Asthma in California

A Surveillance Report

May 2013

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Contents

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Executive Summary

Asthma is one of the most common chronic diseases and has been recognized as a growing public health concern. The effects of asthma include missed school and work days, disruption of sleep and daily activities, urgent medical visits for asthma exacerbations, and even death. Asthma affects not only those with the disease but also their family members and friends, as well as schools and businesses. There is no cure for asthma, but symptoms can be controlled with access to medical care, appropriate medications, proper self-management, and trigger reduction. When asthma is controlled, people can lead normal lives and achieve their goals.

California's asthma surveillance system uses data from a wide variety of sources to describe the burden of asthma in the state. Surveillance data include, but are not limited to: the number of people with asthma, levels of symptoms, use of routine health care, visits to the emergency department (ED) and hospital, costs of health care utilization, and deaths due to asthma. Using all of the most recent available statewide surveillance data, this report presents a comprehensive summary of the burden of asthma in California.

Approximately five million Californians have been diagnosed with asthma at some point in their lives, and almost three million currently have asthma. Over one in five with current asthma are considered to have very poorly controlled asthma. Asthma results in an estimated 11.8 million days of work/usual activities missed per year among adults and 1.2 days of school/day care missed per year among children. Surveillance data show that there is much room for improvement in routine health care for people with asthma. More than half of adults with current asthma have not had a routine asthma checkup in the past year and only 40% of adults and children with asthma have received a written asthma action plan from their health care provider. More encouraging is that the rates of the most serious outcomes — hospitalizations and deaths due to asthma — have declined. Still, there are about 400 deaths, 35,000 hospital discharges, and 180,000 emergency department visits per year due to asthma. In addition, the costs of asthma hospitalizations are enormous — over $1 billion in 2010. Proper prevention efforts could reduce many of these poor outcomes and costs. For example, 12% of people who were hospitalized for asthma in 2010 had at least one repeat visit during that year. Intervening to prevent these repeat asthma hospitalizations could potentially have saved $156 million in medical costs.

Across all measures of asthma burden, there are large disparities by race/ethnicity, income, age, sex, and other characteristics. Blacks have especially disproportionate rates of asthma ED visits, hospitalizations, and mortality. Although people of all incomes have a similar prevalence of asthma, people with lower incomes have more poorly controlled

asthma, higher rates of ED visits and hospitalizations, and are more likely to have repeat hospitalizations. These and other key findings of this report are listed below.

Key Findings

Prevalence

- In 2010, 13.1% of adults and 12.5% of children had been diagnosed with asthma at some point in their lives (lifetime asthma); 7.9% of adults and 7.4% of children had current asthma.
- Each year, there are an estimated 189,700 new cases of asthma in California—approximately 93,150 among adults and 96,550 among children.
- Among adults, both lifetime and current asthma prevalence have increased slightly over time and are similar to prevalence in the U.S. overall.
- Among males with asthma, a higher percentage had their asthma start as a child (69%) than as an adult (31%). Among females with asthma, roughly the same percentage had their asthma start as a child (48%) or as an adult (52%).
- It is estimated that over 974,000 adults in California have asthma that has been caused or aggravated by their work, but work-related asthma (WRA) is often not recognized or diagnosed.

Morbidity and Control

- The majority of adults and children with current asthma (65.9% and 53.7% respectively) had asthma symptoms in the past month.
- Approximately 649,000 adults with current asthma (36.4%) missed work or were unable to carry out their usual activities because of their asthma at some point in the past year. This translates to an estimated 11.8 million days of work/usual activities missed per year.
- Approximately 129,000 children with current asthma (52.3%) missed school or day care because of their asthma at some point in the past year. This translates to an estimated 1.2 million days of school/day care missed per year.
- While most adults and children with current asthma are classified as having well controlled asthma, over one in five are considered to have very poorly controlled asthma.
- Compared to those with well controlled asthma, people with poorly controlled asthma are more likely to miss work or school, have an ED visit for asthma, or be hospitalized for asthma.
- The majority of people with work-related asthma (WRA): (1) cannot do their usual work (56%), (2) report continuing symptoms (56%), and (3) have gone to the ED for their WRA (61%).
- Asthma impact and impairment are greater for adults with WRA than non-WRA.

Routine Health Care

- 19.4% of adults and 4.7% of children with current asthma were uninsured at some point in the past year.
- 11.2% of adults and 9.1% of children with current asthma do not have a usual place for health care.
- About three out of four children have had at least one routine asthma checkup in the past year. Among adults, however, over half have not had a routine asthma checkup in the past year.
- Approximately one quarter of adults and children (27.7% and 24.1%, respectively) used only a rescue medication in the past 3 months (i.e., they did not use any controller medication).
- 88.6% of Medi-Cal Managed Care beneficiaries with persistent asthma receive appropriate medications.
- Flu (influenza) infection can exacerbate asthma symptoms, yet more than one third of children and half of adults with current asthma did not get a flu vaccination in the past year.
- Only about 40% of adults and children have ever been given a written asthma action plan by their health care provider.
- Only 30% of adults and 45% of children have ever been advised to change their home, work or school environment to reduce their asthma symptoms.

Emergency Department Visits, Hospitalizations, and Mortality

- In 2010, there were 179,972 asthma ED visits, or an age-adjusted rate of 46.1 per 10,000 residents.
- In 2010, there were 34,796 asthma hospitalizations, or an age-adjusted rate of 9.0 per 10,000 residents.
- In 2010, of all people who had an asthma hospitalization, 11.6% came back for at least one subsequent asthma hospitalization during that year.
- Asthma hospitalization rates in California have decreased in the past 16 years.
- Asthma ED visits and hospitalizations vary consistently by season, with lower numbers in the summer.
- In 2009, there were 415 deaths due to asthma, or a rate of 11 per million residents. These deaths corresponded to 7,038 years of potential life lost or 17 years lost per person.
- The rate of asthma deaths in California has been decreasing from 2000 to 2009, similar to national trends.

Disparities

- Blacks have the most striking disparity in the burden of asthma. Compared to Whites, Blacks have 40% higher asthma prevalence, four times higher asthma ED visit and hospitalization rates, and two times higher asthma death rates.
- Asthma prevalence among American Indian/Alaska Native (AI/AN) adults is 1.5-2.0 times higher than among White adults (23.3% vs. 15.1% for lifetime asthma and 17.5% vs. 8.9% for current asthma).
- Hispanics have comparatively low asthma prevalence overall, but asthma hospitalization and ED visit rates are higher in Hispanics than Whites, especially among children.
- There are variations in asthma prevalence among Hispanic racial/ethnic subgroups. Lifetime asthma prevalence ranges from a high of 20.6% among European Hispanics to a low of 7.7% among Guatemalans. Similarly, current asthma prevalence ranges from 9.7% among European Hispanics to 4.6% among Guatemalans.
- Pacific Islanders and Filipinos are two subgroups with a high asthma burden; both have high lifetime asthma prevalence, asthma mortality rates, and Medi-Cal asthma hospitalization rates.
- The rate of asthma hospitalizations and ED visits is four times higher for people living in areas where the median household income is $20,000 or less compared to those living in areas where the median household income is more than $100,000.
- Adults with higher household incomes (over $50,000) are about 50-60% more likely to have well controlled asthma than adults with lower incomes; adults who report cost barriers to receiving medical care are significantly less likely to have well controlled asthma than those who do not report cost barriers (33.2% vs. 56.7%).
- Asthma affects people of all ages, but asthma prevalence, hospitalization rates, and ED visit rates are higher for children than adults.
- Among adults, the burden of asthma is greater for females; among children, the burden of asthma is greater for males.
- People born in the U.S. are more likely to have asthma than people born outside of the U.S. The disparity is largest for Hispanics and Asians, who are two to three times more likely to have asthma if they were born in the U.S.
- Lesbian and bisexual females have particularly high asthma prevalence—over 24% lifetime asthma prevalence and 14%–17% current asthma prevalence, which is about 70% higher than straight females.

Costs

- Total charges for asthma hospitalizations in 2010 were over $1 billion (including $155.6 million for repeat hospitalizations).
- The average charge per asthma hospitalization more than doubled between 1995 ($13,247 in 2010 dollars) and 2010 ($33,749). In contrast, the average length of stay for asthma hospitalizations hardly changed (average 3.4 days from 1998-2010).
- Medicare and Medi-Cal covered 65% of asthma hospitalizations and 50% of asthma ED visits in 2010.

Risk Factors

- Almost 12% of adults and teens with current asthma are smokers.
- About 10% of adults with current asthma and 5% of children with current asthma are exposed to secondhand smoke in the home.
- On average, people with asthma are exposed to 2-3 asthma triggers in the home (e.g., mold, cockroaches, rodents, pets, carpeting, wood burning or gas appliances, and tobacco smoke).
- As in the general California population, about 40% of people with asthma are renters, which can impact a resident's ability to reduce exposure to asthma triggers in the home.
- People with work-related asthma (WRA) are most commonly exposed to the following asthma triggers in the workplace: dust, unknown chemicals, cleaning materials, smoke, mold, indoor air pollutants, and paint.
- Outdoor air pollutants are important asthma triggers; their levels vary widely across the state.

Recommendations

To affect changes in asthma outcomes and to increase the effectiveness of prevention efforts, there is a need for systems change in a variety of settings. In a state as large as California, such changes require the participation of many different stakeholders. The California Department of Public Health (CDPH) has created and implemented a Strategic Plan for Asthma in California (SPAC), which allows for facilitation and coordination of asthma activities throughout the state. The SPAC was first developed in 2002, was revised in 2008, and is currently being reviewed to be updated in 2013. Using the SPAC as a guide, the recommendations below are provided as broad goals for asthma-related activities in California.

- Maintain the current asthma surveillance system in California, and address data gaps by expanding current data services, developing new data sources, and making new partnerships with organizations that collect data. Areas with the most significant

data gaps include: doctor's office visits, medications, triggers, costs, and quality of life. There is also a lack of local data for many measures.

- Use surveillance data to inform policy and to help plan, implement, and evaluate interventions, with particular attention to vulnerable populations.
- Improve the quality of asthma prevention, diagnosis, treatment, and management throughout the health care system. Expand access to care and facilitate reimbursement for comprehensive asthma management.
- Establish comprehensive and coordinated policies and procedures in schools and childcare centers to ensure the health and well-being of students and staff with asthma. These policies and procedures should address: improving indoor air quality, educating the public and providers about asthma management, increasing the number of personnel who are knowledgeable and competent around asthma, and minimizing exposure to unhealthy outdoor air.
- Promote asthma-safe healthy housing that minimizes indoor environmental risk factors through home assessments, remediation, and education of tenants, landlords, home owners, and regulators in the housing industry.
- Reduce workplace exposure to asthma triggers and asthmagens (substances documented to be capable of causing new-onset asthma) by evaluating worksites, promoting prevention efforts within industries, expanding surveillance for work-related asthma, and increasing awareness of the issue among workers, health care providers, and employers.
- Create a safer outdoor environment, with particular emphasis on communities with disproportionate exposure to pollution. Reduce air pollution from sources such as: transportation, freight transport, industry, agriculture, and secondhand smoke.
- Support efforts to reduce the burden of other conditions that affect and/or are affected by asthma. Empower individuals, communities, and institutions to create environments that support healthy lifestyles including living tobacco free, making healthy food and beverage choices, and promoting physical activity.

Introduction

What is asthma?

Asthma is a chronic inflammatory lung condition characterized by recurrent episodes of breathlessness, wheezing, coughing, and chest tightness. The severity of symptoms can range from mild to life-threatening. Since the early 1980s, the prevalence of asthma has been increasing in California and nationwide. In 2010, there were approximately 19 million adults and 7 million children with asthma in the United States.[1] In 2008, there were approximately 10.5 million school days and 14.2 million work days missed due to asthma, and in 2007 there were approximately 1.8 million emergency department visits, 456,000 hospitalizations and 3,450 deaths due to asthma nationwide.[2,3]

Asthma also has a substantial economic impact. In 2007, asthma cost the U.S. a total of $56 billion — $50 billion in direct medical expenses and an estimated $6 billion in indirect costs, such as time lost from work. These costs increased about 6% from 2002 to 2007.[4]

New-onset asthma may have a variety of causes, but specific causes cannot be identified for most cases. However, studies have identified several factors that can increase the likelihood of developing asthma. These include: a family history of asthma and/or allergies; certain respiratory infections during early childhood; and exposure to tobacco smoke, house dust mites, cockroaches, or cat dander.[5,6] In addition, research has found over 400 substances, most often found in occupational settings, that are responsible for causing a proportion of new-onset asthma cases.[7,8]

Much more is known about asthma triggers — things that bring on asthma symptoms and asthma episodes. Each person with asthma may be susceptible to different triggers. Some known asthma triggers are listed below.

Air pollution	Changes in weather	Cockroaches
Dust mites	Exercise	Menstrual cycles
Mold	Animal and pet dander	Pollen
Stress	Strong odors	Tobacco smoke
Viral infections	Wood smoke	Certain medications

There is no cure for asthma, but with proper management most people can control their condition so that symptoms occur infrequently and have a minimal im-

1 NCHS, 2009
2 Akinbami, 2011
3 Xu, 2010
4 CDC, 2011
5 NHLBI, 2011
6 IOM, 2000
7 Tarlo, 2008
8 AOEC, 2012

pact on daily life. This takes effort — by people with asthma, parents or caregivers, and health care providers. To keep asthma under control, people with asthma and parents of children with asthma need to learn about asthma, use medications as directed by a clinician, avoid asthma triggers to the greatest extent possible, get regular checkups, and follow an asthma action plan.[9] Standards of care for health care providers have been developed by the National Asthma Education and Prevention Program (NAEPP) of the National Heart, Lung, and Blood Institute.

Governments, communities, and organizations can also adopt policies that help people control their asthma. This might include regulations to decrease outdoor air pollution, bans on smoking in multi-unit housing, and schools using cleaning products free of substances known to cause or trigger asthma. To learn more about ways to reduce asthma in schools, childcare centers, homes, institutional settings, and workplaces, see the Strategic Plan for Asthma in California (www.californiabreathing.org).

Asthma as a Public Health Priority in California

The California Department of Public Health (CDPH) has identified asthma as an important public health concern. In 2002, CDPH developed its first *Strategic Plan for Asthma in California* as a blueprint for taking action, and the *Plan* was extensively revised in 2008. The revised *Plan* was created with the help of stakeholders from public health, medical, environmental, and community organizations, as well as asthma experts and people personally affected by asthma. The *Plan* sets a direction for asthma interventions by outlining priority goals and objectives. Currently, CDPH is re-convening stakeholders to revise and update the *Plan*, with an expected release in 2013.

A number of programs within the CDPH Division of Environmental and Occupational Disease Control (DEODC) include activities related to asthma. These programs are described below.

California Breathing is charged with implementing components of the *Strategic Plan for Asthma in California* through a comprehensive public health approach. California Breathing activities include: maintaining an asthma surveillance system for California and disseminating findings, creating an infrastructure for a statewide partnership of asthma stakeholders (California Asthma Partners), administering programs to address asthma disparities, and conducting activities to improve asthma-related policies and practices in schools, childcare centers, and housing. More information about California Breathing can be found at www.californiabreathing.org.

The Indoor Air Quality (IAQ) program's mission is to investigate indoor air pollution, develop solutions, and promote healthy indoor environments. The program provides technical guidance on regulations and standards, provides information to health agencies and the public, and develops techniques and studies to investi-

9 NHLBI, 2011

gate the links between environmental exposures and disease. More about the IAQ program's projects and resources can be found at www.cal-iaq.org.

The Work-Related Asthma Prevention Program (WRAPP) aims to identify industries, occupations, and exposures that put workers at risk for work-related asthma, and to find ways to help employers and workers prevent work-related asthma. The National Institute for Occupational Safety and Health (NIOSH) funds California (along with four other states) to track work-related asthma through data collection and case interviews. More information on WRAPP can be found at www.cdph.ca.gov/programs/ohsep/Pages/Asthma.aspx.

The Healthy Housing Program, a collaboration of several DEODC programs, promotes healthy housing through various activities including: disseminating data on healthy housing indicators, sponsoring research symposia and trainings based on healthy housing principles, co-founding and participating in the California Healthy Housing Coalition (CHHC), and coordinating a CDPH Healthy Housing Work Group. More information can be found at www.californiabreathing.org/about-us/projects-initiatives/181-cdcp-hhp.

Hundreds of other governmental and non-governmental organizations throughout California work on asthma-related initiatives as well. It would be difficult to outline the breadth and scope of all statewide asthma-related activities in this report. However, California Asthma Partners — a project of California Breathing — has identified organizations working on asthma and linked their efforts to the objectives in the Strategic Plan for Asthma in California. More information about organizations working on asthma in California can be found at www.asthmapartners.org.

Asthma Surveillance in California

The CDC defines surveillance as "a series of ongoing systematic activities, including collection, analysis, and interpretation of health-related data essential to planning, implementing, and evaluating public health practice closely integrated to the dissemination of data to those who need to know and linked to prevention and control."[10] Surveillance is an essential public health activity intended to monitor a population's health. This is different from research, which is conducted for the purpose of advancing and generating new knowledge that can be applied beyond any one specific population.

Ideally, an asthma surveillance system would include data on all parts of the spectrum of experiences, health care, and quality of life for people with asthma. The Asthma Surveillance Pyramid shown on the following page is a model developed by the CDC to describe the spectrum of asthma. The bottom of the pyramid represents asthma prevalence, or all people with asthma. This is the largest group in the pyramid and covers those with the lowest level of asthma severity as well as those with very well controlled asthma. Each successively higher level in the pyra-

10 CDC, 2010

mid represents an increased level of asthma severity and/or lack of asthma control, and affects a smaller proportion of people. Outside the pyramid are quality of life, cost, pharmacy, and triggers; these are four factors that impact all of the other outcomes in the pyramid.

CDPH has developed an asthma surveillance system that integrates data from a variety of sources. These data sources and their strengths and limitations are described beneath the pyramid on the following page. More detailed information about each of these can be found in the Technical Notes section of this report. CDPH attempts to use all available information for comprehensive asthma surveillance. However, some indicators are not currently accessible.

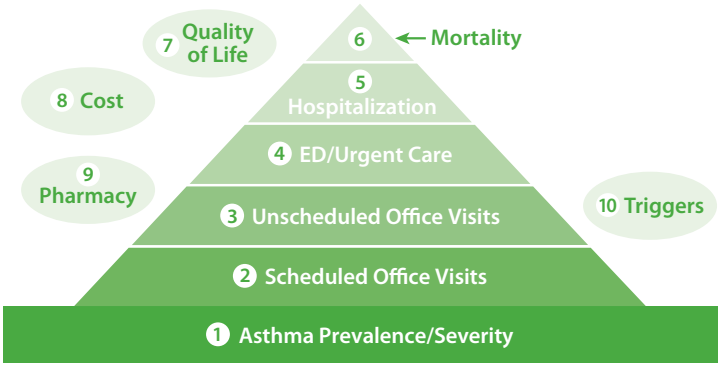
California's asthma surveillance system also includes surveillance of work-related asthma (WRA), though this is not specified in the pyramid. WRA is caused or triggered by conditions or substances in the workplace. An ongoing surveillance system has been in place to track work-related asthma in California since 1993. This system includes doctors' reports of work-related asthma, workers' compensation claims, follow-up interviews with cases, and questions on the Behavioral Risk Factor Surveillance System Asthma Call-Back Survey (BRFSS/ACBS). More information can be found in the work-related asthma section of this report.

As outlined below the pyramid, the California asthma surveillance system is fairly broad, but it has some significant gaps. The indicators with the most room for expansion are: physicians' office visits, pharmacy, asthma triggers, costs, and quality of life. CDPH staff and their partners continually work toward improving and expanding the current asthma surveillance system. For example, this report contains the first California data collected from the ACBS, which was administered in California beginning in 2006. The ACBS is a survey that asks people with asthma an extensive set of questions about their asthma, including detailed questions about symptoms, health care utilization, education provided by health care providers, household environment, and medications.

Description of this Report

This report presents a comprehensive picture of the burden of asthma in California, compiling all available statewide asthma surveillance data in a single document. Data are presented by year to show trends over time and are also grouped by demographics such as age, sex, race/ethnicity, and income to examine disparities. The report clearly shows the significance of asthma as a public health problem in California. It can be used to monitor and evaluate public health programs, and it provides a framework for targeting asthma education, interventions, and policy initiatives. The first report of this kind, entitled The Burden of Asthma in California: A Surveillance Report, was published in 2007. This report updates and expands upon those previously published data. In general, this updated report includes new indi-

The Asthma Surveillance Pyramid: A Description of California's Asthma Data



1. **Asthma Prevalence/Severity:** In California, prevalence is estimated through two telephone surveys, the Behavioral Risk Factor Surveillance System (BRFSS) and the California Health Interview Survey (CHIS). BRFSS has been conducted in California since 1984; however, the sample size of BRFSS is generally too small to get reliable estimates for sub-populations. The CHIS, conducted biennially since 2001, has a much larger sample size and can provide reliable estimates by race/ethnicity and county. Both surveys ask respondents whether they have asthma; CHIS also asks some follow-up questions about morbidity. The Asthma Call-Back Survey (ACBS), a follow-up survey to the BRFSS that has been conducted in California since 2006, asks respondents with asthma detailed questions about their symptoms and medication use. The ACBS can be used to classify level of asthma control. (Although the pyramid specifies asthma severity, NAEPP guidelines now place more emphasis on level of control.)

