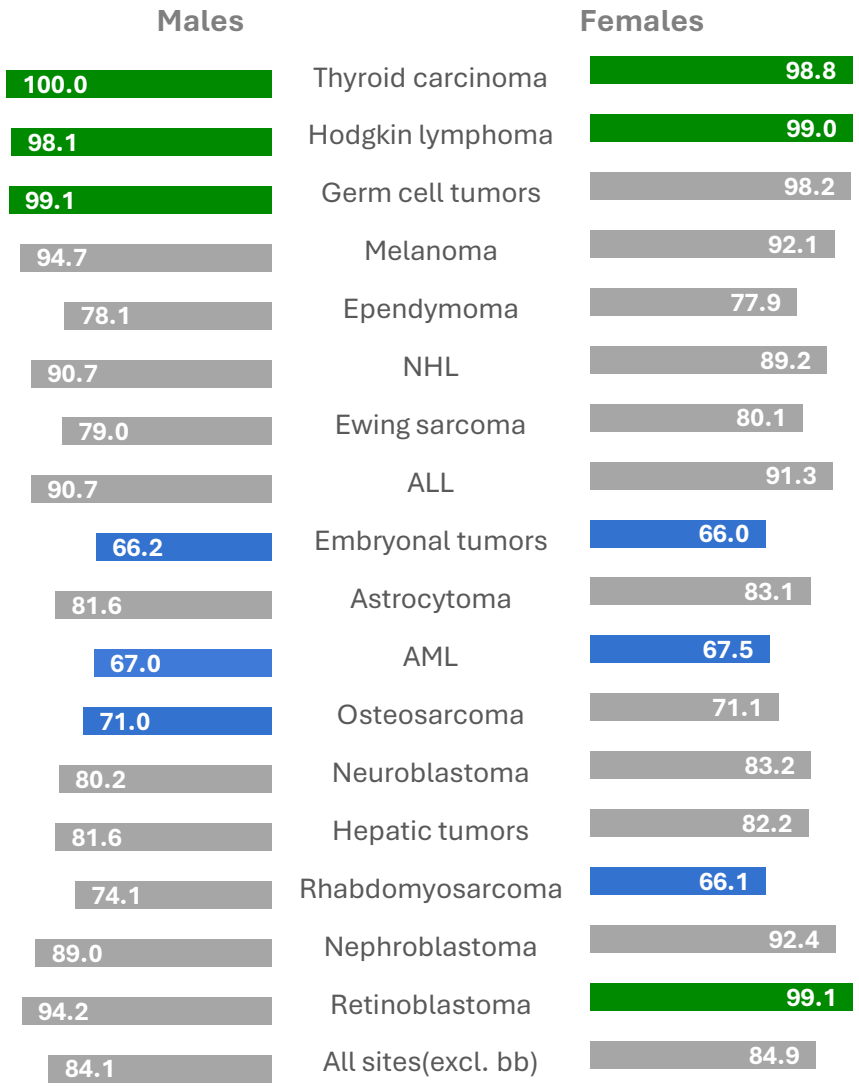
Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
**Significantly different from zero at p < 0.05.*
APC, annual percent change; a negative APC indicates that rates are decreasing, a positive APC indicates that rates are increasing.
*** Rates not calculated for astrocytoma because case counts were <8 for at least 1 year during the study period.*

Note: We did not calculate site specific APCs or trends for Black race/ethnicity because case counts were <8 for at least 1 year during the study period.

Five-year Relative Survival by Type, Sex, and Age Group

Overall, five-year relative survival among male adolescents (83.8) and children (84.1) were similar. Female adolescents had a higher relative survival (88.0) than female children (84.9) (Figures 16, 17).

Figure 16. Five-year Relative Survival (percentage) by Sex and Type, Ages 0-14, California, 2007-2021



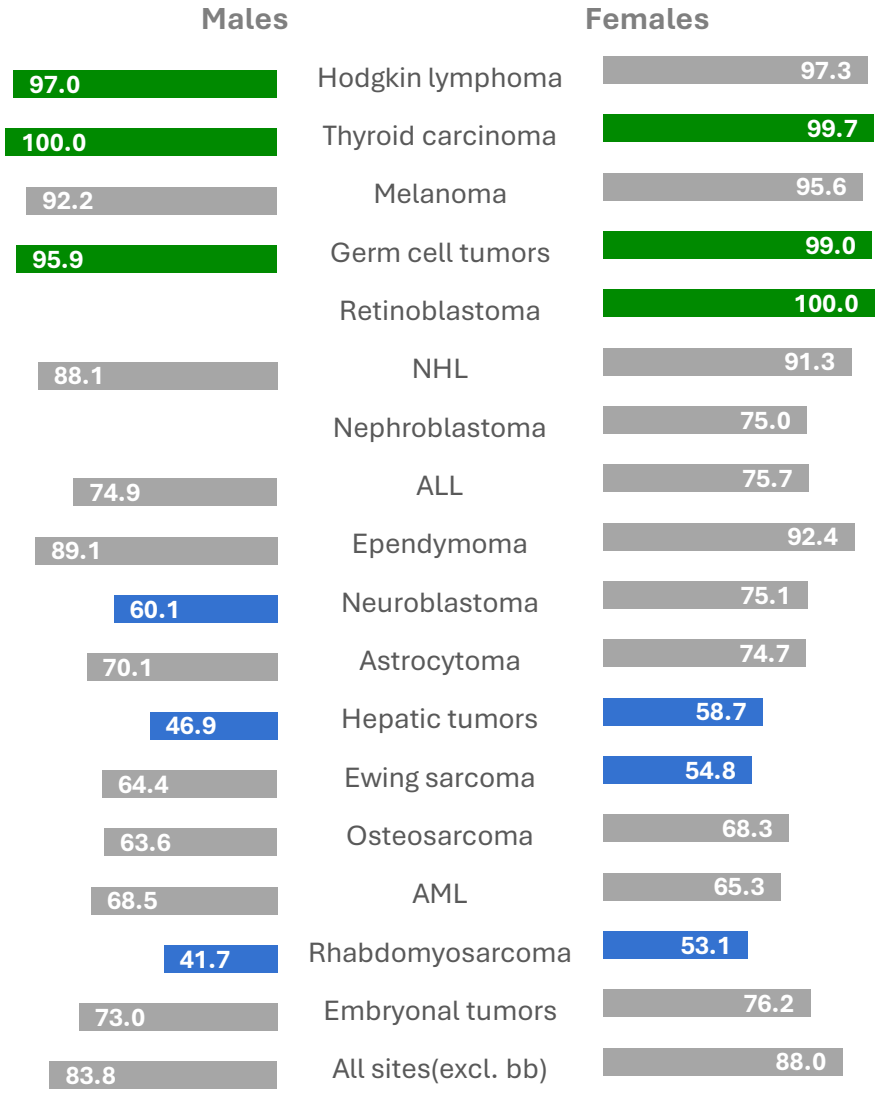
3 highest survival sites by sex
3 lowest survival sites by sex

Source: California Cancer Registry, California Department of Public Health
Abbreviations: NHL, non-Hodgkin lymphoma; AML, acute myeloid leukemia; ALL, acute lymphocytic leukemia

- Among children, females had slightly higher five-year relative survival for retinoblastoma, nephroblastoma, and neuroblastoma than males. Female children had a lower survival than male children for melanoma and rhabdomyosarcoma. (Figure 16).