2/3. **Scheduled and Unscheduled Office Visits:** Currently, there is no centralized system of medical records that includes all asthma-related physician visits in California. The ACBS asks people with asthma how many visits they have had in the past year and whether self-management education was provided. However, self-reported information may be unreliable and does not provide the full extent of information on health care usage and quality that could be obtained from medical records.

4/5. **Emergency Department/Urgent Care and Hospitalizations:** The Office of Statewide Health Planning and Development (OSHPD) collects data on emergency department (ED) visits and inpatient discharges from all licensed acute care hospitals and EDs in California. (ED data have only been collected since 2005.) These data are used to calculate the extent of ED usage and hospitalizations for asthma in the state. This report also contains data on asthma-related ED visits and hospitalizations among Medi-Cal beneficiaries.

6. **Mortality:** The CDPH Office of Health Information and Research compiles death certificate data. These records are used to calculate asthma mortality rates in the state, which have been reported regularly since 2000.

7. **Quality of Life:** Quality of life for people with asthma is currently measured through the BRFSS, CHIS, and ACBS surveys. Topics include activity limitations, work and school days missed, general health status, and co-morbidities. This information is self-reported and extrapolates from a sample population; there is no system for collecting statewide data on the actual total days of work or school missed due to asthma.

8. **Cost:** There are many direct and indirect costs associated with asthma. OSHPD datasets include charges for asthma hospitalizations, which are not equivalent to actual costs, but are generally accepted as a good proxy for hospital costs. Other costs of asthma—both direct costs of health care utilization and medications, as well as indirect costs due to factors such as school and work missed—are not measured on a statewide basis in a systematic way.

9. **Pharmacy:** Asthma surveillance in California includes two sources to describe medication use among people with asthma: 1) The California Department of Health Care Services' measure of appropriate use of medication among Medi-Cal Managed Care enrollees with asthma; 2) Results from the ACBS detailed questions on the types and quantities of asthma medications used. However, there is no system for collecting pharmacy data for all people with asthma throughout the state.

10. **Triggers:** There are many types of asthma triggers and it is difficult to measure levels of exposure. The asthma surveillance system in California includes two main sources of data on asthma triggers: the BRFSS, CHIS, and ACBS surveys and the California Air Resources Board (CARB) monitors. The surveys contain information about potential triggers in the homes of people with asthma (including tobacco smoke, cockroaches, mold, and pets), though all of these data are self-reported. The California Air Resources Board (CARB) monitors, which measure ozone and particulate matter throughout the state, generate data on outdoor air pollutants. However, these data give information for large geographical areas only.

cators and additional demographic groups throughout. A few of the most notable differences from the 2007 report are listed below:

- This report contains data from the California ACBS, which are presented in the Asthma Morbidity and Management section, as well as in parts of the Asthma Prevalence and Environmental Asthma Triggers sections.
- In 2007, complete ED data were not available. This report uses the complete set of ED data and therefore the ED visit rates in the two reports are not comparable.
- County-level data are not presented in this report. California Breathing publishes county-level asthma data on-line in the County Asthma Profiles (http://californiabreathing.org/asthma-data/county-asthma-profiles).
- Data from the California Healthy Kids Survey (CHKS) are not presented in this report, as the number of respondents and reliability of those data for asthma surveillance have declined in recent years.

The main body of this report is divided into the following sections: asthma prevalence, asthma morbidity and management, health status of people with asthma, environmental triggers for asthma, work-related asthma, asthma emergency department visits, asthma hospitalizations, asthma among Medi-Cal members, and asthma mortality. Throughout each section, graphs and tables are accompanied by written summaries. Data sources are noted within each section; more detailed information on methods and data sources is compiled in the Technical Notes section. Data from surveys are presented with 95% confidence intervals (95% CIs). CIs indicate the possible margin of error of the estimate. A detailed explanation of how to interpret CIs is included in the Technical Notes. The main data sections of the report are preceded by a chapter summarizing the report's main findings on disparities in asthma outcomes, and followed by a chapter on how California compares to the CDC's Healthy People 2010 and 2020 objectives.

The various data sources cited in this report use different systems for categorizing race/ethnicity. In order to standardize race/ethnicity labels, we chose to use the names found most commonly in the surveillance data sources. This method does not address the complex issues associated with how these sources originally identified race/ethnicity and also does not address the large and growing population of multi-racial individuals. However, we decided to follow these generally accepted race/ethnicity labels: American Indian/Alaska Native (AI/AN), Asian, Black, Hispanic, Pacific Islander (PI), and White. All Hispanics are grouped into one category, meaning that the other groups are non-Hispanic (e.g., our label White includes only non-Hispanic Whites). When possible, data on Asians and Pacific Islanders are presented separately; otherwise, these groups are combined and labeled as Asian/Pacific Islander (A/PI). In making these particular choices, it is not our intent to offend any race or ethnic group that may disagree with or may feel excluded from these categories.

Similarly, the various data sources cited throughout this report use different systems for categorizing sex and/or gender. Some sources ask respondents to self-identify using the question "Are you male or female?" Other sources ask patients to self-identify using a form labeled either "sex" or "gender", or rely on hospital staff to mark a patient's sex or gender on a medical record. While "sex" generally refers to the biological and physiological characteristics that define men and women, "gender" generally refers to socially constructed roles and attributes that are considered appropriate for men and women. For transgender individuals, one's gender identity does not match one's assigned sex. In this report, we chose to use the term "sex" rather than "gender". Because of the ways that data on sex and gender are collected, this might not always accurately reflect a person's biological sex; however, we have no way of knowing which records are inaccurate. Again, in making this choice, it is not our intent to offend or exclude any individuals on the basis of sex or gender identification.

Asthma Disparities

Health disparities are inequalities in the burden of disease by sex, race/ethnicity, socioeconomic position, or other characteristics. The Strategic Plan for Asthma in California identifies disparities as a priority issue impacting all asthma-related activities. It outlines the need for surveillance data to identify and document disparities in the burden of asthma in California. Data on asthma disparities are included in almost every section of this report, and are summarized below.

Race/Ethnicity

Blacks have the most striking disparity in the burden of asthma; American Indians/Alaska Natives (AI/AN), Puerto Ricans, European Hispanics, Pacific Islanders, and Filipinos also have a high asthma burden.

For Blacks, asthma prevalence is about 40% higher than for Whites (p. 31). Given that, we would expect that Blacks would experience somewhat higher rates of hospitalizations, emergency department (ED) visits, and mortality than Whites. However, the disparities for these measures are much larger. Overall asthma hospitalization and ED visit rates are about four times higher for Blacks (about two times higher for Medi-Cal beneficiaries) and asthma death rates are two times higher for Blacks (pp. 114, 128, 147, 151, 160).

Hispanics overall have a comparatively low asthma prevalence (p. 31). Despite that, asthma hospitalization and ED visits are higher in Hispanics than Whites, especially among children (pp. 115, 130). In addition, lifetime asthma prevalence among Puerto Ricans and European Hispanics is about 30% higher than among Whites (p. 33).

Asthma prevalence for Asians is about equal to or lower than for Whites (p. 31). However, asthma death rates are disproportionately high for Asians (about 30% higher than Whites), and asthma ED visits are disproportionately low (about 50% lower than Whites) (p. 114, 161). Pacific Islanders and Filipinos are two particular Asian subgroups with a high asthma burden. Both Pacific Islanders and Filipinos have especially high lifetime asthma prevalence, asthma mortality rates, and Medi-Cal asthma hospitalization rates (pp. 34, 153, 161).

AI/AN adults have the highest asthma prevalence of any racial/ethnic groups (p. 31). However, overall ED visit and hospitalization rates for asthma among AI/AN are fairly low (pp. 114, 128). This may be due to racial misclassification in hospital records, which has been documented to occur frequently among AI/AN patients.[11] Notably, asthma ED visit and hospitalization rates for AI/AN in Medi-Cal are, on average, 30 percent higher than for Whites (pp. 147, 151). The reasons for these discrepancies are unclear, but perhaps racial classification is more accurate in Medi-Cal enrollment data than in hospital records.

11 Garcia, 2007

Many environmental and individual factors have been suggested as potential causes for asthma disparities by race/ethnicity and income (see section below). These include: exposure to indoor and outdoor air pollutants due to deteriorated housing, location of housing near traffic and/or industrial pollutants, and exposure to tobacco smoke; genetics; unequal access to care and quality of care; underuse of asthma preventive medicines; variations in provider cultural competency and communication styles; and psychosocial factors such as symptom perception, stress, and social support.

Income

The burden of asthma is greater among people who live in areas with lower median incomes, and this disparity is not explained by higher asthma prevalence. Although asthma prevalence does not differ much by income level, the rate of asthma hospitalizations and ED visits is four times higher for people living in areas where the median household income is $20,000 or less compared to those living in areas where the median household income is more than $100,000 (pp. 118, 134). Those in lower income areas are also more likely to have repeat asthma hospitalizations (p. 141). In addition, adults are less likely to have well controlled asthma if they have lower household incomes or report cost barriers to receiving medical care (p. 53, 54).

Sex

Among adults, the burden of asthma is greater for females; among children, the burden of asthma is greater for males. Both lifetime and current asthma prevalence are slightly higher for female adults compared to male adults (p. 30). In addition, more women than men are identified as having work-related asthma (p. 99). Female adults also have higher rates of asthma hospitalizations, asthma ED visits, and asthma mortality than male adults (pp. 117, 133, 163). For children, both lifetime and current asthma prevalence are slightly higher for males compared to females (p. 30). Male children also have higher rates of asthma hospitalizations, asthma ED visits, and asthma mortality than female children (pp. 117, 133, 163). However, for both female adults and male children, the differences in asthma hospitalization, ED visit, and mortality rates are about proportional to the disparity in asthma prevalence.

Similar sex-related disparities in asthma have been demonstrated throughout the epidemiologic literature. However, no single explanation for these differences has been identified. Potential explanations include both biological differences — such as sex hormones or increased bronchial hyper-responsiveness — and sociocultural differences — such as differing perceptions of airflow obstruction or medication compliance.[12]

12 Kynyk, 2011; Melgert, 2007

Age

Asthma has a large impact across all ages, but some asthma measures are higher for children than adults. Both lifetime and current asthma prevalence are highest among children ages 5–17 (p. 29), and asthma hospitalization and ED visit rates are highest among children under age 5 (pp. 112, 125, 146, 150). In addition, asthma hospitalization rates are high and increasing among adults over age 65 (p. 125).

There is no clear explanation of high asthma hospitalization rates among the elderly, but older patients are more likely to have co-morbid conditions that may make management of asthma more difficult.[13] Therefore, hospitalization may be more necessary among these patients. However, it is also possible that asthma is miscoded in some of the hospital records, as chronic obstructive pulmonary disease (COPD) is often misdiagnosed as asthma.[14]

Other

People born in the U.S. are more likely to have asthma than people born outside of the U.S. (p. 35).

Lesbian and bisexual females have significantly higher asthma prevalence than straight females (p. 39).

Certain industries and occupations have particularly high rates of work-related asthma (pp. 105-108).

13 Urso, 2009
14 Tinkelman, 2006

Summary of Asthma Measures by Race/Ethnicity

Measures (All Ages Unless Otherwise Specified)	**Black**	**AI/AN**	**White**	**Hispanic**	**A/PI**
Lifetime Asthma Prevalence (p. 31)	20.8%	21.2%	14.9%	10.0%	12.1%*
Current Asthma Prevalence (p. 31)	13.0%	15.6%	9.0%	5.9%	6.5%*
Percent with Well-Controlled Asthma (adults with current asthma, p. 52)	45.8%	52.0%†	54.7%	48.5%	58.1%*†
Asthma ED Visit Rate (per 10,000, p. 114)	157.5	26.9	38.6	43.2	17.9
Medi-Cal Asthma ED Visit Rate (per 10,000, p. 147)	317.0	227.7	164.9	115.1	60.8
Asthma Hospitalization Rate (per 10,000, p. 128)	29.0	4.7	7.6	8.7	6.1
Percent with Repeat Asthma Hospitalizations (p. 140)	18.8%	4.3%	11.3%	8.9%	10.5%
Medi-Cal Asthma Hospitalization Rate (per 10,000, p. 151)	63.0	31.1	25.3	19.5	17.4
Asthma Death Rate (per million, p. 161)	32.7	6.8	11.5	9.0	15.2*

* Asian only (does not include Pacific Islanders)

† Unstable estimate -- please note the wide confidence interval (see Technical Notes for details).

1 Asthma Prevalence

Summary

- Approximately five million people in California have asthma.
- Each year, there are an estimated 189,700 new cases of asthma in California — approximately 93,150 among adults and 96,550 among children.
- In 2010, 13.1% of adults and 12.5% of children had been diagnosed with asthma at some point in their lives (lifetime asthma); 7.9% of adults and 7.4% of children had current asthma.
- Among males with asthma, a higher percentage had their asthma start as a child (69%) than as an adult (31%). Among females with asthma, roughly half had their asthma start as a child (48%) and half had their asthma start as an adult (52%).
- Among adults, lifetime asthma prevalence has increased over time, and is similar to prevalence in the U.S. overall.
- Both lifetime and current asthma prevalence are about 30% higher among children ages 5–17 than among adults.
- Among adults, both lifetime and current asthma prevalence are higher for females than males. Among children, they are both higher for males than females.
- Asthma prevalence among Black children is about 60% higher than among White children (22.8% vs. 14.3% for lifetime asthma and 15.2% vs. 9.4% for current asthma).
- Asthma prevalence among Black adults is 30–40% higher than among White adults (20.0% vs. 15.1% for lifetime asthma and 12.1% vs. 8.9% for current asthma).
- Asthma prevalence among American Indian/Alaska Native (AI/AN) adults is 1.5–2.0 times higher than among White adults (23.3% vs. 15.1% for lifetime asthma and 17.5% vs. 8.9% for current asthma).
- There are variations in asthma prevalence within the Hispanic ethnic group. Lifetime/current asthma prevalence ranges from 20.6%/9.7% among European Hispanics to 7.7%/4.6% among Guatemalans.
- There are also variations in asthma prevalence within the Asian racial/ethnic group. Lifetime/current asthma prevalence range from 18.5%/10.0% among Filipinos to 9.0%/4.2% among Chinese.
- People born in the U.S. are more likely to have asthma than people born outside of the U.S. The disparity is largest for Hispanics and Asians, who are two to three times more likely to have asthma if they were born in the U.S.
- Lesbian and bisexual females have particularly high asthma prevalence — over 24% lifetime asthma prevalence and 14%–17% current asthma prevalence, which is about 70% higher than among straight females.

What is asthma prevalence?

Approximately 3.7 million adults and 1.2 million children in California have been diagnosed with asthma. Large disparities exist by race/ethnicity and other factors.

The percentage of people who have asthma is also called asthma prevalence. More specifically, asthma prevalence refers to the proportion of people with asthma in a specific population during a certain time frame. This section summarizes asthma prevalence among adults and children in California. The majority of the data are based on two large statewide telephone surveys: the Behavioral Risk Factor Surveillance System (BRFSS) and the California Health Interview Survey (CHIS). These surveys ask about whether adults and children have been diagnosed with asthma and whether they still suffer from asthma (not everyone with asthma continues to have asthma symptoms). A person has lifetime asthma if he or she has been diagnosed with asthma by a health care provider at any time in the past. For BRFSS data, a person has current asthma if he or she had a prior diagnosis of asthma and reports still having asthma. For CHIS data, a person has current asthma if he or she had prior diagnosis of asthma and reports still having asthma or having asthma symptoms in the last year.

This section also includes data from the BRFSS Asthma Call-Back Survey (ACBS), which is a follow-up survey to the BRFSS offered to all respondents reporting lifetime asthma. The ACBS includes a wide range of additional questions related to asthma. For more information about CHIS, BRFSS, or ACBS, please see the Technical Notes section at the end of this report.

How many people have asthma in California?

In 2010, 13.1% of adults reported that they had ever been diagnosed with asthma (lifetime asthma) and 7.9% said they still have asthma (current asthma). Among children under age 18, 12.4% had lifetime asthma and 7.4% had current asthma. This translates to approximately 3.7 million adults and 1.2 million children in California who have been diagnosed with asthma, and 2.2 million adults and 692,000 children in California who have current asthma. Each year, there are an estimated 189,700 new cases of asthma in California — approximately 93,150 among adults and 96,550 among children.

Is the prevalence of asthma changing?

The percentage of adults with lifetime asthma has gone up by about 0.2% per year since 1995, similar to the increase in the U.S. overall. Among children, asthma prevalence has only been measured since 2005 in California and neither current or lifetime asthma prevalence show trends of increasing or decreasing since that time.

Are there disparities in who has asthma in California?

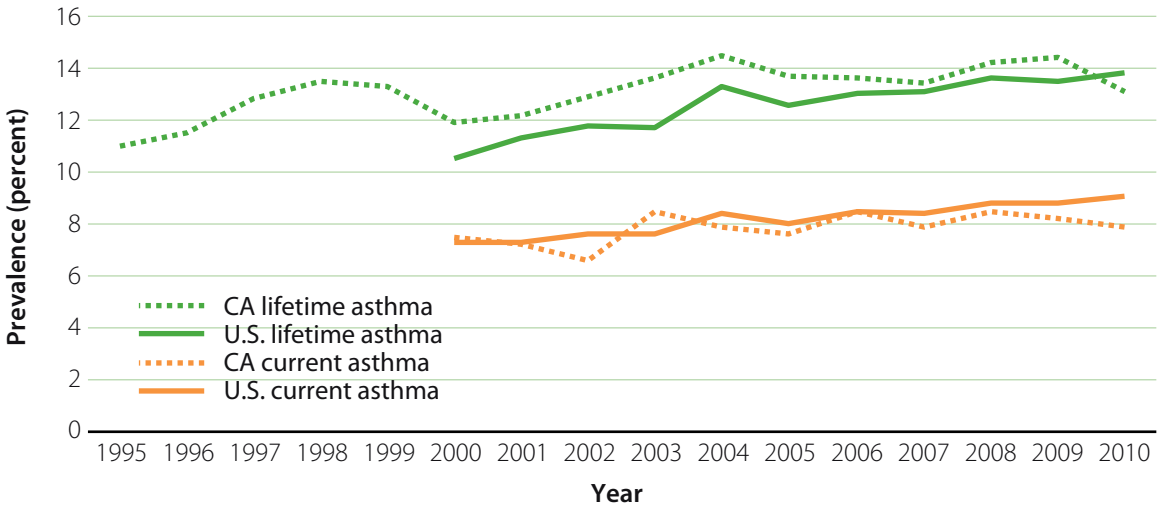
Many people in California have asthma, but some groups have a higher prevalence than others. By age, school-aged children (5–17) have a higher asthma prevalence than other age groups. By race/ethnicity, the groups with the highest asthma prevalence are Blacks, American Indians/Alaska Natives (AI/AN), Pacific Islanders, Filipinos, and European Hispanics. Lesbian and bisexual women also have a particularly high asthma prevalence. People born in the U.S. are more likely to have asthma than their racial/ethnic counterparts born outside of the country.

Data on asthma prevalence for each California county can be found in the County Asthma Profiles, at www.californiabreathing.org. The prevalence of asthma cannot be reliably calculated for smaller geographic areas, such as zip codes.

Lifetime and Current Asthma Prevalence Among Adults, California and the U.S. 1995–2010

Lifetime asthma prevalence among adults (18 and over) in California has increased over time,* with some fluctuations. In 2010, the prevalence was 13.1%. Lifetime asthma prevalence in California has been similar to the U.S. prevalence, which has also increased over the past ten years.* Current asthma prevalence among adults in California is also similar to the U.S. prevalence, but has not increased as consistently over time.

*California Lifetime Asthma: increase of 0.2% per year, p=0.002 (simple linear regression); U.S. Lifetime Asthma: increase of 0.1% per year, p=0.02 (simple linear regression).