- Among male children, those who were diagnosed with thyroid carcinoma (100.0), Hodgkin lymphoma (98.1) or germ cell tumors (99.1) had the highest relative survival while those diagnosed with embryonal tumors (66.2), AML (67.0), and osteosarcoma (71.0) had the lowest.
- Among female children, those with thyroid carcinoma (98.8), Hodgkin lymphoma (99.0) or retinoblastoma (99.1) had the highest five-year relative survival while those with embryonal tumors (66.0), AML (67.5), and rhabdomyosarcoma (66.1) had the lowest survival.
- The largest sex-based difference was observed for rhabdomyosarcoma (74.1 for males vs. 66.1 for females).

Figure 17. Five-year Relative Survival‡ (percentage) by Sex and Type, Ages 15-19, California, 2007-2021



3 highest survival sites by sex

3 lowest survival sites by sex

Source: California Cancer Registry, California Department of Public Health

‡Relative survival is not shown for any sites with fewer than 20 cases during the time period.

Abbreviations: ALL, acute lymphocytic leukemia; NHL, non-Hodgkin lymphoma; AML, acute myeloid leukemia; bb, benign brain

- Female adolescents had a higher five-year relative survival for melanoma, germ cell tumors, NHL, ependymoma, neuroblastoma, astrocytoma, hepatic tumors, osteosarcoma, rhabdomyosarcoma, and embryonal tumors. Male adolescents had a higher five-year relative survival for Ewing sarcoma and AML (Figure 17).
- The three cancers with the highest five-year relative survival among adolescent males were Hodgkin lymphoma (97.0), thyroid carcinoma (100.0), and germ cell tumors (95.9) while the three cancers with the lowest five-year relative survival were neuroblastoma (60.1), hepatic tumors (46.9), and rhabdomyosarcoma (41.7).
- Among female adolescents, the cancers with the highest five-year relative survival were thyroid carcinomas (99.7), germ cell tumors (99.0), and retinoblastoma (100.0) while the cancers with the lowest five-year relative survival were hepatic tumors (58.7), Ewing sarcoma (54.8), and rhabdomyosarcoma (53.1).
- Females had notably higher survival rates than males for neuroblastoma (75.1% vs. 60.1%), hepatic tumors (58.7% vs. 46.9%), and rhabdomyosarcoma (53.1% vs. 41.7%). In contrast, males had significantly better survival than females for Ewing sarcoma (64.4% vs. 54.8%).

SURVIVAL WAS HIGHEST FOR CHILDREN AND ADOLESCENTS WITH THYROID CARCINOMA, GERM CELL TUMORS, AND HODGKIN LYMPHOMA

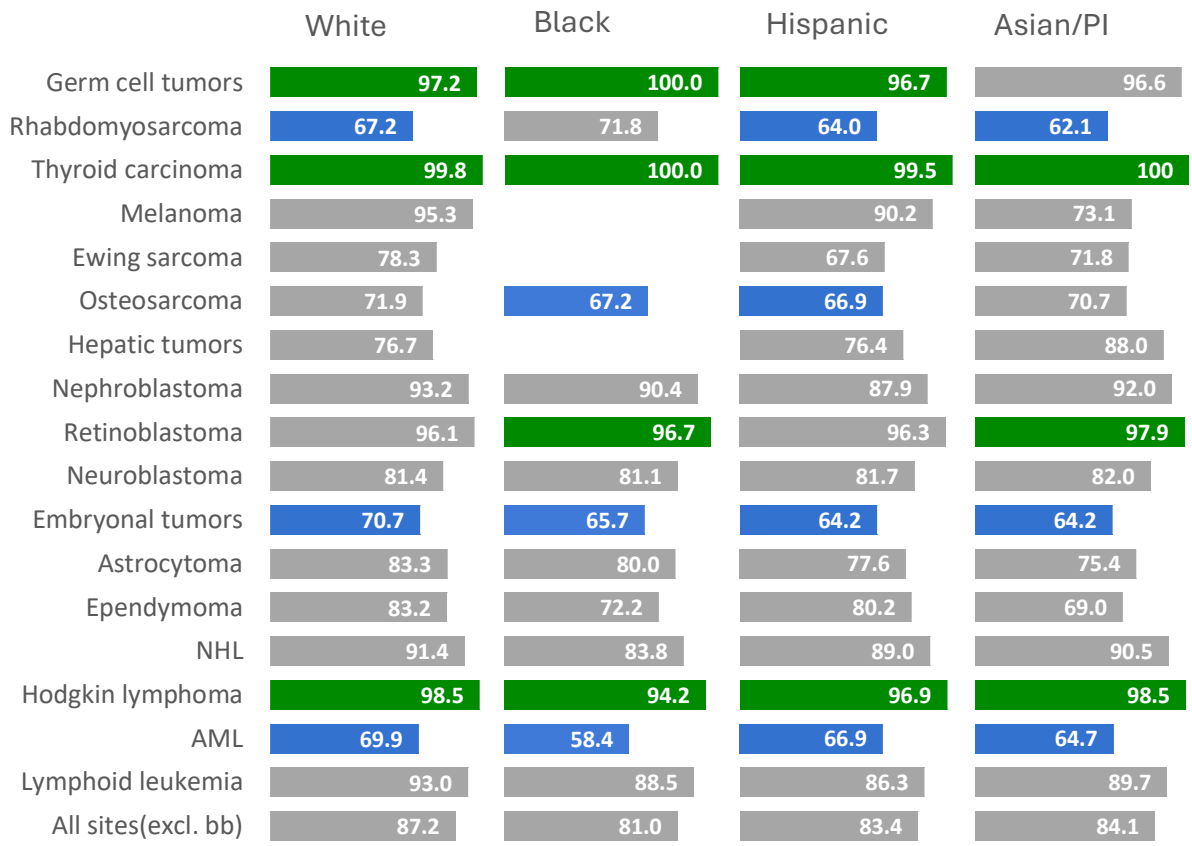
Five-year Relative Survival by Type and Race/Ethnicity

Overall, survival rates for all cancer types were highest for White children and adolescents (87.2) and lowest for Black children and adolescents (81.0).

SURVIVAL WAS LOWEST FOR BLACK CHILDREN AND ADOLESCENTS

- Across racial/ethnic categories, relative survival was highest for those diagnosed with thyroid carcinoma, germ cell tumors, Hodgkin lymphoma, and retinoblastoma and lowest for embryonal tumors, rhabdomyosarcoma, osteosarcoma, and AML (Figure 18).
- By cancer type, Black children and adolescents diagnosed with AML (58.4) had the lowest relative survival.
- Black children and adolescents diagnosed with germ cell tumors (100.0) or thyroid carcinoma (100.0) and Asian/PI children and adolescents diagnosed with thyroid carcinoma (100.0) had the highest relative survival across all cancer types and racial/ethnic groups.
- The largest race/ethnicity-based difference in five-year relative survival was observed in Asian/PI children and adolescents with melanoma, with a five-year survival rate of 73.1%, compared to 95.3% for White patients and 90.2% for Hispanic patients.

Figure 18. Five-year Relative Survival‡ (percentage) by Race/Ethnicity* and Type, Ages 0-19, California, 2007-2021



3 highest survival sites by race/ethnicity

3 lowest survival sites by race/ethnicity

Source: California Cancer Registry, California Department of Public Health

‡Relative survival is not shown for any sites with fewer than 20 cases during the time period.

Abbreviations: NHL, non-Hodgkin lymphoma; AML, acute myeloid leukemia; ALL, acute lymphocytic leukemia; bb, benign brain

**non-Hispanic White (White), non-Hispanic Black (Black), Hispanic, Asian or Pacific Islander (Asian/PI)*

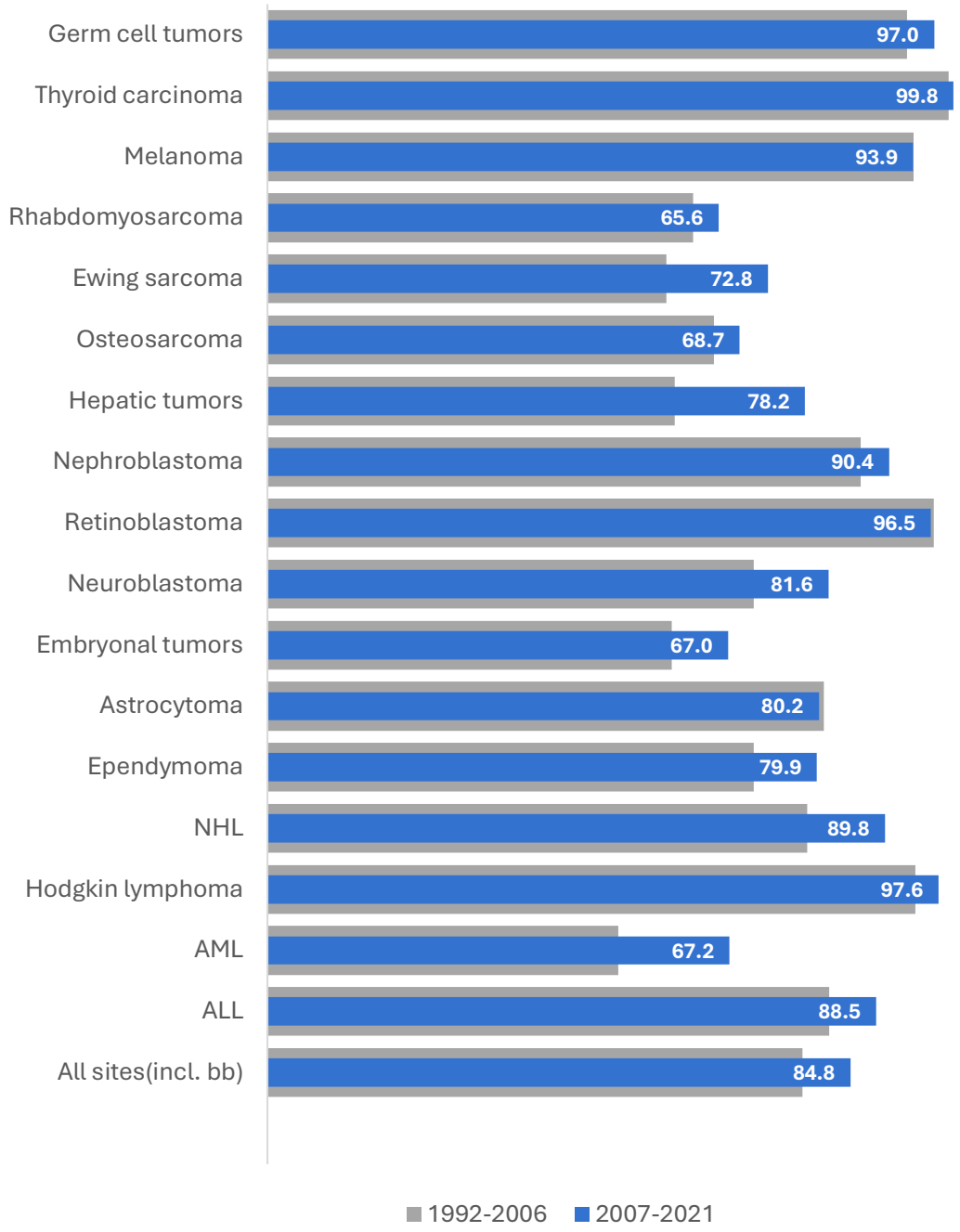
Five-year Relative Survival by Type and Time Period

SURVIVAL INCREASED FOR CHILDREN AND ADOLESCENTS OVER THE STUDY PERIOD

Five-year relative survival for children and adolescents with cancer in California increased from 77.8 (1992-2006) to 84.8 (2007-2021).

- Relative survival increased for 14 of the 17 cancer sites (Figure 19).
- Relative survival did not increase for those with astrocytoma, melanoma, and retinoblastoma. However, survival for melanoma and retinoblastoma was high (93.9, 96.5 respectively).
- Large increases in survival were seen for Ewing sarcoma, hepatic tumors, neuroblastoma, embryonal tumors, ependymomas, NHL, and AML.

Figure 19. Comparison of Five-year Relative Survival (percentage) by Type, Ages 0-19, California, 1992-2006 and 2007-2021