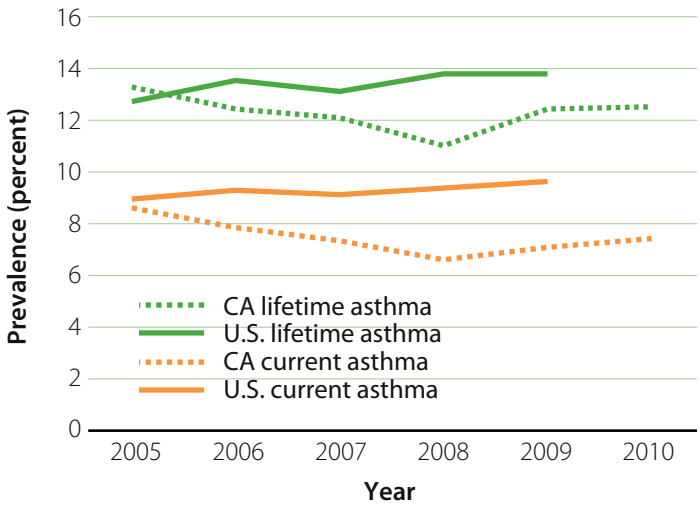
	California				U.S. (States and D.C.)			
	Lifetime asthma prevalence		Current asthma prevalence		Lifetime asthma prevalence		Current asthma prevalence	
Year	%	(95% CI)*	%	(95% CI)	%	(95% CI)	%	(95% CI)
1995	11.0	(9.9–12.2)	—	—	—	—	—	—
1996	11.5	(10.4–12.6)	—	—	—	—	—	—
1997	12.8	(11.6–13.9)	—	—	—	—	—	—
1998	13.5	(12.2–14.7)	—	—	—	—	—	—
1999	13.3	(12.1–14.5)	—	—	—	—	—	—
2000	11.9	(10.8–13.1)	7.5	(6.5–8.4)	11.5	(10.4–12.6)	7.3	(6.4–8.2)
2001	12.2	(11.1–13.3)	7.2	(6.4–8.1)	12.4	(11.2–13.6)	7.2	(6.3–8.1)
2002	12.9	(11.7–14.0)	6.6	(5.7–7.4)	12.7	(11.5–13.9)	6.4	(5.5–7.3)
2003	13.6	(12.4–14.9)	8.5	(7.4–9.5)	13.4	(12.2–14.6)	8.4	(7.4–9.4)
2004	14.5	(13.2–15.7)	7.9	(7.0–8.8)	14.0	(12.7–15.3)	7.7	(6.7–8.7)
2005	13.7	(12.6–14.7)	7.6	(6.8–8.3)	13.2	(12.1–14.3)	7.2	(6.4–8.0)
2006	13.6	(11.5–15.6)	8.5	(6.7–10.3)	12.7	(11.6–13.8)	7.6	(6.8–8.4)
2007	13.4	(12.2–14.7)	7.9	(6.9–8.8)	12.9	(11.7–14.1)	7.5	(6.7–8.3)
2008	14.2	(13.2–15.1)	8.5	(7.7–9.2)	13.8	(12.9–14.6)	8.4	(7.7–9.1)
2009	14.4	(13.6–15.2)	8.2	(7.7–8.8)	13.6	(12.8–14.3)	7.8	(7.3–8.4)
2010	13.1	(12.4–13.9)	7.9	(7.4–8.5)	13.8	—	9.1	—

* 95% CI=95% Confidence Interval

Data Source: CA data from BRFSS 1995–2010; U.S. data (2010 not yet available) from www.cdc.gov/brfss

Lifetime and Current Asthma Prevalence Among Children, California and the U.S. 2005–2010

Among children (ages 0–17), asthma prevalence in California has been measured every year since 2005. Lifetime asthma prevalence has been in the range of 11.0%–13.3%, and current asthma prevalence has been in the range of 6.6%–8.6%; neither show significant trends of increasing or decreasing over time. Asthma prevalence among children in California is slightly lower than U.S. prevalence for both lifetime and current asthma.



	California				U.S.			
	Lifetime asthma prevalence		Current asthma prevalence		Lifetime asthma prevalence		Current asthma prevalence	
Year	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
2005	13.3	(11.7–14.9)	8.6	(7.3–9.9)	12.7	(12.0–13.4)	8.9	(8.3–9.5)
2006	12.4	(8.9–15.9)	7.8	(5.2–10.4)	13.5	(12.7–14.3)	9.3	(8.6–10.0)
2007	12.1	(10.3–13.9)	7.3	(5.9–8.7)	13.1	(12.2–14.0)	9.1	(8.4–9.8)
2008	11.0	(9.7–12.3)	6.6	(5.5–7.6)	13.8	(12.9–14.7)	9.4	(8.6–10.2)
2009	12.4	(11.2–13.6)	7.1	(6.1–8.1)	13.8	(13.0–14.6)	9.6	(8.9–10.3)
2010	12.5	(10.5–14.3)	7.4	(5.8–9.0)	13.6	(12.8–14.4)	9.4	(8.7–10.1)

Data Source: CA data from BRFSS 2005–2010; U.S. data from the National Health Interview Survey (www.cdc.gov/asthma/nhis)

Estimated Annual Incidence Rate of Asthma (per 1,000 People), by Age, California 2006–2009

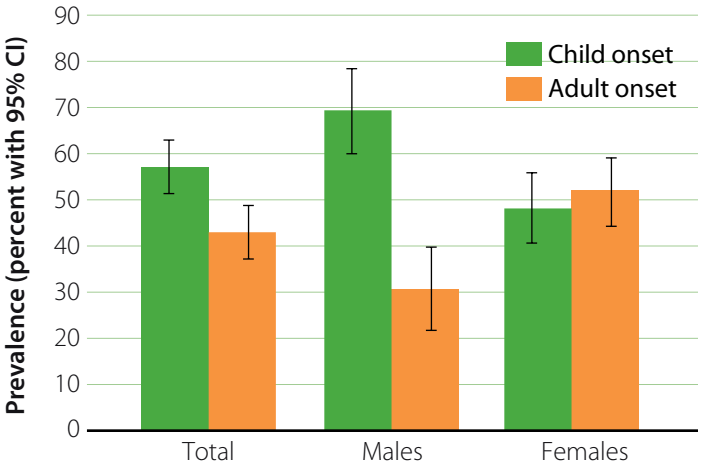
The incidence rate of asthma refers to the frequency of newly diagnosed cases of asthma in a specific population during a certain time frame. The estimated incidence rates of asthma in California are: 4.3 new asthma cases per 1,000 adults per year, and 10.7 new asthma cases per 1,000 children per year. This translates to an estimated 189,700 new cases of asthma in California each year—approximately 93,150 among adults and 96,550 among children. This means that, among people who have not already been diagnosed with asthma, about 1% of adults and 0.4% of children are expected to be newly diagnosed with asthma each year.

Age	Rate	(95% CI)
Adults (18+ years)	4.3	(2.8–5.9)
Children (0–17 years)	10.7	(5.4–16.0)

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Percent of Adults with Lifetime Asthma Who Were First Diagnosed as an Adult vs. as a Child, by Sex, California 2009

Asthma onset is the point when a person is first diagnosed with asthma. Asthma onset occurs during childhood for about 57% of people, and occurs during adulthood for about 43%. However, this varies by sex. Among males, a higher percentage had their asthma start during childhood (69%) than during adulthood (31%). Among females, roughly the same percentage had their asthma start during childhood (48%) or during adulthood (52%). Among adults whose asthma onset occurred during adulthood, the average age of diagnosis was 37.2 years. For adults whose asthma onset occurred during childhood, the average age of diagnosis was 7.7 years.



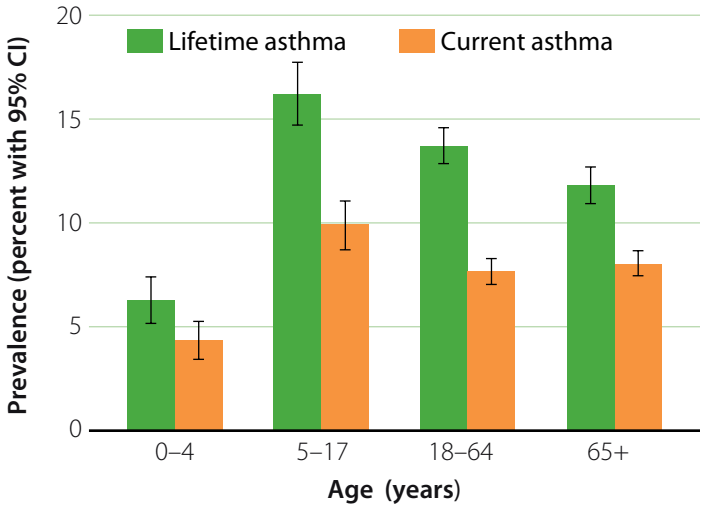
	Asthma Onset as an Adult		Asthma Onset as a Child	
	%	(95% CI)	%	(95% CI)
Total	43.0	(37.2–48.9)	57.0	(51.2–62.9)
Males	30.8	(21.6–40.0)	69.2	(60.0–78.4)
Females	51.8	(44.3–59.4)	48.2	(40.6–55.7)
	Average	**(95% CI)**	**Average**	**(95% CI)**
Age of Onset	37.2	(35.2–39.1)	7.7	(6.9–8.6)

Data Source: Adult ACBS 2009

Lifetime and Current Asthma Prevalence by Age, California 2009

Both lifetime and current asthma prevalence are highest among children ages 5–17 — about 30% higher than among adults.* Young children, ages 0–4, have the lowest asthma prevalence (both lifetime and current). Accurate asthma diagnosis in this age group is difficult because other common conditions can be responsible for asthma-like symptoms and measuring lung function is difficult in very young children.

* Chi-square p<0.01



Age (years)		Lifetime Asthma Prevalence %	Lifetime Asthma Prevalence (95% CI)	Current Asthma Prevalence %	Current Asthma Prevalence (95% CI)
Children	**0–4**	6.3	(5.2–7.4)	4.4	(3.4–5.3)
	5–17	16.2	(14.7–17.8)	9.9	(8.8–11.1)
Adults	**18–64**	13.8	(13.0–14.6)	7.7	(7.0–8.3)
	65+	11.8	(11.0–12.7)	8.1	(7.5–8.7)
Totals	**0–17**	13.4	(12.2–14.7)	8.4	(7.5–9.3)
	18+	13.5	(12.8–14.2)	7.7	(7.2–8.3)
	All Ages	13.5	(12.8–14.1)	7.9	(7.4–8.4)

Data Source: CHIS 2009

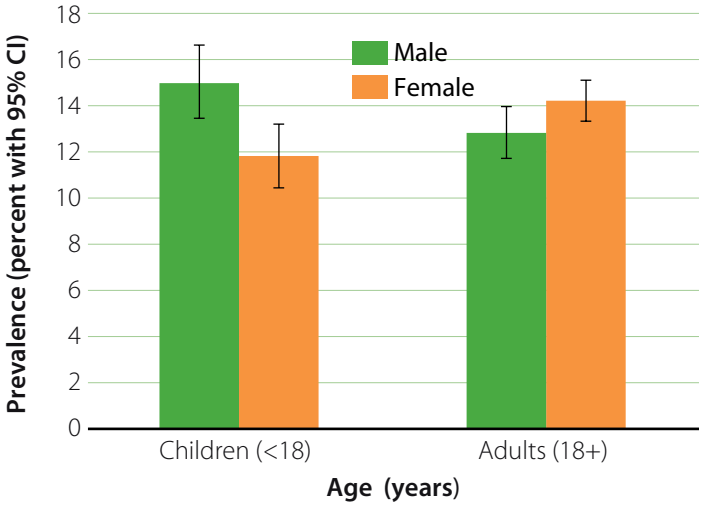
Lifetime and Current Asthma Prevalence by Sex and Age, California 2009

In 2009, lifetime and current asthma prevalence for male children (0–17 years) was about 30% higher than for female children.* The reverse is true for adults: the prevalence of lifetime asthma was about 10% higher in females than in males,† and the prevalence of current asthma was 50% higher in females than in males.* Similar sex differences are seen throughout various asthma studies, and possible explanations include the influence of sex hormones as well as differences in environmental exposures.

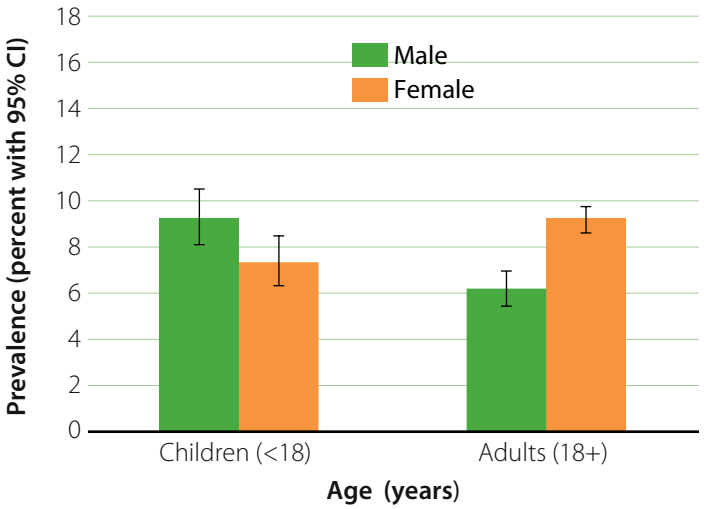
* Chi-square p<0.01

† Chi-square p=0.05

Lifetime



Current



	Children (0–17 years)				Adults (18+ years)			
	Lifetime Asthma Prevalence		Current Asthma Prevalence		Lifetime Asthma Prevalence		Current Asthma Prevalence	
Sex	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Male	15.0	(13.4–16.6)	9.3	(8.2–10.5)	12.8	(11.7–13.9)	6.2	(5.3–7.0)
Female	11.8	(10.4–13.2)	7.4	(6.3–8.5)	14.2	(13.3–15.1)	9.2	(8.6–9.8)

Data Source: CHIS 2009

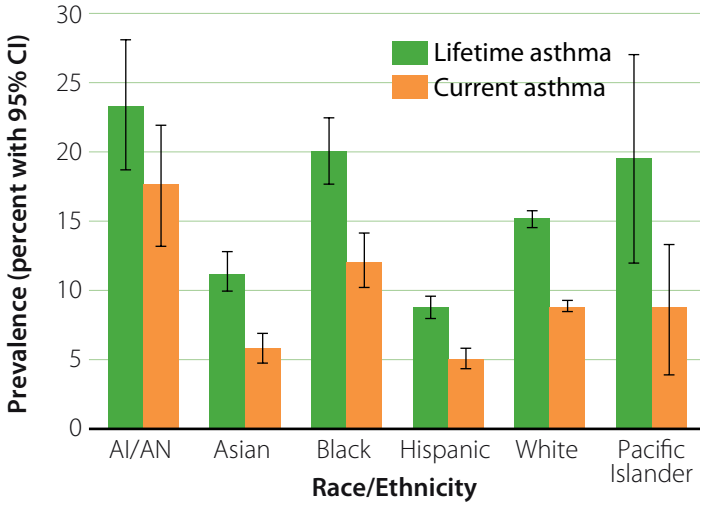
Lifetime and Current Asthma Prevalence by Race/Ethnicity and Age, California 2007 and 2009 Combined*

Among adults, the prevalence of lifetime and current asthma was highest for AI/AN and Blacks — significantly higher than Asians, Hispanics, and Whites. Pacific Islanders also had a high lifetime asthma prevalence — significantly higher than among Hispanics and Asians. Hispanic and Asian adults had significantly lower asthma prevalences (both current and lifetime) compared to White adults.

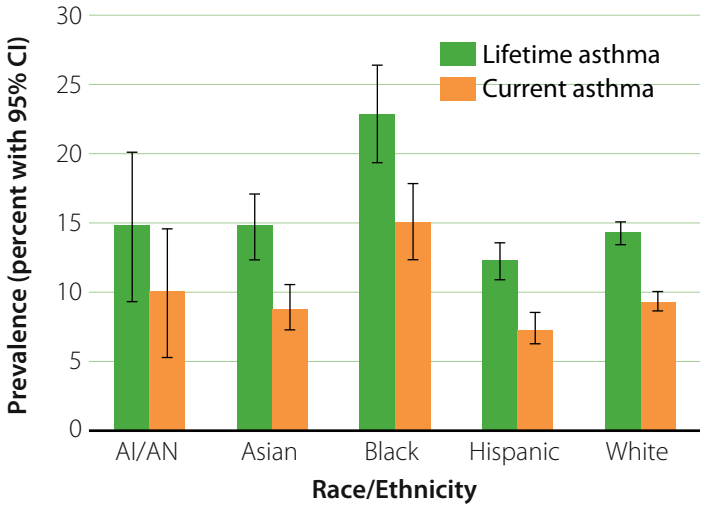
Among children, Blacks had the highest asthma prevalence — significantly higher than all other groups for lifetime asthma and significantly higher than Whites, Hispanics, and Asians for current asthma. Hispanic children had significantly lower asthma prevalence (both current and lifetime) compared to White children. (Data for Pacific Islanders were not available for children.)

*Chi-square p<0.03 for all mentioned comparisons

Adults (18+ years)



Children (0–17 years)



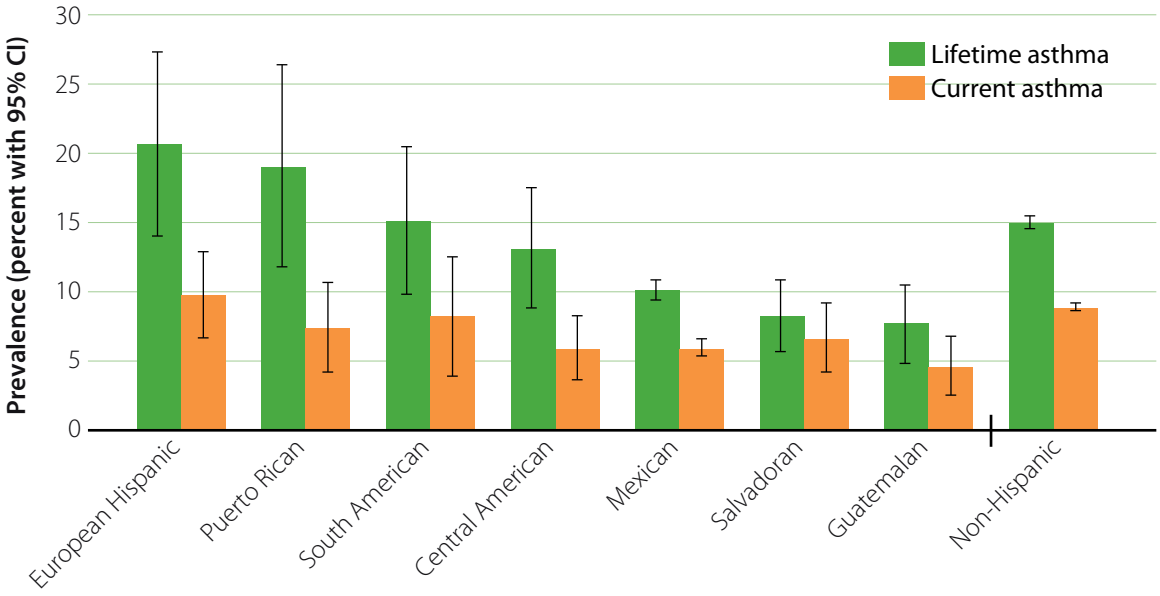
	Children (0–17 years)				Adults (18+ years)				All Ages			
	Lifetime Asthma Prevalence		Current Asthma Prevalence		Lifetime Asthma Prevalence		Current Asthma Prevalence		Lifetime Asthma Prevalence		Current Asthma Prevalence	
Race/Ethnicity	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
AI/AN	14.8	(9.3–20.2)	9.9	(5.3–14.6)	23.3	(18.6–28.0)	17.5	(13.1–21.9)	21.2	(17.5–24.9)	15.6	(12.2–19.1)
Asian	14.7	(12.3–17.1)	8.9	(7.2–10.6)	11.3	(9.9–12.6)	5.8	(4.7–6.9)	12.1	(10.9–13.3)	6.5	(5.5–7.5)
Black	22.8	(19.3–26.3)	15.2	(12.3–18.0)	20.0	(17.6–22.4)	12.1	(10.2–14.0)	20.8	(18.8–22.8)	13.0	(11.4–14.5)
Hispanic	12.3	(10.9–13.7)	7.3	(6.2–8.4)	8.7	(7.9–9.6)	5.1	(4.3–5.8)	10.0	(9.2–10.8)	5.9	(5.2–6.5)
White	14.3	(13.4–15.2)	9.4	(8.7–10.1)	15.1	(14.5–15.7)	8.9	(8.5–9.3)	14.9	(14.4–15.4)	9.0	(8.6–9.3)
Pacific Islander	—	—	—	—	19.5	(12.0–27.0)	8.6	(3.9–13.4)	—	—	—	—

Data Source: CHIS 2007 and 2009

Lifetime and Current Asthma Prevalence among Hispanics, by Hispanic Subgroup, California 2007 and 2009 Combined*

Overall, Hispanics have the lowest asthma prevalence of all race/ethnicity groups (see previous page). But, combining all Hispanics into one group masks important differences among Hispanic subgroups. The CHIS asks respondents about Hispanic ancestry or origin, allowing for analysis of asthma prevalence by subgroup. European Hispanics, Puerto Ricans, and South Americans have higher lifetime asthma prevalences — significantly higher than Mexicans, Salvadorans, and Guatemalans. Lifetime prevalence for Mexicans, Salvadorans, and Guatemalans is also significantly lower than for Non-Hispanics. There is less of a difference between subgroups for current asthma, but European Hispanics still have a significantly higher current asthma prevalence than Mexicans and Guatemalans. Mexicans and Guatemalans also have significantly lower current asthma prevalences than Non-Hispanics.