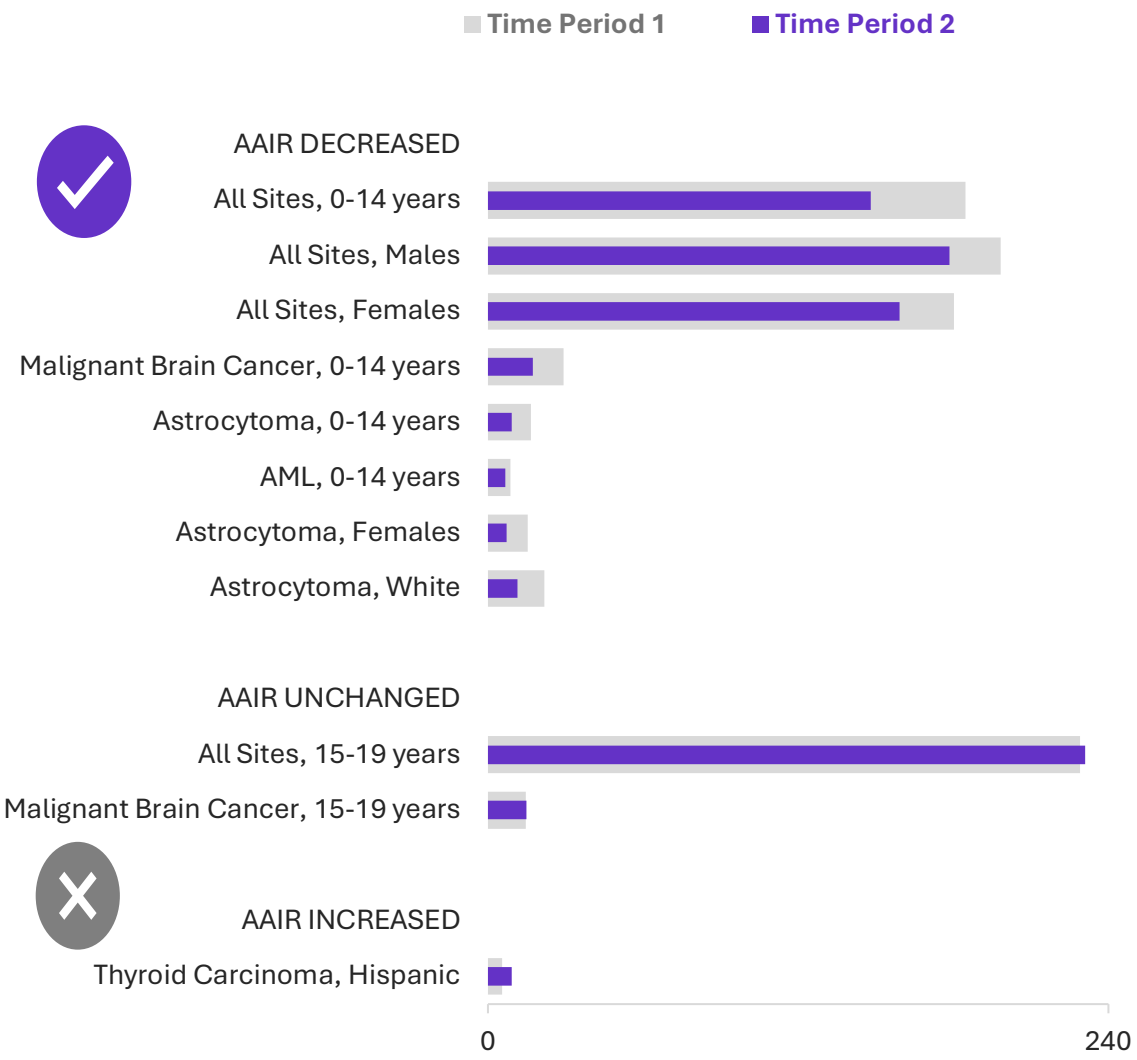


Source: California Cancer Registry, California Department of Public Health
Abbreviations: NHL, non-Hodgkin lymphoma; AML, acute myeloid leukemia; ALL, acute lymphocytic leukemia; bb, benign brain

SUMMARY AND CONCLUSION

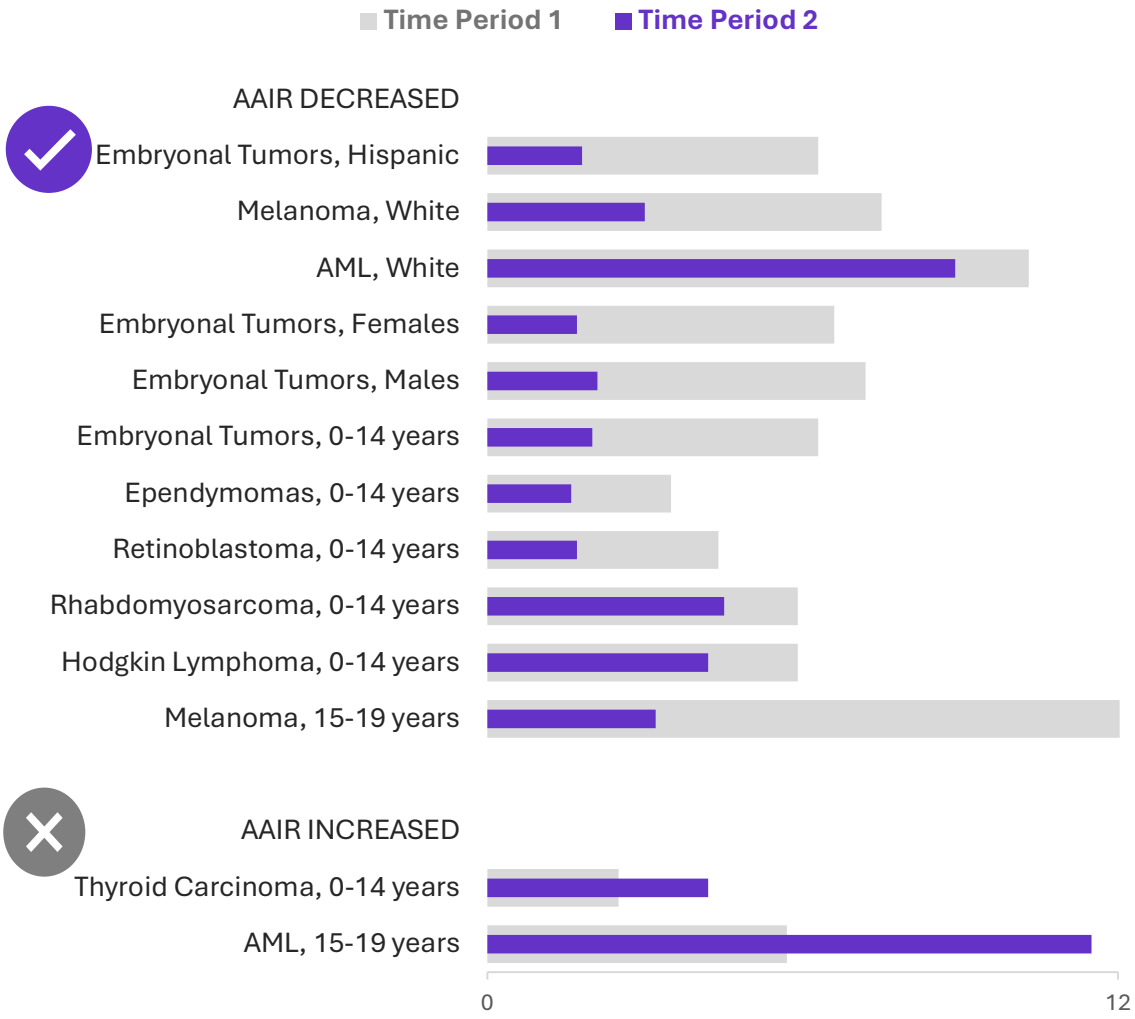
- For all cancer types combined, incidence rates were higher among adolescents (vs. children) and higher among male (vs. female) children and adolescents; by race/ethnicity, AAIRs were highest for White children and adolescents.
- Among children, incidence rates decreased for all sites combined and for malignant brain cancer overall, astrocytoma, and AML (Figure 20).
- Among adolescents, incidence rates for all sites combined and for malignant brain cancer remained unchanged over the study period.
- The incidence rates for thyroid carcinoma increased among children and among Hispanic children and adolescents.
- The incidence rates for AML increased among adolescents.
- Incidence rates decreased for embryonal tumors, ependymomas, retinoblastoma, rhabdomyosarcoma, and Hodgkin lymphoma among children, but only the incidence rates for melanoma decreased among adolescents (Figure 21).
- Incidence rates for embryonal tumors decreased for male and female children and adolescents as well as for Hispanic children and adolescents.
- Among White children and adolescents, incidence rates for melanoma, AML, and astrocytoma decreased.
- Five-year relative survival was highest for children and adolescents with thyroid carcinoma, germ cell tumors, and Hodgkin lymphoma.
- Male children and adolescents had lower five-year relative survival than their female counterparts.
- By race/ethnicity, survival was lowest for Black children and adolescents.
- Survival increases were observed overall and for the most common cancer types (Figure 22). Patients with astrocytoma did not experience survival increases.
- Five-year relative survival was relatively low for AML but increased 16 percentage points over the time period.

Figure 20. Summary of Trends in Age-Adjusted Incidence Rates (AAIR) Among Children and Adolescents Ages 0-19, California, 2007-2021



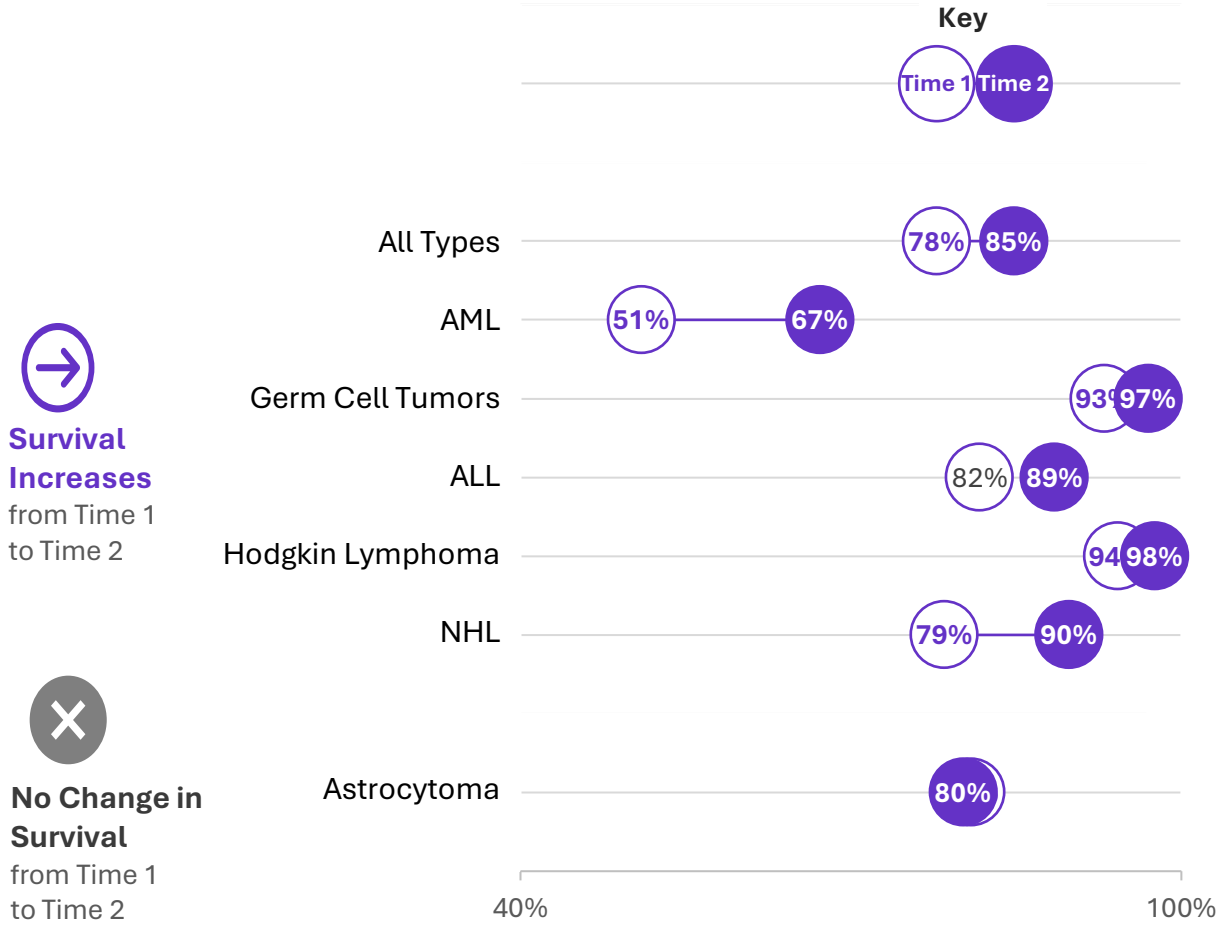
Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
Abbreviations: AML, acute myeloid leukemia
If no joinpoint was detected, time period 1 is 2007. If joinpoint was detected, time period 1 is the start of the last joinpoint segment.

Figure 21. Summary of Trends in Age-Adjusted Incidence Rates (AAIR) Among Children and Adolescents Ages 0-19, California, 2007-2021 for Cancer Types in Appendix Tables 1-3



Source: California Cancer Registry, California Department of Public Health
Rates are per 1,000,000 and age adjusted to 2000 U.S. standard population.
Abbreviations: AML, acute myeloid leukemia
If no joinpoint was detected, time period 1 is 2007. If joinpoint was detected, time period 1 is the start of the last joinpoint segment.

Figure 22. Summary of Changes in Five-Year Relative Survival for Common Cancer Types in Children and Adolescents, Ages 0-19, California, 1992-2006 to 2007-2021



Source: California Cancer Registry, California Department of Public Health
Abbreviations: AML, acute myeloid leukemia; ALL, acute lymphocytic leukemia; NHL, non-Hodgkin lymphoma
Time 1: 1992-2006; Time 2: 2007-2021

In conclusion, we observed declines in incidence for many cancer types and overall increases in survival. However, we observed some notable differences by age group, sex, race/ethnicity, and cancer type. Incidence rate decreases were observed mostly for children and not for adolescents. Male children and adolescents had lower five-year relative survival compared to females. Five-year relative survival was lowest among Black children and adolescents. Incidence rates increased for thyroid cancer among children and among Hispanic children and adolescents; incidence rates of AML increased among adolescents.

Our findings of fewer improvements among adolescents are in line with other studies. Miller et al. found incidence rate increases among adolescents overall and for AML.[5] Causes for these increases are not entirely known, but factors that may contribute include underlying hereditary syndromes, which can account for up to 8% of diagnoses.[6,7] Lifestyle and environmental factors associated with cancer in adults, such as smoking, alcohol, obesity, air pollution, and asbestos, take time to influence cancer risk and are not thought to be significant contributors to cancer development in adolescents.[8] Although there is evidence that increased risk of some cancer types may be linked to prior exposure to radiation from CT scans or from earlier cancer related treatments with radiation or chemotherapy, these studies have been among adults and the implications for adolescents are unclear.[9,10]

The decreased incidence rates in brain cancer overall and brain cancer subtypes have been observed elsewhere.[11,12] Over the past decade, many molecular alterations have been identified for central nervous system tumors.[13] Molecular testing is now used to classify brain tumors and has led to the identification of more tumor types.[14] Categorization into more tumor types could possibly explain the decreasing incidence rates we found for astrocytomas, ependymomas, and embryonal tumors. Continued surveillance of these trends is warranted.

Our findings of increasing thyroid carcinoma incidence rates among children are consistent with prior research. Increasing thyroid carcinoma incidence rates among children have been seen in the United States over the past several decades.[15,16] Reasons are unclear, but could be related to better diagnostics or prior treatment with radiotherapy.[17,18] Additionally, racial/ethnic differences have been observed with Hispanic children experiencing pronounced increases in incidence.[19]

We observed an increase in five-year relative survival across many cancer types over time. This is potentially attributable to improvements in diagnostic techniques, risk assessment, and treatment strategies.[20] Although survival increased overall for some cancer types, it was particularly low for male adolescents with rhabdomyosarcoma or hepatic tumors, and female adolescents with rhabdomyosarcoma or Ewing sarcoma. Sex-

based differences in five-year relative survival were observed across several cancer types. Although the specific reasons vary by cancer type, differences associated with sex may be influenced by factors, such as differences in treatment response, delays in diagnosis, and underlying tumor biology.[21] Five-year relative survival was lowest for Black children and adolescents which is consistent with previous studies.[22]

AML has had historically low survival rates,[23] but new treatment options have become available including molecularly targeted therapies, immunotherapy, and hematopoietic cell transplantation.[24-26] These new treatments may have contributed to the survival increases we observed.