*Chi-square p<0.03 for all mentioned comparisons



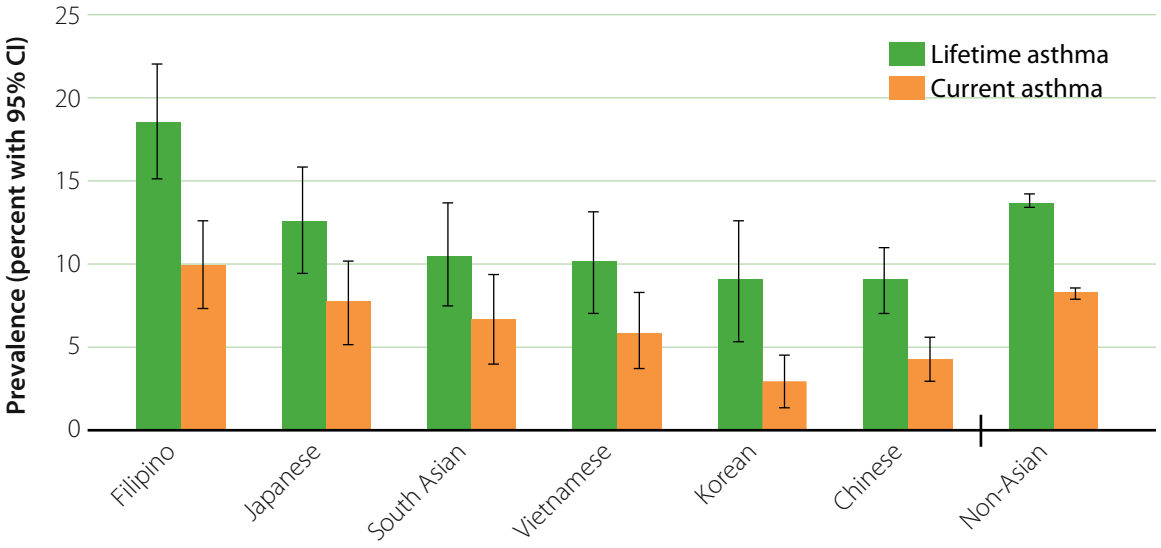
	Lifetime Asthma Prevalence		Current Asthma Prevalence	
Hispanic Subgroup	%	(95% CI)	%	(95% CI)
European Hispanic	20.6	(14.0–27.2)	9.7	(6.6–12.8)
Puerto Rican	19.0	(11.8–26.2)	7.4	(4.2–10.6)
South American	15.1	(9.8–20.3)	8.2	(3.9–12.4)
Central American	13.1	(8.8–17.4)	5.9	(3.6–8.3)
Mexican	10.1	(9.4–10.8)	5.9	(5.4–6.5)
Salvadoran	8.3	(5.7–10.9)	6.6	(4.2–9.1)
Guatemalan	7.7	(4.8–10.5)	4.6	(2.5–6.7)
Non-Hispanic	14.9	(14.4–15.4)	8.9	(8.5–9.2)

Data Source: CHIS 2007 and 2009

Lifetime and Current Asthma Prevalence among Asians, by Asian Subgroup, California 2007 and 2009 Combined*

Asians also have a low overall asthma prevalence, but variations among subgroups are similarly masked when all Asians are combined together. Lifetime asthma among Filipinos is significantly higher than all other Asian subgroups, including Non-Asians combined. The Chinese subgroup has significantly lower asthma prevalence than Non-Asians. For current asthma, both Chinese and Korean subgroups have significantly lower prevalences than Filipinos, Japanese, and Non-Asians.

*Chi-square p<0.02 for all mentioned comparisons



	Lifetime Asthma Prevalence		Current Asthma Prevalence	
Asian Subgroup	**%**	**(95% CI)**	**%**	**(95% CI)**
Filipino	18.5	(15.1–21.9)	10.0	(7.3–12.7)
Japanese	12.6	(9.4–15.8)	7.7	(5.2–10.2)
South Asian	10.5	(7.4–13.6)	6.7	(3.9–9.4)
Vietnamese	10.1	(7.0–13.2)	5.9	(3.7–8.2)
Korean	9.0	(5.3–12.7)	2.9	(1.4–4.5)
Chinese	9.0	(7.0–11.0)	4.2	(3.0–5.5)
Non-Asian	13.7	(13.3–14.1)	8.2	(7.9–8.5)

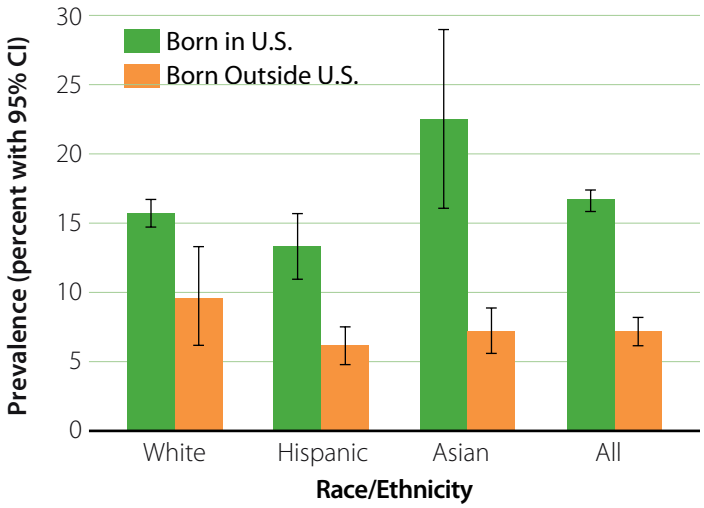
Data Source: CHIS 2007 and 2009

Lifetime and Current Asthma Prevalence among Adults, By Race/Ethnicity and Country of Birth, California 2009*

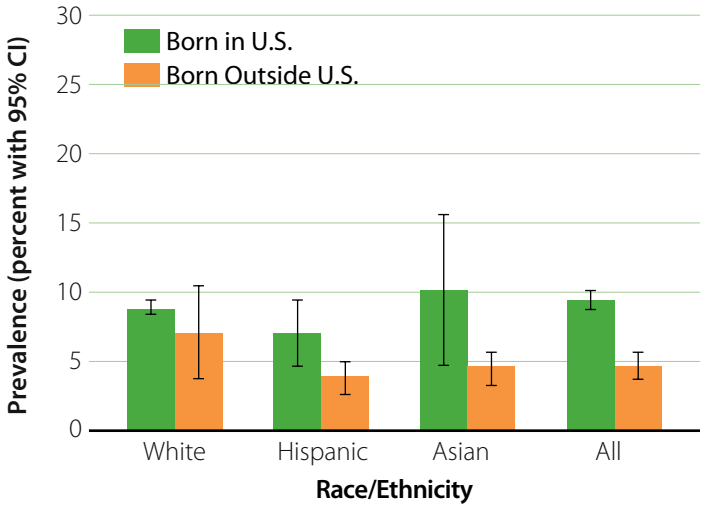
People born in the U.S. are more likely to have current or lifetime asthma than people born outside of the U.S. The disparity is largest for Hispanics and Asians, who are 1.8-3.1 times more likely to have current or lifetime asthma if they were born in the U.S.

*Chi-square p<0.01 for all mentioned comparisons

Lifetime



Current



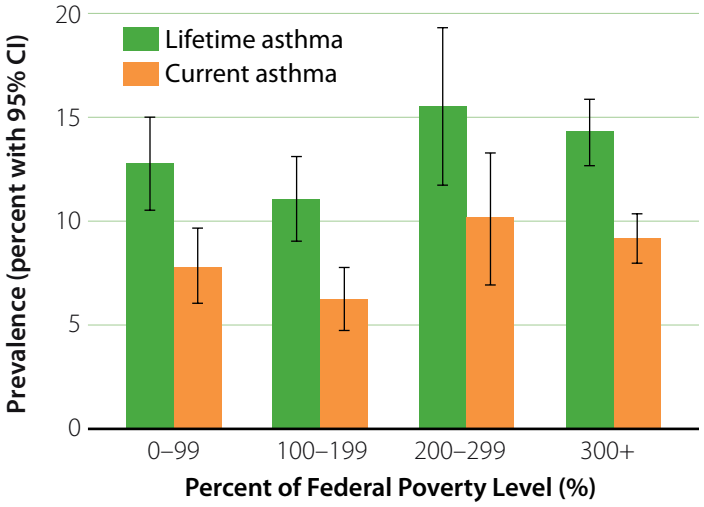
	Lifetime Asthma Prevalence				Current Asthma Prevalence			
	Born in U.S.		Born Outside U.S.		Born in U.S.		Born Outside U.S.	
Race/Ethnicity	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
White	15.8	(14.7–16.9)	9.8	(6.2–13.3)	8.8	(8.2–9.5)	7.2	(3.7–10.6)
Hispanic	13.4	(11.0–15.9)	6.1	(4.7–7.6)	7.0	(4.6–9.4)	3.9	(2.6–5.1)
Asian	22.5	(16.1–28.9)	7.3	(5.7–8.9)	10.1	(4.7–15.4)	4.5	(3.1–5.8)
All	16.7	(15.9–17.5)	7.1	(6.1–8.1)	9.3	(8.6–9.9)	4.6	(3.7–5.5)

Data Source: CHIS 2009

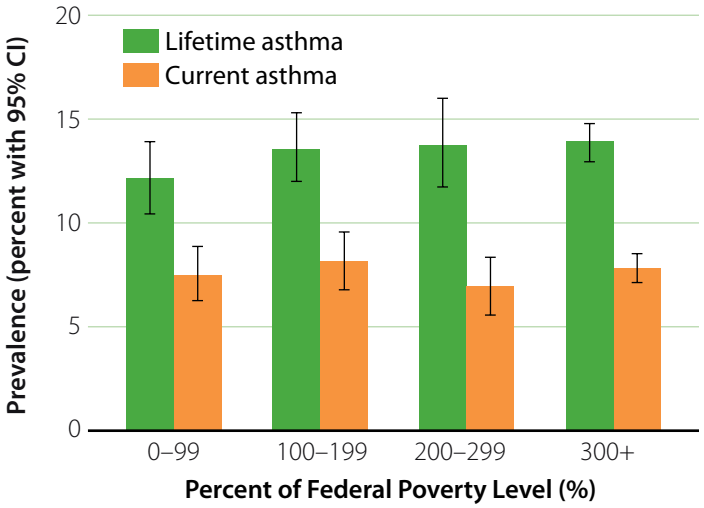
Lifetime and Current Asthma Prevalence by Poverty Level and Age, California 2009

These data do not show an association between income level and asthma prevalence. However, others studies have shown that low-income Californians experience more asthma symptoms, use the emergency room more for asthma care, and miss more school due to asthma.[15]

Children (0–17 years)



Adults (18+ years)



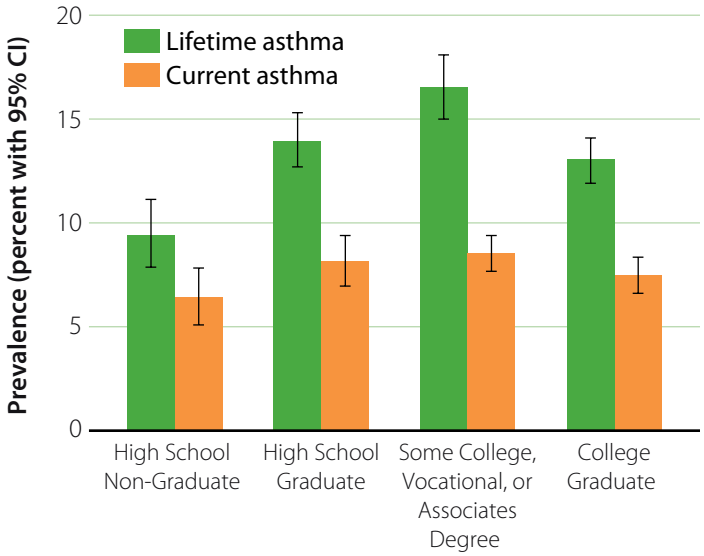
Percent of Federal Poverty Level (%)	Children (0-17 years)				Adults (18+ years)			
	Lifetime Asthma Prevalence		Current Asthma Prevalence		Lifetime Asthma Prevalence		Current Asthma Prevalence	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
0–99	12.8	(10.5–15.0)	7.8	(6.0–9.7)	12.1	(10.3–13.9)	7.5	(6.2–8.8)
100–199	11.1	(9.0–13.1)	6.2	(4.7–7.7)	13.6	(11.9–15.3)	8.2	(6.8–9.6)
200–299	15.5	(11.7–19.3)	10.1	(6.9–13.3)	13.7	(11.5–15.9)	7.0	(5.6–8.4)
300+	14.3	(12.7–15.9)	9.1	(8.0–10.3)	13.8	(12.9–14.7)	7.8	(7.1–8.6)

Data Source: CHIS 2009

15 Babey, 2007.

Lifetime and Current Asthma Prevalence among Adults, by Educational Attainment, California 2009

These data do not show any clear association between asthma prevalence and education level among adults.

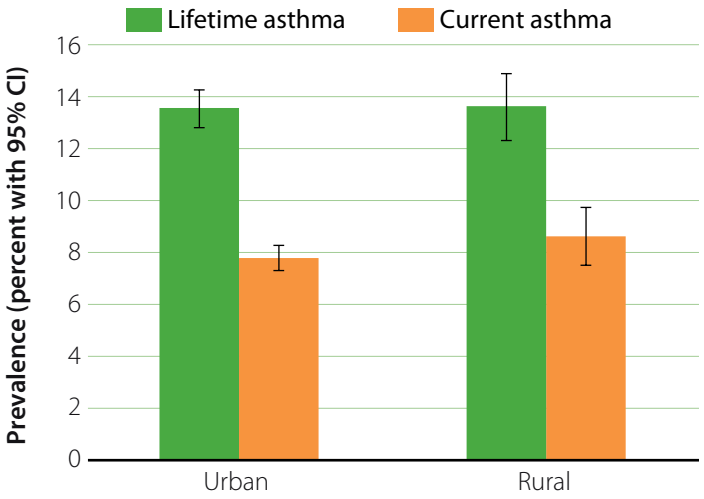


	Lifetime Asthma Prevalence		Current Asthma Prevalence	
Educational Attainment	%	(95% CI)	%	(95% CI)
High School Non-Graduate	9.5	(7.9–11.1)	6.5	(5.1–7.8)
High School Graduate	13.9	(12.7–15.2)	8.1	(6.9–9.3)
Some College, Vocational, or Associates Degree	16.5	(15.0–18.0)	8.5	(7.7–9.4)
College Graduate	13.0	(11.9–14.1)	7.4	(6.5–8.4)

Data Source: CHIS 2009

Lifetime and Current Asthma Prevalence by Urban/Rural Residence, California 2009

These data do not show any association between asthma prevalence urban/rural residence in California.



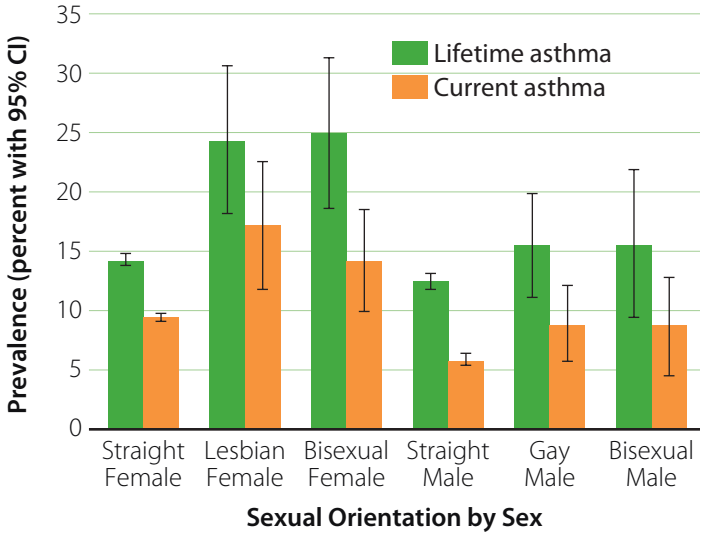
	Lifetime Asthma Prevalence		Current Asthma Prevalence	
	%	(95% CI)	%	(95% CI)
Urban	13.5	(12.8–14.2)	7.8	(7.3–8.4)
Rural	13.6	(12.3–15.0)	8.6	(7.5–9.6)

Data Source: CHIS 2009

Lifetime and Current Asthma Prevalence among Adults by Sexual Orientation and Sex, California 2007 and 2009 Combined*

For males, there is no significant trend in asthma prevalence by sexual orientation. However, lesbian and bisexual females have similarly high asthma prevalence — significantly higher than straight females for both lifetime and current asthma.

*Chi-square p<0.02 for all mentioned comparisons



	Lifetime Asthma Prevalence		Current Asthma Prevalence	
	%	(95% CI)	%	(95% CI)
Straight Female	14.2	(13.6–14.8)	9.4	(9.0–9.8)
Lesbian Female	24.2	(18.0–30.4)	17.1	(11.7–22.5)
Bisexual Female	24.9	(18.6–31.3)	14.2	(9.9–18.4)
Straight Male	12.4	(11.6–13.1)	5.8	(5.2–6.3)
Gay Male	15.5	(11.0–20.0)	8.8	(5.7–12.0)
Bisexual Male	15.6	(9.4–21.9)	8.6	(4.5–12.7)

Data Source: CHIS 2007 and 2009

2 Asthma Morbidity and Management

Summary

Among Californians with current asthma:

- The majority of adults and children (65.9% and 53.7%, respectively) had asthma symptoms in the past month.
- Over 15% of adults and children had four or more asthma attacks in the past three months.
- Approximately 649,000 adults ages 18-69 (36.4%) missed work or were unable to carry out their usual activities because of their asthma at some point in the past year. This translates to an estimated 11.8 million days of work/usual activities missed per year.
- Approximately 129,000 children missed school or day care because of their asthma at some point in the past year (52.3%). This translates to an estimated 1.2 million days of school/day care missed per year.
- Among adults, about 12% visited the ED and about 3% were hospitalized for asthma in the past year.
- Among children, about 22% visited the ED for asthma in the past year, and over 10% visited the ED for asthma two or more times in the past year.
- While most adults and children are classified as having well controlled asthma, over one in five are considered to have very poorly controlled asthma.
- Adults with higher household incomes (over $50,000) are about 50–60% more likely to have well controlled asthma than adults with lower incomes; adults who report cost barriers to receiving medical care are significantly less likely to have well controlled asthma (33.2%) than those who do not report cost barriers (56.7%).
- Adults whose asthma is considered not well controlled or very poorly controlled are 2.5 times more likely to be unable to work or carry out usual activities due to asthma than adults with well controlled asthma.
- Children whose asthma is considered not well controlled or very poorly controlled are about 70% more likely to miss school or day care due to asthma than children with well controlled asthma.
- Adults with very poorly controlled asthma are four times more likely to have an ED visit for asthma and six times more likely to be hospitalized than those with well controlled asthma.
- Children whose asthma is considered not well controlled or very poorly controlled are nearly three times more likely to have an ED visit for asthma than those with well controlled asthma.
- About three out of four children have had at least one routine asthma checkup in the past year. Among adults, however, over half have not had a routine asthma checkup in the past year.

- Approximately one quarter of adults and children (27.7% and 24.1%, respectively) used only a rescue medication in the past 3 months (i.e., they did not use any controller medication).
- Only about 40% of adults and children have ever been given a written asthma action plan by their health care provider.
- Only 30% of adults and 45% of children have ever been advised to change their home, work or school environments to improve their asthma.
- Just over two-thirds of adults and children (69.8% and 68.8%, respectively) feel very confident in their ability to manage and control their asthma.

How does asthma affect the lives of those who have it?

Asthma symptoms include wheezing, coughing, chest tightness, and trouble breathing. The majority of Californians with current asthma experienced symptoms in the past month, and approximately one in seven adults with asthma has symptoms every day. The majority of Californians with current asthma also had an asthma attack or episode in the past year, and over 15% had four or more asthma attacks in the past three months.

Many people with asthma suffer from frequent asthma attacks, miss work and school due to asthma, and go to the ED for asthma treatment.

Over one in five Californians with current asthma have very poorly controlled asthma.

Only about 40% of adults and children with current asthma have ever been given a written asthma action plan.

Asthma symptoms and attacks can make it difficult for people to carry out their usual activities. Over one third of adults (ages 18-69) with asthma missed work or were unable to carry out their usual activities because of their asthma at some point in the past year, resulting in nearly 12 million days of work/usual activities missed per year. Over half of children with asthma missed school or day care because of their asthma in the past year, resulting in 1.2 million days of school/day care missed per year.

Sometimes asthma symptoms require emergency medical care. About 12% of adults with current asthma visited the ED and about 3% were hospitalized for asthma in the past year. About 22% of children visited the ED for asthma in the past year; over 10% visited the ED for asthma two or more times in the past year.

How well controlled is asthma in California?

The ultimate goal of asthma management and treatment is to achieve control of symptoms. The National Institutes of Health (NIH) expert panel on asthma has outlined how to use elements such as the frequency of asthma symptoms, nighttime awakenings, and use of short-acting rescue medications to classify asthma control into three categories: well controlled, not well controlled, and very poorly controlled.[16] Using similar elements from the ACBS, an algorithm has been developed to classify survey respondents into the same categories of asthma control. See the Technical Notes section of this report for a full description of the method used to classify level of asthma control.

Just over half of Californians with current asthma have well controlled asthma. This, however, means that just under half have asthma that is either not well controlled or is very poorly controlled. Compared to those with well controlled asthma, those whose asthma is not well or very poorly controlled are more likely to miss work, school, day care or other activities due to asthma, and are also much more likely to be hospitalized or visit the ED for asthma.

While level of asthma control does not differ significantly by age, sex, race/ethnicity, educational attainment, or insurance status, financial barriers to achieving asthma control do seem to exist: adults with household incomes over $50,000 are more likely to have well controlled asthma than adults with lower incomes, and adults who report cost barriers to receiving medical care are less likely to have well controlled asthma (33.2%) than those who do not report cost barriers (56.7%). Adults who have respiratory co-morbidities, such as COPD, are also significantly less likely to have well controlled asthma (35.5%) than those who do not have respiratory co-morbidities (60.6%).

Are Californians with asthma receiving appropriate preventive health care?

Many of the problems associated with asthma can be avoided when people receive proper management and treatment. Unfortunately, many Californians are not receiving appropriate care. One quarter of children and over half of adults with current asthma have not had a routine asthma checkup in the past year. Only about 40% of adults and children have ever been given a written asthma action plan by their health care provider, and only 30% of adults and 45% of children have ever been advised to change their home, work or school environment to improve their asthma. Among adults and children who currently use controller asthma medications, fewer than 40% report using them properly. Overall, just over two-thirds of Californians with current asthma feel very confident in their ability to manage and control their asthma.

16 NHLBI, 2007.

Technical Notes

This chapter examines asthma morbidity, level of control and management. Most of these factors relate to the respondent's current or recent state of health (e.g., past 30 days or past 12 months), so this chapter examines these factors only among people who report current asthma, not lifetime asthma. The majority of the data in this chapter are from the ACBS survey, for which current asthma is defined as having lifetime asthma *and* reporting still having asthma. For CHIS data, a person has current asthma if he or she has lifetime asthma *and* reports still having asthma *or* having asthma symptoms in the last year. The ACBS has a somewhat small sample size, and therefore some data estimates are not stable. The following notation is used in this chapter to denote unstable estimates:

> Estimates marked "*" are unstable. When interpreting these estimates, please note that they have wide confidence intervals.
>
> Estimates marked "—" are too unstable to present.

Please see the Technical Notes section at the end of this report for more information about unstable estimates, the method used to classify the level of asthma control, and other information about ACBS and CHIS.

This chapter references controller and rescue medications, which are defined as:

> Controller medications (also called long-term control, preventive, or maintenance medications) are taken daily on a long-term basis to reduce airway inflammation and help prevent and control asthma symptoms. They take time to work and will not stop an asthma episode after it has begun. They may be inhaled, nebulized, or swallowed as a pill or liquid.
>
> Rescue medications (also called quick relief, reliever, or fast-acting medications) are taken immediately to treat an asthma episode or attack. They are often inhaled into the lungs to open up the airways and relieve symptoms within minutes. They are very effective for relieving acute symptoms, but do not have a long-term effect. Frequent use of rescue medications may indicate inadequate asthma control.

Asthma Morbidity

Number of Days with Asthma Symptoms in the Past 30 Days Among Californians with Current Asthma, by Age, 2006–2009

The majority of adults and children with current asthma experienced asthma symptoms in the past 30 days (65.9% and 53.7%, respectively). About 14% of adults experienced asthma symptoms every day.

	Adults (18+)		Children (0–17)	
Number of Days	%	(95% CI)	%	(95% CI)
0	34.1	(30.4–37.8)	46.3	(37.0–55.7)
1–5	26.7	(22.8–30.7)	20.3	(12.2–28.5)
6–10	7.1	(5.3–8.8)	13.0	(6.2–19.7)
11–20	14.0	(11.2–16.7)	11.7	(5.1–18.3)
21–29	3.9	(2.4–5.5)		
Every day, sporadically	2.4	(1.6–3.2)	8.7*	(1.5–15.8)
Every day, throughout the day	11.8	(9.7–13.9)		

* Unstable estimate — please note the wide confidence interval (see Technical Notes for more information).

Data Source: Adult ACBS 2009, Child ACBS 2006–2008

Number of Days with Nighttime Asthma Symptoms in the Past 30 Days Among Californians with Current Asthma, by Age, 2006–2009

Asthma symptoms made sleeping difficult for 42.8% of adults and 32.3% of children with current asthma in the past 30 days.

	Adults (18+)		Children (0–17)	
Number of Days	%	(95% CI)	%	(95% CI)
0	57.2	(52.5–62.0)	67.7	(57.7–77.6)
1–5	24.0	(19.7–28.4)	21.0	(12.9–29.0)
6–10	4.5	(3.0–6.0)	11.3*	(3.1–19.6)
11–20	5.7	(3.7–7.6)		
21–29	1.8	(0.8–2.8)		
Every day	6.8	(4.6–9.0)		

* Unstable estimate — please note the wide confidence interval (see Technical Notes for more information).

Data Source: Adult ACBS 2009, Child ACBS 2006–2008

Percent of Californians with Current Asthma Reporting Asthma Attacks or Episodes, by Age, 2006–2009

The majority of adults and children with current asthma had an asthma attack in the past year (52.9% and 58.1%, respectively). Over 15% of adults and children with current asthma had four or more asthma attacks in the past three months, an indication of poor asthma control.

	Adults (18+)		Children (0–17)	
Asthma Attacks or Episodes	%	95% CI	%	95% CI
Had an asthma attack in past 12 months	52.9	(49.0–56.9)	58.1	(49.0–67.2)
Number of asthma attacks in the past 3 months				
0	55.7	(49.2–62.3)	52.3	(43.3–62.0)
1	13.0	(9.0–16.9)	17.4	(11.0–23.8)
2–3	14.7	(10.0–19.5)	14.1	(8.1–20.2)
4+	16.6	(11.8–21.3)	15.8	(7.6–24.0)

Data Source: Adult ACBS 2009, Child ACBS 2006–2008

Number of Days Unable to Work or Carry Out Usual Activities Due to Asthma in the Past 12 Months Among Adults (18–69) with Current Asthma, California 2009

Approximately 649,000 adults (18-69) with current asthma missed work or were unable to carry out their usual activities because of their asthma at some point in the past year (36.4%). The average number of days missed was 6.6, for an estimated total of 11.8 million days of work/usual activities missed due to asthma.

Number of Days Missed	%	95% CI
0	63.6	(56.2–70.9)
1 –2	11.3	(5.3–17.2)
3–5	10.0	(5.8–14.2)
6–10	5.8	(2.7–9.0)
11+	9.3	(4.7–14.0)

	Mean	95% CI
Mean days missed	6.6	(3.7–9.5)
Mean days missed, among >0	18.1	(9.9–26.3)

Data Source: Adult ACBS 2009

Number of Day Care or School Days Missed Due to Asthma in the Past 12 Months Among Children (0–17) with Current Asthma, California 2006–2008

Approximately 129,000 children with current asthma missed school or day care because of their asthma in the past year (52.3%). The average number of days missed was 5, for an estimated total of 1.2 million days of school/day care missed due to asthma.

Number of Days Missed	%	95% CI
0	47.7	(37.5–57.9)
1 –2	13.0	(6.3–19.7)
3–5	20.0	(11.9–28.2)
6–10	9.5*	(3.7–15.4)
11+	9.7*	(3.4–16.0)

	Mean	95% CI
Mean days missed	5.0	(2.0–8.1)
Mean days missed, among >0	9.6	(4.1–15.2)

* Unstable estimate — please note the wide confidence interval (see Technical Notes for details).

Data Source: Child ACBS 2006–2008

Degree of Activity Limitations Due to Asthma in the Past 12 Months Among Californians with Current Asthma, by Age, 2006–2009

Over 63% of adults and children with current asthma report some degree of activity limitation due to asthma at some point in the past year.

	Adults (18+)		Children (0–17)	
Degree of Activity Limitations	%	95% CI	%	95% CI
None at all	36.5	(29.7–43.2)	36.1	(26.5–45.6)
A little	41.1	(34.0–48.1)	40.0	(30.2–49.9)
A moderate amount	15.8	(10.8–20.8)	16.7	(8.9–24.5)
A lot	6.6	(3.9–9.4)	7.2*	(1.6–12.8)

* Unstable estimate — please note the wide confidence interval (see Technical Notes for details).

Data Source: Adult ACBS 2009, Child ACBS 2006–2008

Percent of Californians with Current Asthma who Reported ED Visits or Hospitalizations for Asthma in the Past 12 Months, by Age, 2006–2009

Over one in five children with current asthma visited the ED in the past year for asthma, a substantially greater proportion than among adults with current asthma. Of even greater concern, more than one of every ten children with current asthma visited the ED for asthma two or more times in the past year.

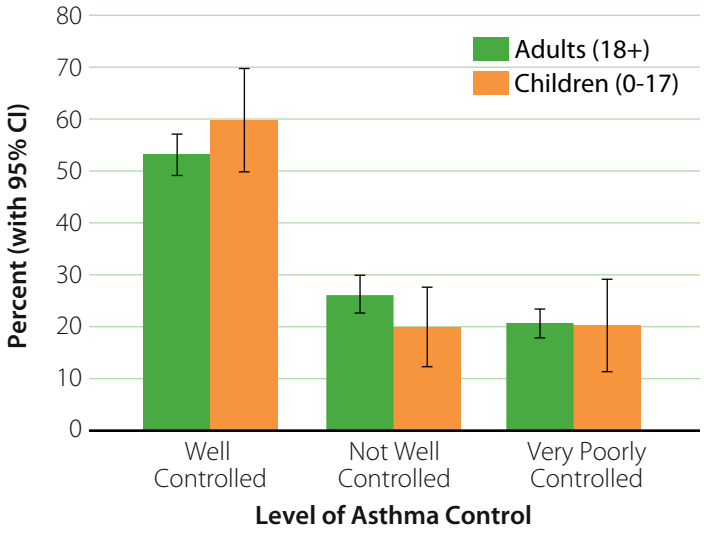
	Adults (18+)		Children (0–17)	
Hospitalizations or ED Visits	%	95% CI	%	95% CI
Any Hospitalizations	2.6	(1.5–3.7)	—	—
Any ED Visits	12.3	(9.8–14.7)	21.6	(14.3–28.9)
Number of ED Visits				
0	87.8	(85.3–90.2)	78.4	(71.1–85.7)
1	7.0	(5.0–8.9)	10.1	(4.5–15.6)
2+	5.3	(3.7–6.8)	11.5	(6.0–17.0)

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Level of Asthma Control

Level of Asthma Control Among Californians with Current Asthma, by Age, 2006–2009

While the majority of adults and children with current asthma are classified as well controlled (53.1% and 59.7%, respectively), one in five in both groups are considered to be very poorly controlled (20.7% and 20.3%, respectively).

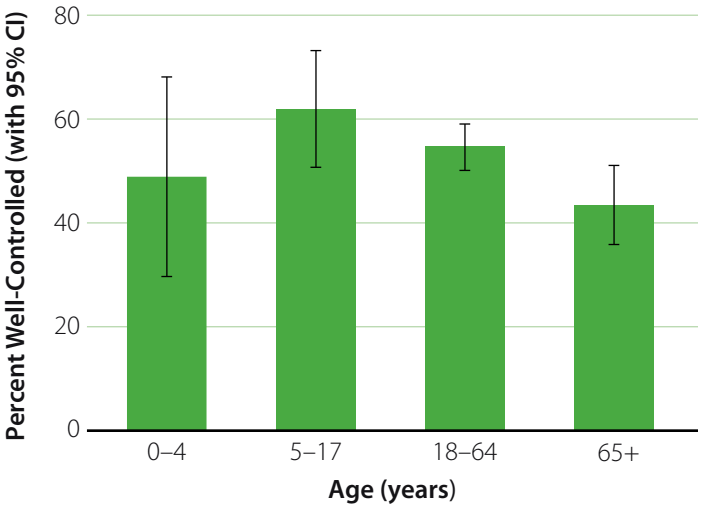


	Adults (18+)		Children (0–17)	
Level of Control	%	95% CI	%	95% CI
Well Controlled	53.1	(49.1–57.1)	59.7	(49.8–69.6)
Not Well Controlled	26.2	(22.5–30.0)	20.0	(12.2–27.8)
Very Poorly Controlled	20.7	(17.9–23.5)	20.3	(11.4–29.2)

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Percent with Well-Controlled Asthma Among Californians with Current Asthma, by Age, 2006–2009

School-aged children are most likely to have well controlled asthma (62%), while older adults (age 65+) are least likely to have well controlled asthma (43.3%). However, these differences are not statistically significant.



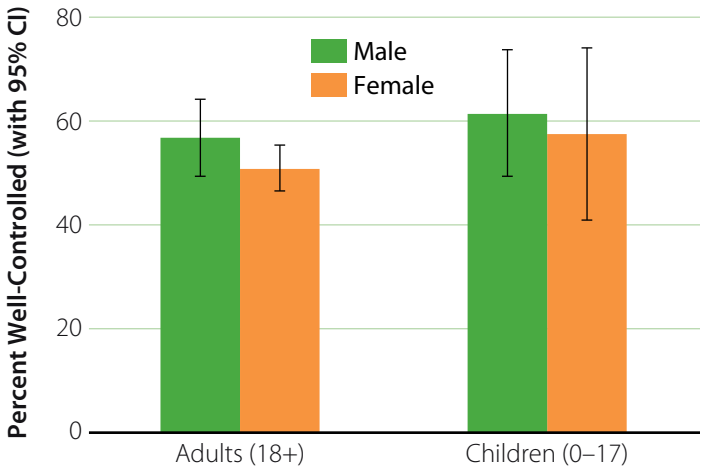
Age (Years)		%	95% CI
Children	**0 –4**	48.9*	(29.6–68.3)
	5 –17	62.0	(50.7–73.3)
Adults	**18–64**	54.6	(50.1–59.0)
	65+	43.3	(35.7–50.9)
Totals	**0–17**	59.7	(49.8–69.6)
	18+	53.1	(49.1–57.1)

* Unstable estimate — please note the wide confidence interval (see Technical Notes for details).

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Percent with Well-Controlled Asthma Among Californians with Current Asthma, by Age and Sex, 2006–2009

Level of asthma control does not differ notably by sex for either adults or children.

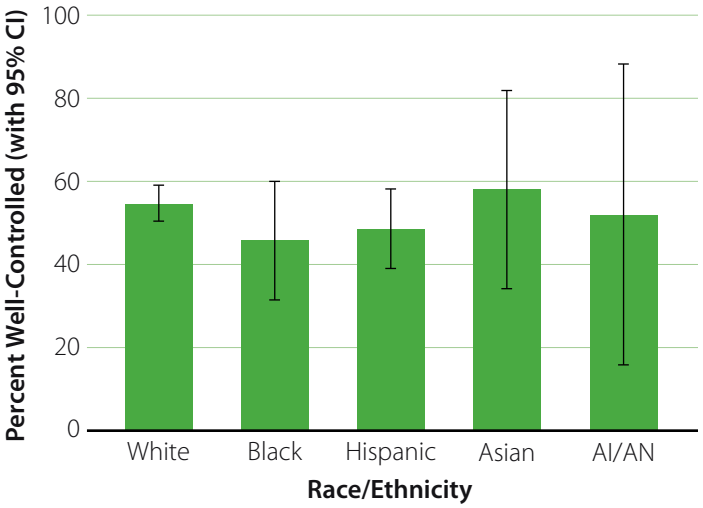


	Adults (18+)		Children (0–17)	
Sex	%	95% CI	%	95% CI
Male	56.7	(49.2–64.2)	61.4	(49.3–73.6)
Female	50.9	(46.5–55.3)	57.4	(40.9–73.8)

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Percent with Well-Controlled Asthma Among Adults with Current Asthma, by Race/Ethnicity, California 2006–2009

Blacks (45.8%) and Hispanics (48.5%) are less likely to have well controlled asthma compared to other races/ethnicities, but these differences are not statistically significant.



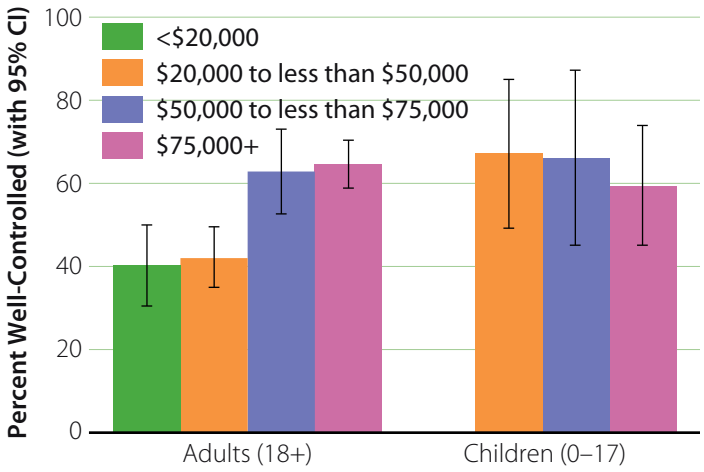
Race/Ethnicity	%	95% CI
White	54.7	(50.3–59.2)
Black	45.8	(31.5–60.0)
Hispanic	48.5	(39.0–57.9)
Asian	58.1*	(34.2–82.0)
Pacific Islander	—	—
AI/AN	52.0*	(15.9–88.2)

* Unstable estimate—please note the wide confidence interval (see Technical Notes for details).

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Percent with Well-Controlled Asthma Among Californians with Current Asthma, by Age and Annual Household Income, 2006–2009

Adults with household incomes over $50,000 are about 50–60% more likely to have well controlled asthma than adults with lower incomes. For children, level of asthma control does not vary significantly by household income.



	Adults (18+)		Children (0–17)	
Annual Household Income	%	95% CI	%	95% CI
<$20,000	40.2	(30.4 – 50.0)	—	—
$20,000 to less than $50,000	42.2	(35.0 – 49.5)	67.1*	(49.2 – 85.1)
$50,000 to less than $75,000	62.8	(52.5 – 73.1)	66.1*	(44.9 – 87.3)
$75,000+	64.5	(58.7 – 70.3)	59.3	(44.9 – 73.7)

* Unstable estimate — please note the wide confidence interval (see Technical Notes for details).

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Percent with Well-Controlled Asthma Among Adults with Current Asthma, by Selected Characteristics, California 2006–2009

Well controlled asthma does not differ notably by education level or insurance coverage in the past year. Adults who report cost barriers are significantly less likely to have well controlled asthma (33.2%) than those who do not report cost barriers (56.7%). Adults who have respiratory co-morbidities are also significantly less likely to have well controlled asthma (35.5%) than those who do not have respiratory co-morbidities (60.6%).

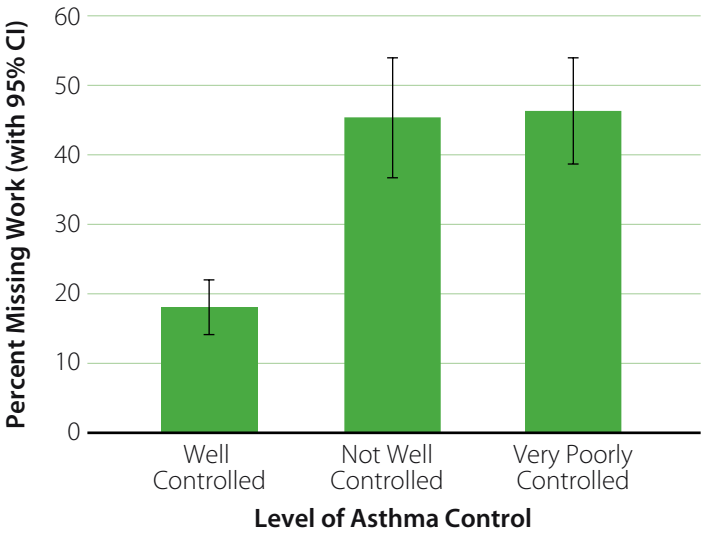
	%	95% CI
Educational Attainment		
Less than High School	47.8	(33.9–61.6)
High School Graduate	51.1	(41.0–61.1)
Some College or Technical School	48.3	(41.2–55.4)
Graduate of College or Technical School	59.2	(53.6–64.8)
Insurance Coverage in the Past 12 Months		
Full Year Coverage	53.0	(48.8–57.2)
Partial Year or No Coverage	53.6	(42.9–64.3)
Cost Barriers in the Past 12 Months*		
Any Cost Barrier	33.2	(24.7–41.7)
No Cost Barrier	56.7	(52.5–61.0)
Respiratory Co-Morbidities†		
Any Respiratory Co-Morbidity	35.5	(29.9–41.2)
No Respiratory Co-Morbidity	60.6	(55.6–65.6)

* Includes barriers to seeing a primary care doctor or specialist for asthma and/or purchasing medication for asthma treatment.
† Includes diagnoses of chronic obstructive pulmonary disease (COPD), emphysema, and chronic bronchitis.