Our investigation had some limitations. Because of small case counts, we were unable to calculate type specific trends for Black children and adolescents and we were unable to do any analyses for American Indian children and adolescents. Differences in pediatric cancer incidence between racial/ethnic groups have been previously reported[27] and future work should consider including additional years of diagnosis or geographic regions to increase the sample size. Additionally, we did not examine the impact of sociodemographic or clinical factors on survival. Despite these limitations we provided an overview of the burden of cancer among children and adolescents in California. We found that cancer continues to pose a significant health burden for children and adolescents across California.

APPENDIX

Table A1. Age-Adjusted Incidence Rate (AAIR), Annual Percent Change (APC) by Type and Age Group, California, 2007-2021

0-14 years

Cancer Type	Count (2007-2021)	AAIR (2017-2021)	APC1 (95% CI)	Years	APC2 (95% CI)	Years	APC3 (95% CI)	Years
All Types	18,862	158.8	-0.5 (-3.4, 0.7)	2007-2012	3.0 (0.5, 4.5)*	2012-2015	-3.3 (-4.8, -2.5)*	2015-2021
ALL	5391	46.1	-0.2 (-0.9, 0.4)	2007-2021				
AML	978	8.2	0.2 (-1.0, 8.7)	2007-2018	-8.9 (-15.2, -1.6)*	2018-2021		
NHL	866	7.7	1.3 (-0.8, 3.6)	2007-2021				
Hodgkin lymphoma	585	4.7	-1.9 (-3.4, -0.4)*	2007-2021				
Astrocytoma	1571	12.2	2.4 (-0.8, 14.0)	2007-2014	-6.5 (-15.2, -3.3)*	2014-2017		
Embryonal tumors	719	4.3	-2.0 (-4.7, 3.0)	2007-2017	-25.0 (-38.9, -15.8)*	2017-2021		
Ependymomas	327	2.8	1.2 (-1.1, 8.3)	2007-2018	-22.2(-34.0, -6.9)*	2018-2021		
Neuroblastoma	1055	9.0	-1.2 (-3.3, 0.7)	2007-2021				
Retinoblastoma	453	3.4	0.3 (-1.7, 3.7)	2007-2018	-27.5(-36.4, -15.6)*	2018-2021		
Nephroblastoma	861	7.0	-1.4 (-3.4, 0.7)	2007-2021				
Osteosarcoma	500	4.6	0.9 (-3.5, 5.3)	2007-2021				
Ewing sarcoma	262	2.3	0.1 (-4.0, 4.3)	2007-2021				
Rhabdomyosarcoma	563	4.6	-2.3 (-3.7, -0.8)*	2007-2021				
Hepatic tumors	363	0.4	-4.3 (-13.0, 4.9)	2007-2021				
Germ cell tumors	344	1.9	0.0 (-2.5, 2.6)	2007-2021				
Thyroid carcinoma	395	3.8	4.6 (1.2, 7.9)*	2007-2021				
Melanoma	201	1.2	-[a]					

15-19 years

Cancer Type	Count (2007-2021)	AAIR (2017-2021)	APC1 (95% CI)	Years	APC2 (95% CI)	Years	APC3 (95% CI)	Years
All Types	9153	225.9	0.6 (-0.3, 1.4)	2007-2021				
ALL	952	23.5	0.8 (-0.2, 1.9)	2007-2021				
AML	392	8.8	2.7 (-0.5, 13.9)	2007-2014	-15.8 (-5.0, -22.9) *	2014-2017	16.0 (4.4, 31.6)*	2017-2021
NHL	634	16.9	2.1 (-0.2, 4.4)	2007-2021				
Hodgkin lymphoma	1110	28.9	0.2 (-1.6, 2.0)	2007-2021				

Astrocytoma	404	8.1	5.8 (-5.9, 55.7)	2007-2012	-6.0 (-28.3, 1.6)	2012-2021
Embryonal tumors	92	1.5	-[a]			
Ependymomas	49	1.0	-[a]			
Neuroblastoma	13	-[b]	-[a]			
Retinoblastoma	1	-[b]	-[a]			
Nephroblastoma	12	-[b]	-[a]			
Osteosarcoma	323	7.4	0.8 (-2.8, 4.3)	2007-2021		
Ewing sarcoma	135	3.5	-[a]			
Rhabdomyosarcoma	141	3.6	-[a]			
Hepatic tumors	52	1.1	-[a]			
Germ cell tumors	1116	31.9	-0.5 (-3.2, 2.2)	2007-2021		
Thyroid carcinoma	1083	28.1	1.9 (-0.4, 4.1)	2007-2021		
Melanoma	306	56.5	-5.5 (-9.4, -1.6)*	2007-2021		

Source: California Cancer Registry, California Department of Public Health
**Significantly different from zero at p < 0.05*
-[a] APC was not calculated if case count was <8 in any given year.
-[b] AAIR not calculated if count <20 during 2017-2021.
Abbreviations: ALL, acute lymphocytic leukemia; AML, acute myeloid leukemia; NHL, non-Hodgkin lymphoma

Table A2. Age-Adjusted Incidence Rate (AAIR), Annual Percent Change (APC) by Type and Sex, California, 2007-2021

Males

Cancer Type	Count (2007-2021)	AAIR (2017-2021)	APC1 (95% CI)	Years	APC2 (95% CI)	Years
All Types	15,213	186.6	0.80 (0.1, 3.7)*	2007-2015	-1.8 (-4.9, -0.6)*	2015-2021
ALL	3630	46.6	0.4 (-0.5, 1.4)	2007-2021		
AML	754	9.2	-0.2 (-2.7, 2.3)	2007-2021		
NHL	917	11.6	1.0 (-1.4, 3.5)	2007-2021		
Hodgkin lymphoma	919	11.2	-0.8 (-3.1, 1.5)	2007-2021		
Astrocytoma	1055	12.3	-1.7 (-4.7, 1.2)	2007-2021		
Embryonal tumors	489	4.3	-1.1 (-4.7, 11.2)	2007-2017	-24.7 (-42.6, -11.1)*	2017-2021
Ependymomas	205	2.6	-[a]			
Neuroblastoma	539	6.7	-1.3 (-3.9, 1.1)	2007-2021		
Retinoblastoma	234	2.6	-[a]			
Nephroblastoma	405	5.0	-0.8 (-4.1, 2.6)	2007-2021		

Osteosarcoma	487	6.2	1.8 (-2.0, 5.4)	2007-2021		
Ewing sarcoma	245	3.2	-[a]			
Rhabdomyosarcoma	399	4.6	-3.2 (-6.4, 0.1)	2007-2021		
Hepatic tumors	269	0.6	-0.5 (-4.0, 2.9)	2007-2021		
Germ cell tumors	1049	15.9	-0.9 (-2.9, 1.1)	2007-2021		
Thyroid carcinoma	283	3.9	3.5 (-1.5, 8.4)	2007-2021		
Melanoma	218	1.6	-[a]			