Data Source: Adult ACBS 2006–2009

Percent Reporting Any Days Unable to Work or Carry Out Usual Activities Due to Asthma in the Past 12 Months Among Adults (18–69) with Current Asthma, by Level of Asthma Control, California 2006–2009

Adults whose asthma is considered not well or very poorly controlled are 2.5 times more likely to be unable to work or carry out usual activities due to asthma than adults with well controlled asthma.

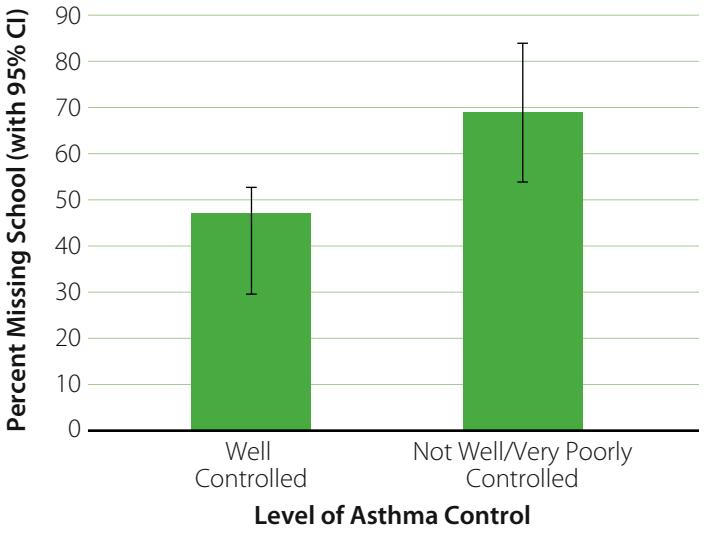


Level of Control	%	95% CI
Well Controlled	18.0	(14.1–21.9)
Not Well Controlled	45.2	(36.6–53.8)
Very Poorly Controlled	46.1	(38.5–53.7)

Data Source: Adult ACBS 2006–2009

Percent Reporting Any Missed Day Care or School Days Due to Asthma in the Past 12 Months Among Children (0–17) with Current Asthma, by Level of Asthma Control , California 2006–2008

Children whose asthma is considered not well or very poorly controlled are about 70% more likely to miss school or day care due to asthma than children with well controlled asthma.

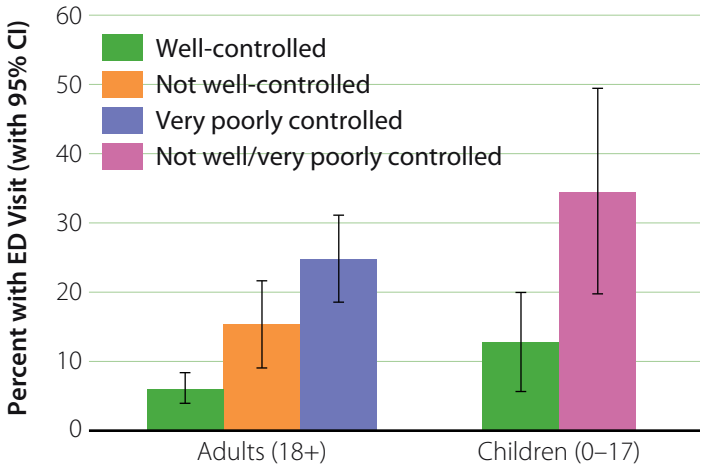


Level of Control	%	95% CI
Well Controlled	41.1	(29.5–52.8)
Not Well/Very poorly controlled	68.8	(53.7–83.8

Data Source: Child ACBS 2006–2008

Percent Reporting an ED Visit for Asthma in the Past 12 Months Among Californians with Current Asthma, by Age and Level of Asthma Control, 2006–2009

Adults with very poorly controlled asthma are four times more likely to have an ED visit for asthma than those with well controlled asthma (adults in the not well controlled asthma category are 2.5 times more likely). Children whose asthma is considered not well or very poorly controlled are 2.7 times more likely to have an ED visit for asthma than those with well controlled asthma.

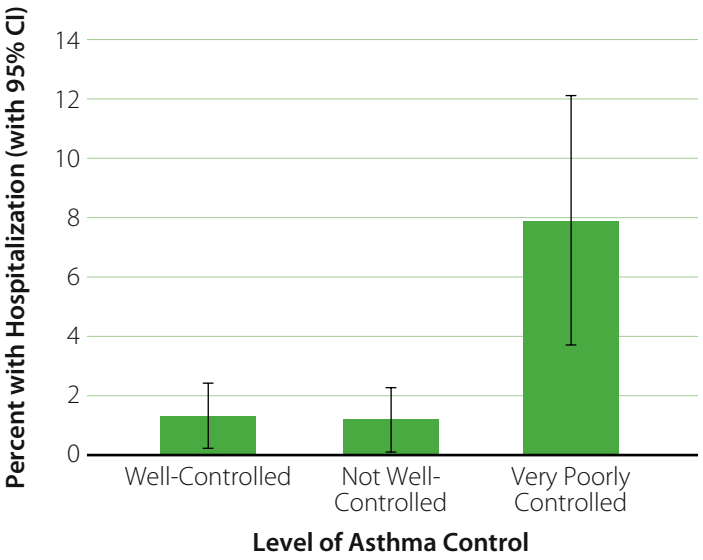


	Adults (18+)		Children (0–17)	
Level of Control	**%**	**95% CI**	**%**	**95% CI**
Well Controlled	6.2	(4.0–8.5)	12.8	(5.7–19.8)
Not Well Controlled	15.4	(9.1–21.6)	34.6	(19.8–49.5)
Very Poorly Controlled	24.9	(18.6–31.6)		

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Percent Reporting a Hospitalization for Asthma in the Past 12 Months Among Adults with Current Asthma, by Level of Asthma Control, California 2006–2009

Adults with very poorly controlled asthma are 6 times more likely to have been hospitalized for asthma in the past year when compared to adults in the well controlled or not well controlled categories.

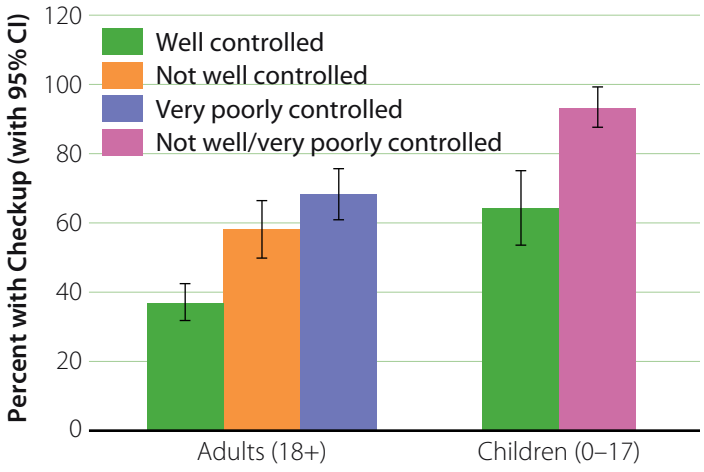


Level of Control	%	95% CI
Well Controlled	1.3*	(0.2–2.4)
Not Well Controlled	1.2*	(0.1–2.3)
Very Poorly Controlled	7.9	(3.7–12.1)

* Unstable estimate—please note the wide confidence interval (see Technical Notes for details).
Data Source: Adult ACBS 2006–2009

Percent Reporting a Routine Asthma Checkup in the Past 12 Months Among Californians with Current Asthma, by Age and Level of Asthma Control, California 2006–2009

Adults and children with well controlled asthma are significantly less likely to have had a routine asthma checkup in the past year than those with not well or very poorly controlled asthma.

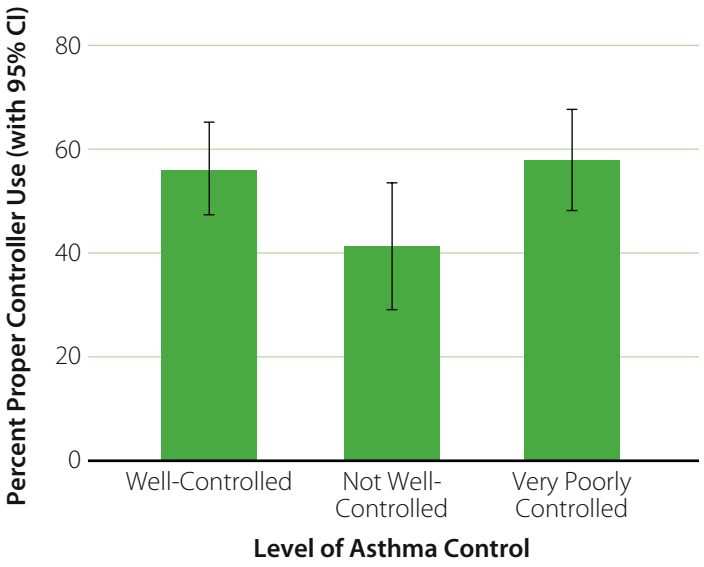


	Adults (18+)		Children (0–17)	
Level of Control	%	95% CI	%	95% CI
Well Controlled	37.2	(31.8–42.5)	64.3	(53.5–75.1)
Not Well Controlled	58.2	(49.6–66.7)	93.4	(87.4–99.4)
Very Poorly Controlled	68.2	(60.7–75.7)		

Data Source: Adult ACBS 2006–2009, Child ACBS 2006–2008

Percent Reporting Proper Use of Controller Medication in the Past 3 Months Among Adults with Current Asthma, by Level of Asthma Control, California 2009

Proper use of controller medication does not differ significantly by level of asthma control.



Level of Control	%	95% CI
Well Controlled	56.2	(47.3–65.2)
Not Well Controlled	41.3	(29.1–53.4)
Very Poorly Controlled	58.0	(48.2–67.8)

Data Source: Adult ACBS 2009

Asthma Management Practices

Current national guidelines for the proper management and treatment of asthma[17] recommend that all asthma patients should: have a routine checkup with a health care provider at least every 6 months; receive education on how to avoid exposure to environmental asthma triggers; receive a written asthma management plan from a health care provider; receive education on how to manage asthma attacks; and receive education on how to use a prescription inhaler. For patients with persistent asthma (i.e., those experiencing asthma symptoms more than twice a week), the guidelines also recommend the use of daily inhaled corticosteroids.

Number of Routine Asthma Checkups in the Past 12 Months Among Californians with Current Asthma, by Age, 2006–2009

About three out of four children with current asthma (76%) have had at least one routine asthma checkup in the past year. Among adults, however, over half (54%) have not had a routine asthma checkup in the past year.

Number of asthma checkups	Adults (18+)		Children (0–17)	
	%	95% CI	%	95% CI
0	54.0	(47.1–60.9)	24.0	(16.1–31.9)
1–2	29.8	(23.2–36.3)	46.8	(36.9–56.7)
3+	16.2	(11.7–20.7)	29.2	(19.6–38.7)

Data Source: Adult ACBS 2009, Child ACBS 2006–2008

17 NHLBI, 2007.

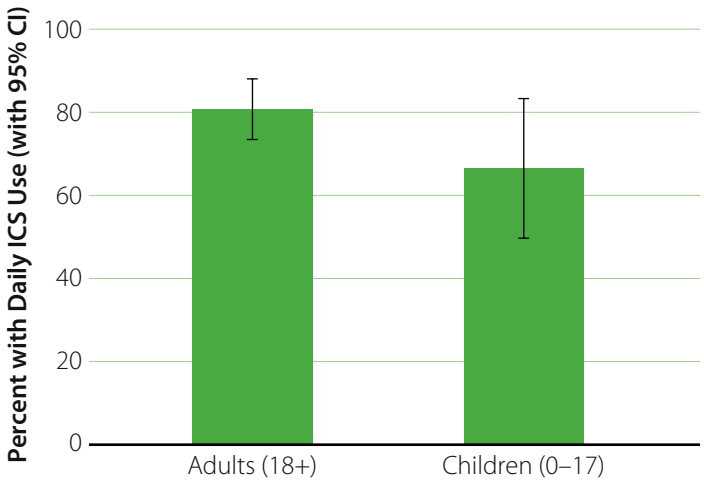
Type of Prescription Medication Use in the Past Three Months Among Californians with Current Asthma, by Age, 2006–2009

Nearly one third of adults and one quarter of children with current asthma used no prescription asthma medication in the past three months. Approximately one quarter of adults and children with current asthma (27.7% and 24.1%, respectively) used only a rescue medication in the past 3 months (i.e., they did not use any controller medication).

	Adults (18+)		Children (0–17)	
Prescription Medicine Use	%	95% CI	%	95% CI
No prescription medication used	31.2	(25.4–37.0)	23.5	(15.7–31.3)
Rescue medication only	27.7	(21.5–33.9)	24.1	(14.7–33.6)
Controller medication only	10.1	(5.9–14.3)	9.7*	(3.8–15.7)
Both controller and rescue use	31.0	(24.8–37.2)	42.7	(33.0–52.3)

* Unstable estimate — please note the wide confidence interval (see Technical Notes for details).
Data Source: Adult ACBS 2009, Child ACBS 2006–2008

Percent Reporting Daily Inhaled Corticosteroid (ICS) Use in the Past 3 Months Among Californians with Current Asthma who Use Inhaled Corticosteroids, by Age, 2006–2009



	Adults (18+)		Children (0–17)	
ICS Use	%	95% CI	%	95% CI
Daily ICS use	80.7	(73.4–88.0)	66.4*	(49.6–83.4)

* Unstable estimate — please note the wide confidence interval (see Technical Notes for details).
Data Source: Adult ACBS 2009, Child ACBS 2006–2008

Percent Reporting Proper Use of Inhaled Prescription Asthma Medications in the Past 3 Months Among Californians with Current Asthma who Use Inhaled Prescription Asthma Medications, by Age, 2006–2009

The majority of adults and children with current asthma report proper use of rescue medication (67.6% and 69.6%, respectively). However, fewer than 40% report proper use of controller medications.

	Adults (18+)		Children (0–17)	
Proper Use of Medications	%	95% CI	%	95% CI
Proper use of controller medications†	39.8	(29.3–50.4)	36.0*	(20.5–51.5)
Proper use of rescue medications‡	67.6	(59.2–75.9)	69.6	(57.6–81.5)

*Unstable estimate — please note the wide confidence interval (see Technical Notes for details).
† For all inhaled control medications reported, they must be used on a schedule every day, not used for attacks, and for certain medications not used before exercise.
‡ For all inhaled rescue medications reported, they must be used for attacks, not used on a schedule every day, and for certain medications not used before exercise.
Data Source: Adult ACBS 2009, Child ACBS 2006–2008

Asthma Self-Management Education Among Californians with Current Asthma, by Age, 2006–2009

Almost all adults and children with current asthma report receiving at least one form of asthma self-management education (99.2% and 99.3%, respectively). The most commonly received forms of self-management education are: how to use a prescription inhaler, what to do during an asthma attack, and how to recognize early signs of an asthma attack. Fewer adults and children (about 30–45%) have been given an asthma action plan or have been advised to change their environments to improve their asthma. Very few adults or children (10–20%) have ever taken a formal class on how to manage their asthma.

	Adults (18+)		Children (0–17)	
Self-Management Education	**%**	**95% CI**	**%**	**95% CI**
Ever been taught how to recognize early signs of an asthma attack	69.3	(63.9–74.8)	86.1	(80.6–91.7)
Ever been taught what to do during an asthma attack	84.0	(80.1–87.9)	88.4	(83.3–93.6)
Ever been taught how to use a peak flow meter to adjust daily medications	52.8	(46.1–59.4)	42.1	(32.8–51.4)
Ever been given an Asthma Action Plan	37.7	(31.0–44.4)	44.6	(35.8–53.4)
Ever taken a class on how to manage asthma	11.2	(7.9–14.5)	18.9	(10.9–26.9)
Ever been shown how to use their prescription inhaler	97.3	(96.0–98.7)	91.3	(84.8–97.8)
Ever been advised to change things in their home, work or school environment to improve their asthma	29.9	(24.1–35.6)	44.4	(34.6–54.3)
Received any self-management education	99.2	(98.5–99.8)	99.3	(98.0–100.0)
Total number of self-management education elements reported				
None or 1	7.0	(4.3–9.7)	5.8*	(1.8–9.7)
2–3	35.3	(29.1–41.5)	29.3	(19.2–39.3)
4+	57.7	(51.2–64.2)	65.0	(54.8–75.2)

* Unstable estimate — please note the wide confidence interval (see Technical Notes for details).
Data Source: Adult ACBS 2009, Child ACBS 2006–2008

Level of Confidence to Control and Manage Asthma among Californians with Current Asthma, by Age, 2009

	Adults (18+)		Children (0–17)	
Level of Confidence	%	95% CI	%	95% CI
Very confident	69.8	(66.1–73.4)	68.8	(64.1–73.6)
Somewhat confident	25.9	(22.3–29.5)	27.0	(22.6–31.5)
Not too/not at all confident	4.4	(3.0–5.7)	4.1	(2.5–5.7)

Data Source: CHIS 2009

3 Health Status of People With Asthma

Summary

- People with current asthma report worse general health than people without asthma.
- Adults with current asthma are 8-10 times more likely to have chronic obstructive pulmonary disease (COPD) than adults who do not have asthma.
- Almost one in three adults with current asthma is obese (31% vs. 21.7% among adults who do not have asthma), and one in seven teens (age 12–17) with current asthma is obese (14.4% vs. 10.9% among teens who do not have asthma).
- Among adults with current asthma, 11.6% also have diabetes, 37% also have high blood pressure, and 9.8% also have heart disease (compared to 8.2%, 25.5%, and 5.6%, respectively, among adults who do not have asthma).
- Over 40% of adults with current asthma are disabled (compared to 26.3% among adults who do not have asthma).
- About 6% of adults and teens with current asthma have psychological distress.
- Over one third of children and half of adults with current asthma did not have a flu vaccination in the past year.
- Almost 12% of adults and teens with current asthma are smokers.
- 19.4% of adults and 4.7% of children with current asthma were uninsured at some time in the past year.
- 11.2% of adults and 9.1% of children with current asthma do not have a usual place for health care.

What is the general health status of people with asthma in California?

Overall, people with current asthma report worse general health than people without asthma. Many people with asthma also have other chronic conditions that contribute to poorer health. Among adults with current asthma, 20% have chronic obstructive pulmonary disease (COPD), 37% have high blood pressure, 12% have diabetes, 10% have heart disease, 41% are disabled, 31% are obese, and 6% have psychological distress. All of these conditions are more prevalent among adults with current asthma than other adults.

Some data on health behaviors are also available, including current smoking and flu vaccination. Smoking is very frequently a trigger of asthma symptoms, yet 11.9% of adults and teens with current asthma are smokers. Flu (influenza) infection can seriously exacerbate asthma symptoms, yet more than one third of children and half of adults with current asthma did not get a flu vaccination in the past year.

Can people with asthma in California access the care they need?

Although the majority of people with current asthma have health insurance, 19.4% of adults and 4.7% of children with current asthma were uninsured some time in the past year. In addition, 11.2% of adults and 9.1% of children with current asthma reported not having a place they usually go when they are sick or need health advice.

People with asthma report worse general health than people without asthma.

One in nine adults and teens with asthma smokes tobacco.

Over 30% of adults and 14% of teens with asthma are obese.

Technical Notes

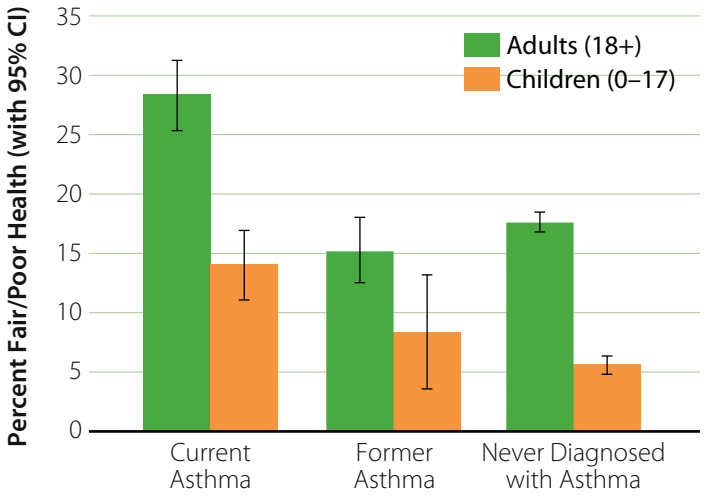
This chapter examines factors related to health status. Most of these factors relate to the respondents' current or recent state of health and so it is more appropriate to look at these factors among people who also report current asthma, not just lifetime asthma. Therefore, in this chapter, asthma status is divided into current asthma, former asthma, and never diagnosed with asthma. Although there is no cure for asthma, some people's symptoms improve over time, even after treatment and management have ended. We use the term 'former asthma' to denote people who have been diagnosed with asthma in their lifetime, but report that they no longer have asthma or asthma symptoms (i.e., their symptoms are no longer active). Current asthma is defined differently in the BRFSS and CHIS surveys. For BRFSS data, a person has current asthma if he or she has lifetime asthma and reports still having asthma. For CHIS data, a person has current asthma if he or she has lifetime asthma and reports still having asthma or having asthma symptoms in the last year.