Females

Cancer Type	Count (2007-2021)	AAIR (2017-2021)	APC1 (95% CI)	Years	APC2 (95% CI)	Years
All Types	12,802	164.0	1.2 (0.04, 8.2)*	2007-2015	-2.4 (-8.2, -0.4)*	2015-2021
ALL	2713	34.0	-0.8 (-1.9, 0.4)	2007-2021		
AML	616	7.4	-1.4 (-4.4, 1.6)	2007-2021		
NHL	583	8.3	2.6 (-0.2, 5.5)	2007-2021		
Hodgkin lymphoma	776	10.3	-0.4 (-2.9, 2.0)	2007-2021		
Astrocytoma	920	10.0	2.7 (0.1, 6.9)*	2007-2015	-11.1 (-17.0, -7.2)*	2015-2021
Embryonal tumors	322	2.9	-6.8 (-12.9, -0.8)*	2007-2021		
Ependymomas	171	2.1	-[a]			
Neuroblastoma	529	7.1	-1.0 (-3.4, 1.4)	2007-2021		
Retinoblastoma	220	2.5	-[a]			
Nephroblastoma	468	5.6	-2.1 (-4.9, 0.7)	2007-2021		
Osteosarcoma	336	4.3	-0.6 (-4.2, 2.7)	2007-2021		
Ewing sarcoma	152	2.1	-[a]			
Rhabdomyosarcoma	305	4.0	0.4 (-4.2, 4.9)	2007-2021		
Hepatic tumors	146	0.5	-[a]			
Germ cell tumors	411	5.6	1.0 (-1.8, 3.8)	2007-2021		
Thyroid carcinoma	1195	16.2	2.4 (-0.4, 5.1)	2007-2021		
Melanoma	289	2.8	-3.5 (-8.1, 1.0)	2007-2021		

Source: California Cancer Registry, California Department of Public Health
**Significantly different from zero at p < 0.05*
-[a] APC was not calculated if case count was <8 in any given year.
Abbreviations: ALL, acute lymphocytic leukemia; AML, acute myeloid leukemia; NHL, non-Hodgkin lymphoma

Table A3. Age-Adjusted Incidence Rate (AAIR), Annual Percent Change (APC) by Type and Race/Ethnicity**, California, 2007-2021

White

Cancer Type	Count (2007-2021)	AAIR (2017-2021)	APC1 (95% CI)	Years	APC2 (95% CI)	Years
All Types	8,923	189.9	1.4 (0.4, 3.0)*	2007-2015	-2.9 (-5.6, -1.4)*	2015-2021
ALL	1618	38.1	0.7 (-0.5, 1.9)	2007-2021		
AML	377	7.2	-2.0 (-3.7, -0.2)*	2007-2021		
NHL	445	8.9	-0.6 (-4.1, 3.0)	2007-2021		
Hodgkin lymphoma	707	15.6	0.3 (-1.8, 2.3)	2007-2021		
Astrocytoma	815	15.8	3.7 (-1.1, 23.3)	2007-2013	-6.8 (-18.6, -3.5)*	2013-2021
Embryonal tumors	301	4.2	-[a]			
Ependymomas	125	3.2	-[a]			
Neuroblastoma	404	9.4	-0.4 (-4.9, 4.1)	2007-2021		
Retinoblastoma	105	2.3	-[a]			
Nephroblastoma	302	7.1	0.1 (-3.3, 3.3)	2007-2021		
Osteosarcoma	240	5.1	-[a]			
Ewing sarcoma	168	4.2	-[a]			
Rhabdomyosarcoma	217	4.6	-[a]			
Hepatic tumors	109	2.2	-[a]			
Germ cell tumors	338	9.5	-1.4 (-4.2, 1.6)	2007-2021		
Thyroid carcinoma	480	10.2	1.1 (-0.9, 3.0)	2007-2021		
Melanoma	342	5.3	0.6 (-2.4, 8.0)	2007-2017	-21.4 (-36.7, -9.8)*	2017-2021

Black

Cancer Type	Count (2007-2021)	AAIR (2017-2021)	APC1 (95% CI)	Years
All Types	1,438	142.1	-0.4 (-2.4, 1.6)	2007-2021
ALL	205	20.8	-[a]	
AML	76	7.1	-[a]	
NHL	105	9.5	-[a]	
Hodgkin lymphoma	119	11.7	-[a]	
Astrocytoma	115	9.2	-[a]	

Embryonal tumors	46	-[b]	-[a]			
Ependymomas	21	-[b]	-[a]			
Neuroblastoma	67	-[b]	-[a]			
Retinoblastoma	30	-[b]	-[a]			
Nephroblastoma	73	6.7	-[a]			
Osteosarcoma	69	9.3	-[a]			
Ewing sarcoma	9	-[b]	-[a]			
Rhabdomyosarcoma	63	-[b]	-[a]			
Hepatic tumors	19	-[b]	-[a]			
Germ cell tumors	36	-[b]	-[a]			
Thyroid carcinoma	37	-[b]	-[a]			
Melanoma	7	-[b]	-[a]			

Hispanic

Cancer Type	Count (2007-2021)	AAIR (2017-2021)	APC1 (95% CI)	Years	APC2 (95% CI)	Years
All Types	13,905	171.3	0.6 (-0.3, 6.2)	2007-2016	-2.1 (-6.9, -0.2)*	2016-2021
ALL	3783	44.8	-0.8 (-2.1, 0.5)	2007-2021		
AML	694	8.4	8.2 (-2.1, 34.7)	2007-2010	-2.1 (-15.1, 1.4)	2010-2021
NHL	686	9.6	2.1 (-0.3, 4.5)	2007-2021		
Hodgkin lymphoma	693	8.6	-1.3 (-2.9, 0.3)	2007-2021		
Astrocytoma	799	9.5	-1.1 (-5.1, 2.8)	2007-2021		
Embryonal tumors	352	3	-1.5 (-6.1, 22.9)	2007-2015	-13.5 (-29.8, -6.4)*	2015-2021
Ependymomas	185	2	-1.6 (-4.7, 1.6)	2007-2021		
Neuroblastoma	427	5.3	-1.8 (-3.9, 0.4)	2007-2021		
Retinoblastoma	244	2.3	-[a]			
Nephroblastoma	409	4.4	-1.9 (-4.6, 0.9)	2007-2021		
Osteosarcoma	411	5	0.1 (-3.5, 3.7)	2007-2021		
Ewing sarcoma	177	2.1	-[a]			
Rhabdomyosarcoma	333	4.2	-0.1 (-3.9, 3.7)	2007-2021		
Hepatic tumors	212	2.5	-[a]			

Germ cell tumors	950	15.7	0.2 (-2.9, 3.3)	2007-2021		
Thyroid carcinoma	711	9.8	3.8 (1.2, 6.5)*	2007-2021		
Melanoma	92	-[b]	-[a]			