Perceived Health Status

Perceived health status is determined from the following question in CHIS: "Would you say that in general your health is excellent, very good, good, fair, or poor?"

Percent of People Reporting Fair or Poor General Health, by Asthma Status and Age, California 2009

People with current asthma report worse general health than people without asthma. Among adults, fair or poor health was reported for 28.4% of those with current asthma, compared to 17.7% of those who have never had asthma.* Among children, fair or poor health was reported for 14% of those with current asthma, compared to 5.6% of those who have never had asthma.*



*Chi-square p<0.01

	Percent Fair/Poor General Health			
	Adults (18+)		Children (0–17)	
	%	95% CI	%	95% CI
Current Asthma	28.4	(25.4–31.4)	14.0	(11.1–16.9)
Former Asthma	15.3	(12.5–18.1)	8.4	(3.6–13.1)
Never Diagnosed with Asthma	17.7	(16.8–18.6)	5.6	(4.8–6.4)

Data Source: CHIS 2009

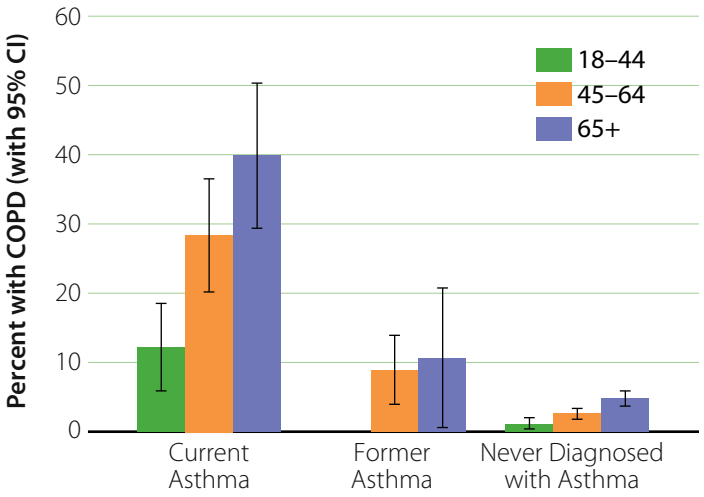
COPD

Chronic obstructive pulmonary disease (COPD) is a lung disease that includes primarily emphysema and chronic bronchitis. COPD is a major cause of disability and is the third leading cause of death in the U.S. when combined with asthma.[18] COPD and asthma are different diseases, and a person can have both COPD and asthma. However, COPD and asthma have similar symptoms and risk factors, so they can be difficult to differentiate, especially among older adults.

Percent of Adults Ever Diagnosed with COPD, by Asthma Status and Age, California 2009

Adults with current asthma are almost 8-10 more likely to have COPD than adults who have never had asthma.*

*Chi-square p<0.01 for all age groups



	Percent of Adults with COPD	
	%	95% CI
Current Asthma	20.4	(15.7–25.0)
Former Asthma	5.8	(2.4–9.1)
Never Diagnosed with Asthma	2.3	(1.6–2.6)

Data Source: BRFSS 2009

18 Hoyert, 2012.

Obesity

In addition to being an important public health problem in general, obesity has been identified as a risk factor for asthma, affecting development, severity, and even treatment.

For adults, obesity is determined by using weight and height to calculate a number called the *body mass index* (BMI). BMI is used because, for most people, it correlates with their amount of body fat. An adult who has a BMI of 30 or higher is considered obese.

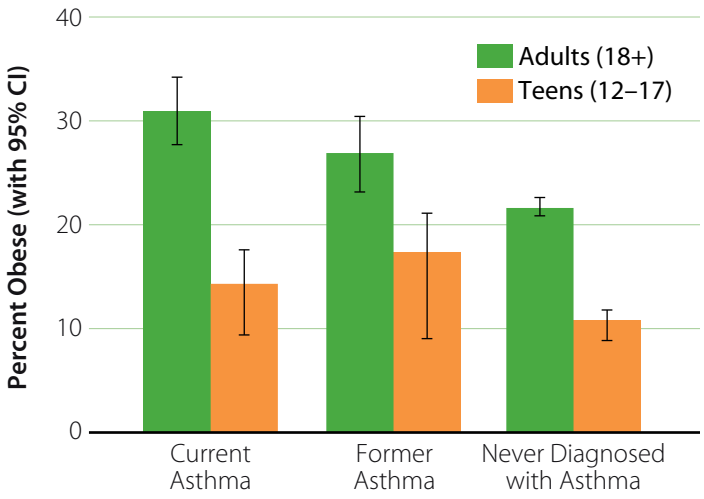
The equation for BMI is:

$$\text{BMI} = \frac{\text{weight in kilograms}}{(\text{height in meters})^2}$$

For most children and teens, BMI is also a reasonable indicator of body fat. However, children's body composition varies by age and gender. Therefore, a child's obesity status is determined using an age- and sex-specific percentile for BMI. The percentile shows the position of the child's BMI relative to other children of the same sex and age. For children, obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex. In the CHIS, information on BMI is only available for adults and teens (ages 12–17).

Percent of Adults and Teens Who Are Obese, by Asthma Status, California 2009

Almost one in three adults with current asthma (31%) is obese, and one in seven teens (age 12–17) with current asthma is obese (14.4%). For adults, obesity is significantly higher among those with current asthma than among those who have never had asthma;* for teens there is no significant difference.



*Chi-square p<0.01

	Percent Obese			
	Adults (18+)		Teens (12–17)	
	%	95% CI	%	95% CI
Current Asthma	31.0	(27.8–34.2)	14.4	(9.4–19.4)
Former Asthma	26.9	(23.2–30.5)	17.4	(9.1–25.7)
Never Diagnosed with Asthma	21.7	(20.8–22.6)	10.9	(8.9–13.0)

Data Source: CHIS 2009

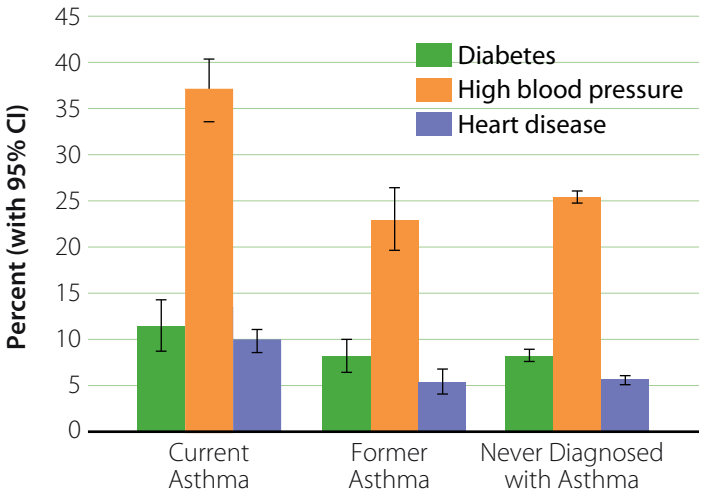
Other Co-Morbid Conditions

Co-morbidity is the presence of one or more diseases in addition to a primary disease. It is important to consider co-morbid conditions when assessing the total burden of disease for people with asthma. Three common adult conditions for which data are available are diabetes, high blood pressure, and heart disease.

Percent of Adults with Diabetes, High Blood Pressure, or Heart Disease, by Asthma Status, 2009

Among adults with current asthma, 11.6% also have diabetes, 37.0% also have high blood pressure, and 9.8% also have heart disease. The prevalence of these diseases are all significantly higher in adults with current asthma than in adults who have never had asthma.*

*Chi-square p<0.01 for all mentioned comparisons



	Percent with Diabetes		Percent with High Blood Pressure		Percent with Heart Disease	
	%	95% CI	%	95% CI	%	95% CI
Current Asthma	11.6	(8.7–14.4)	37.0	(33.5–40.4)	9.8	(8.5–11.2)
Former Asthma	8.2	(6.3–10.0)	22.9	(19.5–26.4)	5.4	(4.1–6.7)
Never Diagnosed with Asthma	8.2	(7.6–8.8)	25.5	(24.7–26.2)	5.6	(5.1–6.0)

Data Source: CHIS 2009

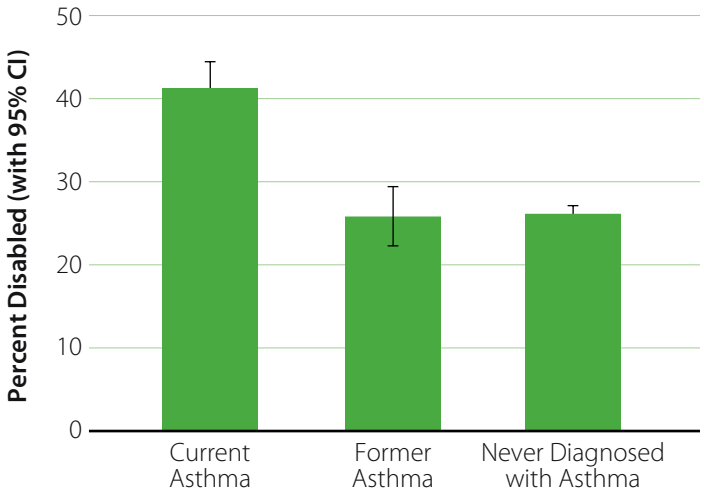
Disability

CHIS respondents are asked a series of six questions about long-lasting physical, emotional, and mental limitations. Adapted from the Census Bureau's American Community Survey, these questions measure disability status as a function of sensory, physical, mental, self-care, daily life, and/or work limitations. The survey does not include information on whether asthma is the source of the disability or not.

Percent of Adults with a Disability, by Asthma Status, California 2009

Over 40% of adults with current asthma report being disabled due to a physical, mental, or emotional condition. This is significantly higher than among adults who have never had asthma.*

*Chi-square p<0.01



	Percent Disabled	
	%	95% CI
Current Asthma	41.1	(37.9–44.4)
Former Asthma	25.9	(22.3–29.4)
Never Diagnosed with Asthma	26.3	(25.4–27.2)

Data Source: CHIS 2009

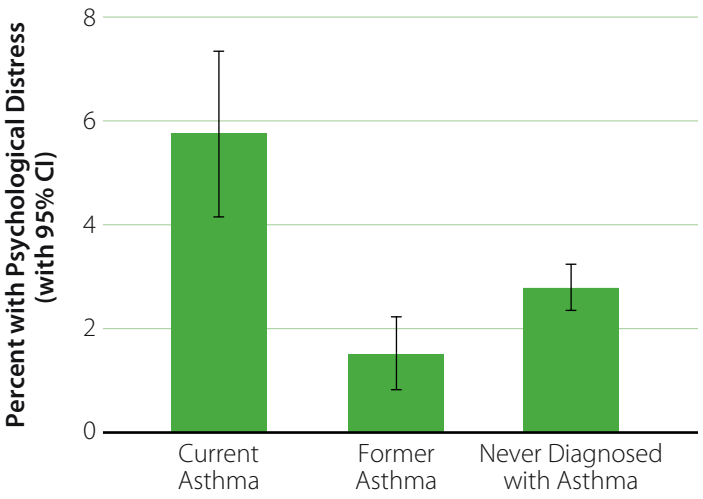
Psychological Distress

In the CHIS, psychological distress is measured using the Kessler K6 Scale, a series of questions used to measure an individual's stress levels in relation to serious mental illness. People with a score of 13 or greater are considered likely to have psychological distress and are included in the percentages presented below.

Percent of Adults and Teens With Psychological Distress in the Past Month, by Asthma Status, California 2009

About 6% of adults and teens with current asthma reported psychological distress in the past month. This is two times higher than among those who have never had asthma.*

*Chi-square p<0.01



	Percent Adults/Teens with Psychological Distress in Past Month	
	%	95% CI
Current Asthma	6.2	(4.5–7.8)
Former Asthma	1.5	(0.9–2.2)
Never Diagnosed with Asthma	2.9	(2.4–3.3)

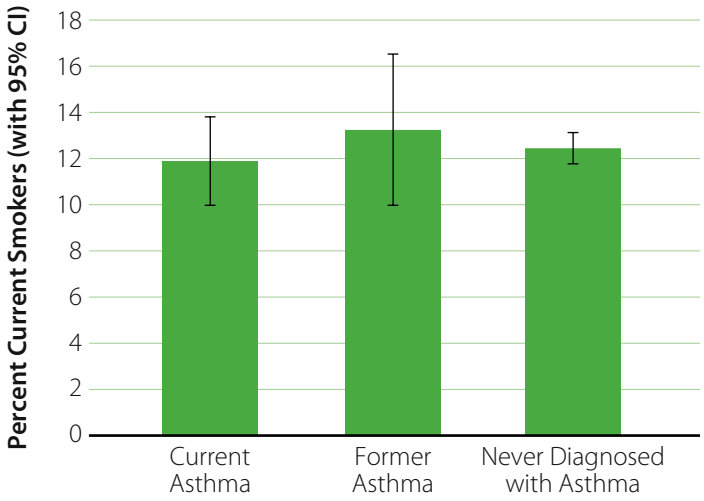
Data Source: CHIS 2009

Personal Smoking Status

Tobacco smoke is very frequently a trigger of asthma symptoms and exposure to secondhand tobacco smoke is also a risk factor for development of new cases of asthma in young children.

Percent of Adults and Teens Who Are Current Smokers, by Asthma Status, California 2009

Although the majority of people with current asthma are not current smokers, 11.9% of adults and teens are current smokers. This is not significantly different from people who do not have current asthma, but given the serious effects of smoking on asthma, these rates of smoking are of concern.



	Percent Current Smokers (Adults and Teens)	
	%	95% CI
Current Asthma	11.9	(10.0–13.8)
Former Asthma	13.3	(10.0–16.5)
Never Diagnosed with Asthma	12.5	(11.8–13.3)

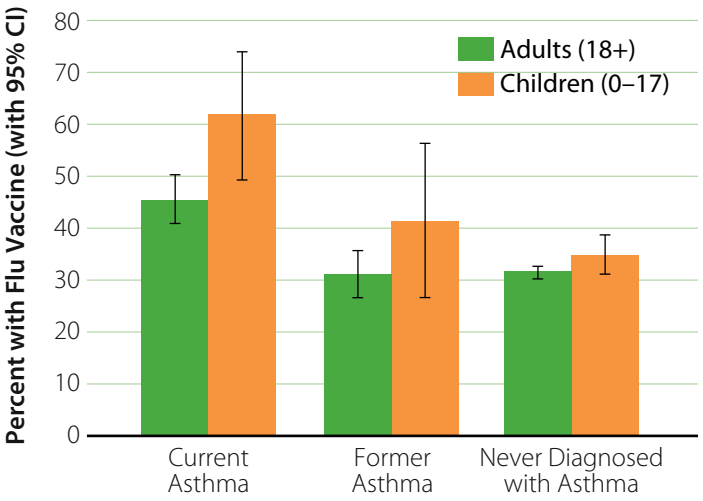
Data Source: CHIS 2009

Flu Vaccination

The CDC's Advisory Committee on Immunization Practices (ACIP) now recommends that all people age six months and older receive a flu vaccination annually. When vaccine supply is limited, though, delivery efforts are focused on vulnerable populations, including people with asthma.[19] Flu (influenza) and other respiratory infections very frequently cause an increase in asthma symptoms.

Percent of People Who Had a Flu Vaccine* in the Last Year, by Asthma Status and Age, California 2009

Adults and children with current asthma are more likely to get a flu vaccination than those who have never had asthma.† However, coverage does not meet the 100% ACIP recommendation; while 62% of children and 46% of adults with current asthma had a flu vaccination in the past year, more than one third of children and half of adults with current asthma did not.



*Either shot/injection or nasal spray
†Chi-square p<0.001

	Percent with Flu Vaccine in Last Year			
	Adults (18+)		Children (0–17)	
	%	95% CI	%	95% CI
Current Asthma	45.6	(41.0–50.1)	61.8	(49.3–74.3)
Former Asthma	31.1	(26.5–35.7)	41.5	(26.7–56.3)
Never Diagnosed with Asthma	31.5	(30.3–32.7)	34.9	(31.1–38.8)

Data Source: BRFSS 2009

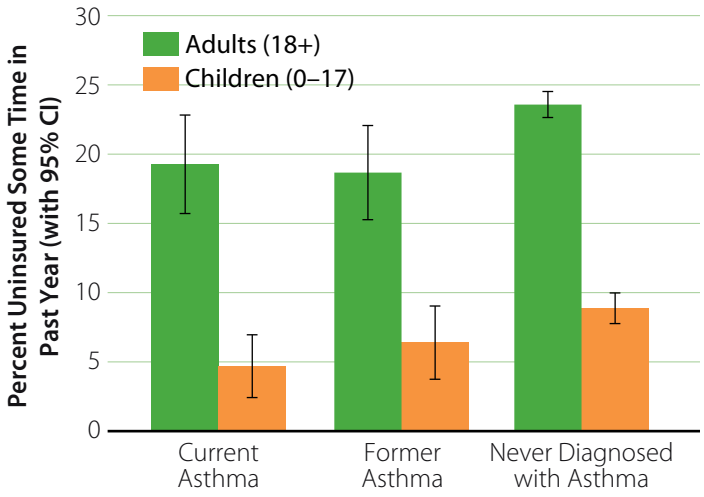
19 Fiore, 2010.

Access to Care

Having insurance is important for people with asthma in order to receive appropriate care and medication. However, costs and coverage levels vary widely across insurance plans, and having insurance does not guarantee that health care will be affordable, easy to access, or of high quality.

Percent of People Who Were Uninsured for All or Part of the Last Year, by Asthma Status and Age, California 2009

Although the majority of people with current asthma have health insurance, 19.4% of adults and 4.7% of children with current asthma were uninsured some time in the past year. Lack of insurance coverage among people with current asthma is not significantly different from lack of coverage among the other groups.



	Percent Uninsured All or Part of the Last Year			
	Adults (18+)		Children (0–17)	
	%	95% CI	%	95% CI
Current Asthma	19.4	(15.7–23.0)	4.7	(2.4–7.1)
Former Asthma	18.7	(15.3–22.1)	6.4	(3.6–9.1)
Never Diagnosed with Asthma	23.6	(22.7–24.5)	8.9	(7.8–10.0)

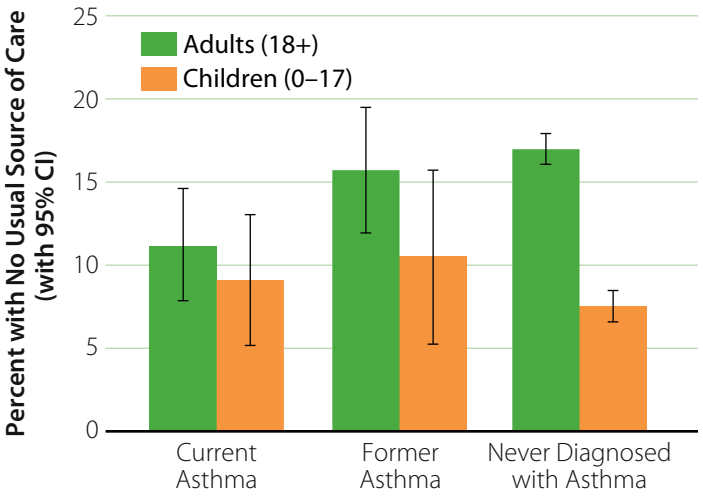
Data Source: CHIS 2009

Usual Source of Care

CHIS respondents are asked whether there is a place that they usually go to when they or their child are sick or need advice about their health.

Percent of People with No Usual Source of Health Care, by Asthma Status and Age, California 2009

Although the majority of people with current asthma have a usual source of care, 11.2% of adults and 9.1% of children with current asthma reported not having a usual source of care. For adults, the difference in the percent with no usual source of care is significant between those with current asthma and those who never had asthma,* but for children there is no significant difference.