Asian/Pacific Islander

Cancer Type	Count (2007-2021)	AAIR (2017-2021)	APC1 (95% CI)	Years	APC2 (95% CI)	Years
All Types	3,212	153.1	-0.4 (-2.0, 1.1)	2007-2021		
ALL	643	32.4	-0.01 (-2.3, 2.2)	2007-2021		
AML	207	10.3	3.4 (-0.2, 32.2)	2007-2018	-17.8 (-33.6, 0.4)	2018-2021
NHL	225	12.0	3.1 (-3.5, 9.7)	2007-2021		
Hodgkin lymphoma	153	7.3	-[a]			
Astrocytoma	204	7.5	-[a]			
Embryonal tumors	97	3.8	-[a]			
Ependymomas	40	-[b]	-[a]			
Neuroblastoma	146	7.3	-[a]			
Retinoblastoma	66	3.1	-[a]			
Nephroblastoma	75	3.3	-[a]			
Osteosarcoma	92	4.9	-[a]			
Ewing sarcoma	37	1.4	-[a]			
Rhabdomyosarcoma	80	3.7	-[a]			
Hepatic tumors	68	3.0	-[a]			
Germ cell tumors	107	10.5	-[a]			
Thyroid carcinoma	222	11.6	3.2 (-1.4, 8.0)	2007-2021		
Melanoma	23	-[b]	-[a]			

Source: California Cancer Registry, California Department of Public Health
**Significantly different from zero at p < 0.05*
***non-Hispanic White (White), non-Hispanic Black (Black), Hispanic, Asian or Pacific Islander (Asian/PI)*
-[a] APC was not calculated if case count was <8 in any given year.
-[b] AAIR not calculated if count <20 during 2017-2021.
Abbreviations: ALL, acute lymphocytic leukemia; AML, acute myeloid leukemia; NHL, non-Hodgkin lymphoma

Table A4. Five-Year Relative Survival (percentage) by Type and Race/Ethnicity**, California, 2007-2021

Cancer Type	White (n)	Black (n)	Hispanic (n)	Asian/PI (n)
All Types	87.2 (8,683)	81.0 (1,402)	83.4 (13,545)	84.1 (3,120)
ALL	93.0 (1,602)	88.5 (204)	86.3 (3,752)	89.7 (635)
AML	69.9 (342)	58.4 (70)	66.9 (644)	64.7 (191)
Hodgkin lymphoma	98.5 (698)	94.2 (119)	96.9 (685)	98.5 (153)
NHL	91.4 (432)	83.8 (104)	89.0 (664)	90.5 (222)
Ependymoma	83.2 (124)	72.2 (21)	80.2 (178)	69.0 (39)
Astrocytoma	83.3 (791)	80.0 (109)	77.6 (775)	75.4 (192)
Embryonal tumors	70.7 (299)	65.7 (45)	64.2 (775)	64.2 (96)
Neuroblastoma	81.4 (397)	81.1 (66)	81.7 (417)	82.0 (75)
Retinoblastoma	96.1 (104)	96.7 (30)	96.3 (241)	97.9 (66)
Nephroblastoma	93.2 (299)	90.4 (73)	87.9 (408)	92.0 (75)
Hepatic tumors	76.7 (107)	~	76.4 (206)	88.0 (68)
Osteosarcoma	71.9 (229)	67.2 (67)	66.9 (388)	70.7 (87)
Ewing sarcoma	78.3 (162)	~	67.6 (174)	71.8 (35)
Rhabdomyosarcoma	67.2 (212)	71.8 (60)	64.0 (317)	62.1 (78)
Melanoma	95.3 (334)	~	90.2 (88)	100.0 (22)
Thyroid carcinoma	99.8 (463)	100.0 (36)	99.5 (683)	100.0 (216)
Germ cell tumors	97.2 (332)	100.0 (35)	96.7 (944)	96.6 (105)

Follow-up is through December 2021. Cancers that were unstaged at time of diagnosis were excluded.
Source: California Cancer Registry, California Department of Public Health
***non-Hispanic White (White), non-Hispanic Black (Black), Hispanic, Asian or Pacific Islander (Asian/PI)*
Abbreviations: ALL, acute lymphocytic leukemia; AML, acute myeloid leukemia; NHL, non-Hodgkin lymphoma

Table A5. Five-Year Relative Survival (percentage) by Type, Age, and Sex, California, 2007-2021

Cancer Type	0-14		15-19	
	Male (n)	Female (n)	Male (n)	Female (n)
All Types	84.1 (9,969)	84.9 (8,438)	83.1 (4,821)	88.0 (4,026)
ALL	90.7 (2,958)	91.3 (2,392)	74.9 (640)	75.7 (295)
AML	67.0 (492)	67.5 (412)	68.5 (192)	65.3 (165)
Hodgkin lymphoma	98.1 (366)	99.0 (211)	97.0 (545)	97.3 (556)
NHL	90.7 (517)	89.2 (326)	88.1 (380)	91.3 (237)
Ependymoma	78.1 (170)	77.9 (150)	89.1 (28)	92.4 (19)
Astrocytoma	81.6 (802)	83.1 (723)	70.1 (210)	74.7 (170)
Embryonal tumors	66.2 (424)	66.0 (283)	73.0 (59)	76.2 (31)
Neuroblastoma	80.2 (519)	83.2 (511)	~	~
Retinoblastoma	94.2 (232)	99.1 (217)	~	~
Nephroblastoma	89.0 (400)	92.4 (457)	~	~
Hepatic tumors	81.6 (236)	82.2 (119)	46.9 (30)	58.7 (21)
Osteosarcoma	71.0 (257)	71.1 (216)	63.6 (206)	68.3 (103)
Ewing sarcoma	79.0 (152)	80.1 (101)	80.7 (84)	54.8 (49)
Rhabdomyosarcoma	74.1 (304)	66.1 (240)	41.7 (80)	53.1 (54)
Melanoma	94.7 (92)	92.1(104)	92.2 (121)	95.6 (174)
Thyroid carcinoma	100.0 (90)	98.8 (287)	100.0 (171)	99.7 (878)
Germ cell tumors	99.1(207)	98.2 (207)	95.9 (901)	99.0 (200)

Follow-up is through December 2021. Cancers that were unstaged at time of diagnosis were excluded.

Source: California Cancer Registry, California Department of Public Health

Abbreviations: ALL, acute lymphocytic leukemia; AML, acute myeloid leukemia; NHL, non-Hodgkin lymphoma

Table A6. Five-Year Relative Survival (percentage) by Type, 1992-2021 and 2007-2021

Cancer Type	1992-2006 (n)	2007-2021 (n)
All Types	77.8 (23,945)	84.8 (27,254)
ALL	81.7 (5,627)	88.5 (6,285)
AML	51.0 (1,212)	67.2 (1,261)
Hodgkin lymphoma	94.2 (1,594)	97.6 (1,678)
NHL	78.5 (1,094)	89.8 (1,460)
Ependymoma	70.7 (371)	79.9 (367)
Astrocytoma	80.9 (1,929)	80.2 (1,905)
Embryonal tumors	58.8 (1,016)	67.0 (797)
Neuroblastoma	70.7 (984)	81.6 (1,043)
Retinoblastoma	96.9 (558)	96.5 (450)
Nephroblastoma	86.3 (798)	90.4 (868)
Hepatic tumors	59.2 (310)	78.2 (406)
Osteosarcoma	64.9 (748)	68.7 (782)
Ewing sarcoma	58.0 (368)	72.8 (386)
Rhabdomyosarcoma	61.9 (676)	65.6 (678)
Melanoma	94.0 (723)	93.9 (491)
Thyroid carcinoma	99.1 (745)	99.8 (1,426)
Germ cell tumors	93.0 (1,139)	97.0 (1,443)

Follow-up is through December 2021. Cancers that were unstaged at time of diagnosis were excluded.
Abbreviations: ALL, acute lymphocytic leukemia; AML, acute myeloid leukemia; NHL, non-Hodgkin lymphoma

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