*Chi-square p<0.01

	Percent With No Usual Source of Health Care			
	Adults (18+)		Children (0–17)	
	%	95% CI	%	95% CI
Current Asthma	11.2	(7.9–14.6)	9.1	(5.1–13.1)
Former Asthma	15.7	(11.9–19.5)	10.5	(5.3–15.7)
Never Diagnosed with Asthma	17.1	(16.1–18.0)	7.5	(6.6–8.4)

Data Source: CHIS 2009

4 Environmental Triggers for Asthma

Summary

- About 10% of adults with current asthma and 5% of children with current asthma are exposed to secondhand smoke in the home.
- On average, people with asthma are exposed to 2–3 asthma triggers in the home (e.g., mold, cockroaches, rodents, pets, carpeting, wood burning or gas appliances, and tobacco smoke).
- On average, people with asthma have taken 3–4 actions to reduce exposure to asthma triggers in the home.
- About 40% of people with asthma are renters, which can impact their ability to reduce exposure to housing-related asthma triggers.
- About 25% of people with asthma live in multi-unit housing, where asthma triggers might pass from one unit in the building to another.
- Outdoor air pollutants are important asthma triggers; their levels vary widely across the state.

What things in the environment can trigger asthma?

People with asthma can be exposed to things in indoor and outdoor environments that cause an asthma attack or make asthma symptoms worse — these things are called asthma triggers. Triggers can be found outdoors or indoors, especially in places where people spend a lot of time, including residences, work places, schools, or childcare facilities. Each person with asthma might be sensitive to different asthma triggers. Some common asthma triggers are: secondhand smoke (also called environmental tobacco smoke), dust mites, outdoor air pollutants like ozone and particulate matter, cockroach allergens, pet dander, mold and/or excessive moisture, wood smoke (or smoke from other types of burning), and certain chemicals (e.g., cleaning products, perfumes, air fresheners, preservatives, or chemicals that off-gas from new products).

What do we know about environmental triggers for asthma in California?

Although data on environmental asthma triggers are limited, surveys and air monitoring provide some information to describe the burden of environmental hazards in housing, indoor air, and outdoor air. About 10% of adults with current asthma and 5% of children with current asthma are exposed to secondhand smoke in the home. On average, people with asthma are exposed to 2–3 asthma triggers in the home (e.g., mold, cockroaches, rodents, pets, carpeting, wood burning or gas appli-

ances, and tobacco smoke). About 40% of people with asthma are renters, which can impact the level of control they have over health-related housing problems. About 25% of people with asthma live in multi-unit housing, where asthma triggers might intrude from other units. Outdoor air pollutants are also important asthma triggers; their levels vary widely across the state.

Technical Notes

Data on housing characteristics and indoor asthma triggers are from the California Health Interview Survey (CHIS) and the BRFSS Asthma Call-Back Survey (ACBS). Data on outdoor air pollutants are from the California Air Resources Board (CARB). Details about the data presented in this chapter can be found in the Technical Notes section at the end of this report.

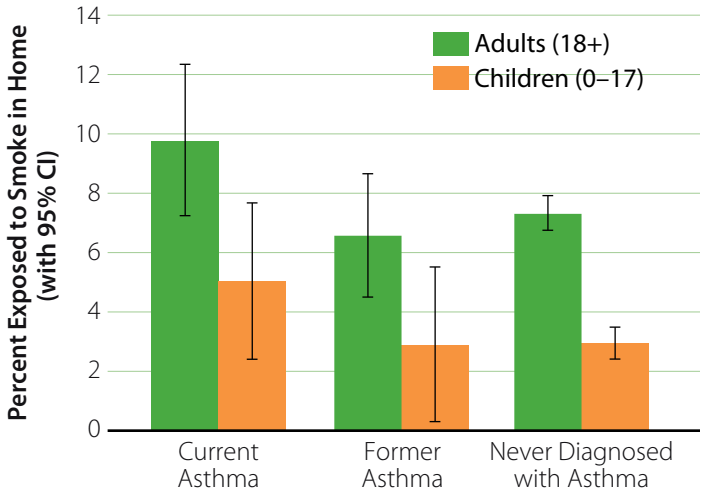
Americans spend about 90% of their time indoors. Asthma attacks are often triggered by indoor allergens and irritants.

Outdoor air pollution from sources such as cars and trucks, fireplaces, factories, and power plants is also a major cause of asthma attacks.

Percent of People Exposed to Secondhand Smoke in the Home, by Asthma Status and Age, California 2009

The home is the primary source of exposure to secondhand smoke (SHS), which can trigger asthma episodes, can increase the severity of attacks, and is also a risk factor for new cases of asthma in young children. About 10% of adults with current asthma are exposed to SHS in the home, and this is significantly higher than adults who have never had asthma.* Five percent of children with current asthma are exposed to SHS in the home. This is higher than children who do not have asthma, but this difference is not statistically significant.

*Chi-square $p<0.05$



	Percent Exposed to Smoke in the Home			
	Adults (18+)		Children (0–17)	
	%	(95% CI)	%	(95% CI)
Current Asthma	9.8	(7.2–12.3)	5.0	(2.4–7.6)
Former Asthma	6.6	(4.5–8.7)	2.9†	(0.3–5.4)
Never Diagnosed with Asthma	7.3	(6.7–7.9)	2.9	(2.4–3.5)

†Unstable estimate — please note the wide confidence interval (see Technical Notes for details).

Data Source: CHIS 2009

Percent of People with Current Asthma Who Report Home Environmental Exposures, by Age, California 2006–2009

The ACBS asks people with asthma a variety of questions about things in their home environments that might trigger or worsen asthma symptoms. The table below lists the percentages of people with current asthma who report environmental exposures in the home, such as mold, cockroaches, rodents, pets, carpeting (which may increase exposure to dust, dust mites, and moisture), wood burning and gas appliances, and tobacco smoke. On average, adults and children are exposed to about three of these triggers. (Information is not available for people who do not have asthma.)

	Adults (18+)		Children (0–17)	
Environmental Exposures	%	(95% CI)	%	(95% CI)
Mold (past 30 days)	10.6	(6.4–14.8)	8.4*	(2.5–14.5)
Cockroaches, mice or rats (past 30 days)	10.9	(6.3–15.6)	6.0*	(1.2–10.8)
Pets inside home	60.1	(53.7–66.5)	59.7	(50.0–69.4)
Carpeting or rugs in bedroom	70.9	(64.8–77.0)	71.7	(63.0–80.4)
Wood burning fireplace/stove	22.3	(17.1–27.5)	29.3	(20.4–38.1)
Gas used for cooking	70.8	(65.3–76.4)	65.9	(56.2–75.6)
Unvented gas fireplace/unvented gas stove†	9.8	(5.6–13.9)	—	—
Smoking inside home (past week)	9.4	(5.4–13.4)	8.4*	(0.3–16.4)
Current smoker				
Adult is a current smoker	13.1	(8.9–17.2)	NA	
Child lives in a home with a current smoker	NA		12.8*	(4.5–21.1)
Average number of exposures reported, of the ten exposures listed above‡	2.8	(2.6–3.0)	2.7	(2.4–2.9)

* Unstable estimate — please note the wide confidence interval (see Technical Notes for details).

† Survey does not specify whether vented stoves vent to the outside or not.

‡ There are a total of ten exposures because mice/rats are counted separately from cockroaches.

Data Source: Adult ACBS 2009; Child ACBS 2006–2008

Percent of People with Current Asthma Who Report Actions Taken to Reduce Home Environmental Exposures, by Age, California 2006–2009

A variety of actions can be taken to reduce exposure to environmental asthma triggers in the home. The table below lists the percentages of people with current asthma who report taking trigger-reducing measures, such as using sealed plastic mattress or pillow covers, washing sheets in hot water, not allowing pets in the bedroom, using exhaust fans, using air cleaners, and using dehumidifiers. On average, people with current asthma report taking about 3.5 of these actions. (Information is not available for people who do not have asthma.)

	Adults (18+)		Children (0–17)	
Actions taken to reduce environmental exposures	%	(95% CI)	%	(95% CI)
Mattress cover used	37.2	(30.4–44.1)	37.1	(27.5–46.7)
Pillow cover used	32.4	(25.8–39.1)	38.8	(29.5–48.2)
Sheets/pillowcases washed in hot water	45.5	(38.8–52.1)	47.4	(37.6–57.2)
Pets not allowed in bedroom (if pets inside the home)	19.7	(13.3–26.2)	33.3	(21.6–45.0)
Kitchen exhaust fan regularly used	64.7	(58.4–71.0)	76.3	(68.9–83.8)
Bathroom exhaust fan regularly used	58.7	(52.2–65.1)	55.5	(45.8–65.1)
Air cleaner/purifier regularly used*	29.4	(22.9–35.8)	32.8	(23.3–42.2)
Dehumidifier regularly used	7.5	(3.7–11.4)	12.7	(6.4–19.0)
Average number of actions taken, of the eight actions listed above	3.4	(3.1–3.7)	3.6	(3.3–3.9)

* Information on the type of air cleaner used was not collected. Please note that some air cleaners emit ozone and may make asthma worse.

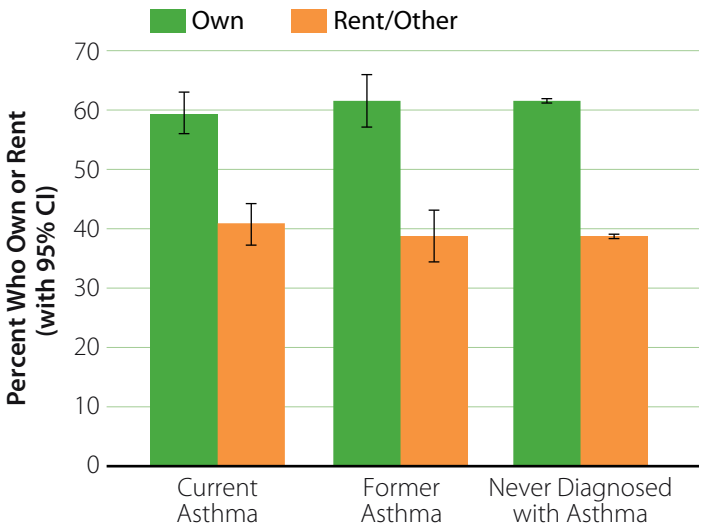
Data Source: Adult ACBS 2009; Child ACBS 2006–2008

Percent of People Who Own Their Home vs. Rent or Have Another Arrangement, by Asthma Status and Age, California 2009

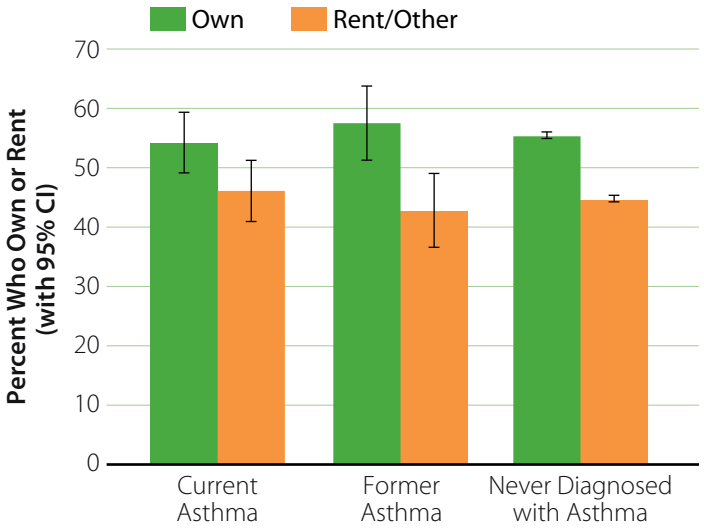
Whether a resident rents or owns a housing unit may affect the level of control they have over preventing, remediating or abating health-related housing problems. About 40% of people with asthma are renters (or have another arrangement besides owning). Although this is not significantly higher than people who do not have asthma, it is important to note the prevalence of this characteristic.

Note: For children, own or rent refers to the living arrangement reported by the parent or legal guardian.

Adults (18+)



Children (0–17)

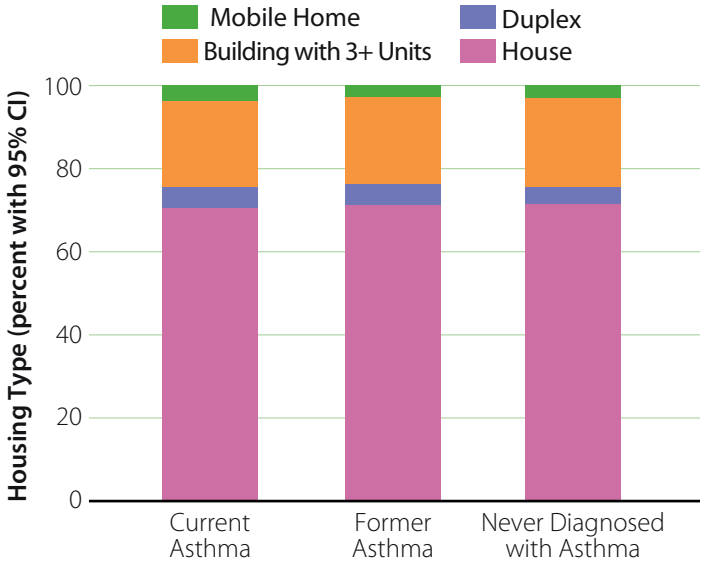


	Adults (18+)				Children (0–17)			
	Own		Rent/Other		Own		Rent/Other	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Current Asthma	59.3	(55.7–62.9)	40.7	(37.1–44.3)	54.1	(49.0–59.2)	45.9	(40.8–51.0)
Former Asthma	61.3	(56.9–65.6)	38.7	(34.4–43.1)	57.3	(51.1–63.5)	42.7	(36.5–48.9)
Never Diagnosed with Asthma	61.4	(61.0–61.8)	38.6	(38.2–39.0)	55.3	(54.7–55.9)	44.7	(44.1–45.3)

Data Source: CHIS 2009

Type of Housing by Asthma Status, Adults (18+), California 2009

The number of housing units per structure can affect exposure to asthma triggers. For example, housing units with shared walls may be affected by secondhand smoke drifting from neighbors, pest infestation from other units, or moisture intrusion from leaks in other parts of the building. Multi-unit buildings may also differ in building management policies. Among adults with asthma, about 5% live in duplexes and 20% live in buildings with three or more units. This is similar to adults who do not have asthma.



	Housing Type							
	House		Duplex		Building with 3+ Units		Mobile Home	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Current Asthma	70.5	(66.7–74.3)	5.2	(3.7–6.8)	20.5	(16.5–24.5)	3.8	(2.7–4.8)
Former Asthma	71.3	(67.4–75.3)	4.9	(2.2–7.5)	21.1	(17.6–24.7)	2.7	(1.6–3.7)
Never Diagnosed with Asthma	71.5	(70.8–72.2)	4.1	(3.7–4.4)	21.3	(20.6–22.0)	3.1	(2.8–3.4)

Data Source: CHIS 2009

Outdoor Air Pollutants in California Air Basins

Particulate matter (PM) and ozone are air pollutants that can worsen asthma symptoms. Both PM and ozone can result from the emissions produced from combustion processes that occur in motor vehicles, at power plants, ports, railyards, industrial facilities, and elsewhere. PM_{10} and $PM_{2.5}$ are particles that are less than 10 microns or 2.5 microns in diameter, respectively. (As a reference, human hair is about 40-100 microns in diameter.) They pose a greater health concern than larger particles because they are small enough that they can pass through the nose and throat and get into the lungs. Ozone is a gas that, when inhaled, damages lung tissue and people with asthma are particularly vulnerable to its effects.

To protect public health, both the California and U.S. governments have established Ambient Air Quality Standards (AAQS) for a number of outdoor air pollutants. The standards for PM_{10}, $PM_{2.5}$, and ozone are listed in the box below. California standards for PM_{10} and ozone are more stringent than the national standards (NAAQS); there is no 24-hour California standard for $PM_{2.5}$.

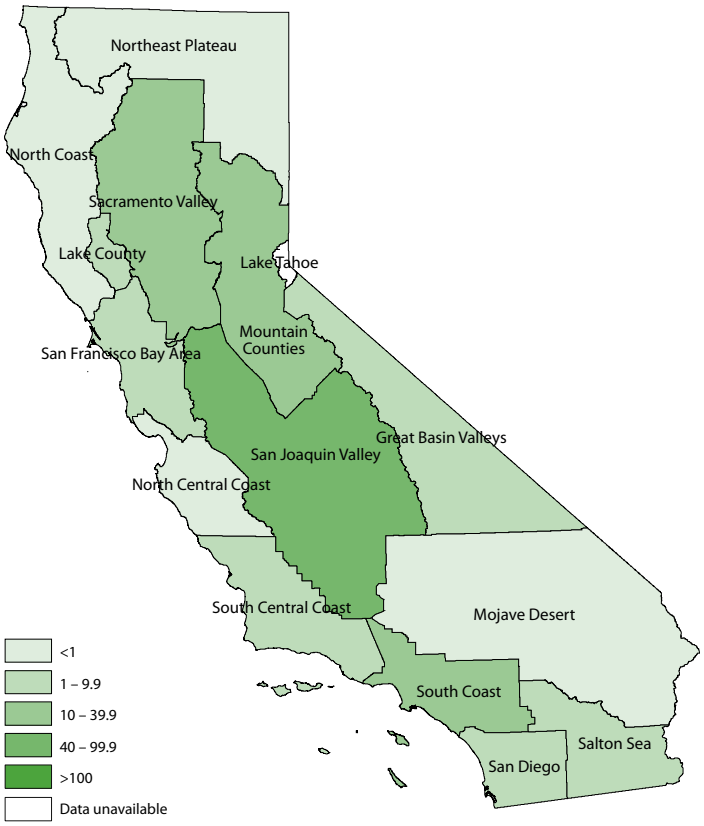
Pollutant (measurement period)	California AAQS	NAAQS
PM_{10} (24-hour)	50 µg/m³	150 µg/m³
$PM_{2.5}$ (24-hour)	N/A	35 µg/m³
Ozone (8-hour)	0.070 ppm	0.075 ppm

To measure air quality in relation to these standards, a network of air monitors is placed throughout the state, though there are many less-populated areas with sparse monitor coverage. Air monitor placement is intended to represent regional air pollution levels and therefore monitors are rarely located next to busy streets, freeways, and heavy industry. (Recently, the U.S. EPA began requiring some near-road monitoring.)

California is geographically divided into 15 air basins for the purpose of air quality management. Air basin boundaries are determined by grouping adjacent areas with similar meteorological and geographical conditions. Measuring air quality by air basin reflects the fact that air pollution is not contained by political boundaries (such as county borders). However, levels of outdoor pollutants within each air basin do vary a great deal, and while certain parts of an air basin might have very good air quality, others may have very poor air quality.

The maps in this section show a 3-year average (2008–2010) of the number of days in which each air basin in the state exceeded an AAQS. All data on air pollutants are from the California Air Resources Board (CARB) Aerometric Data Analysis and Measurement System (ADAM). For more information on outdoor air pollutants or to find the location of air monitors please visit www.arb.ca.gov.

Estimated Number of Days per Year Above the U.S. 24-hour PM2.5 Standard, by Air Basin, California 2008–2010

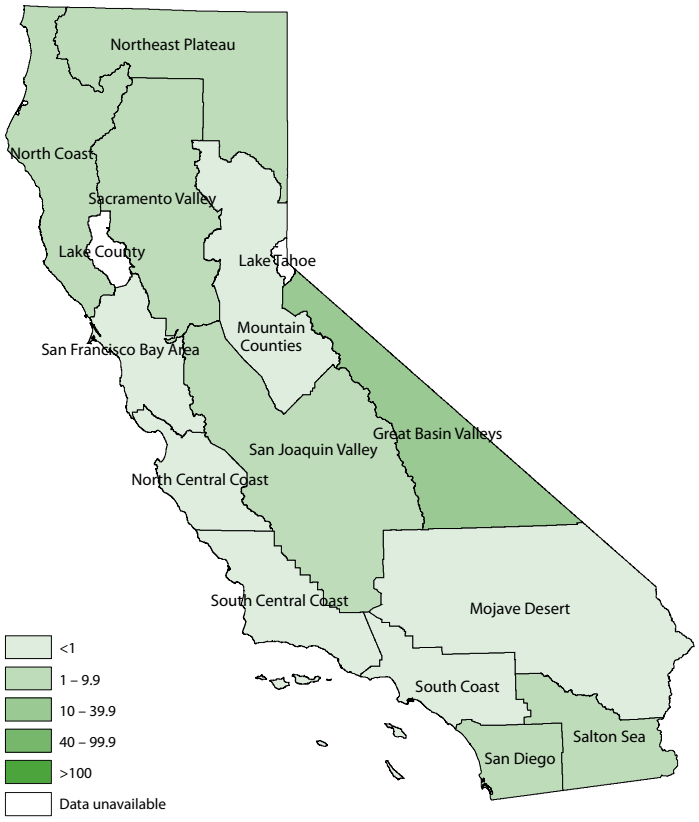


Note: Only one year of data was available for the Northeast Plateau air basin.

Estimated Number of Days per Year Above the California 24-hour PM10 Standard, by Air Basin, California 2008–2010

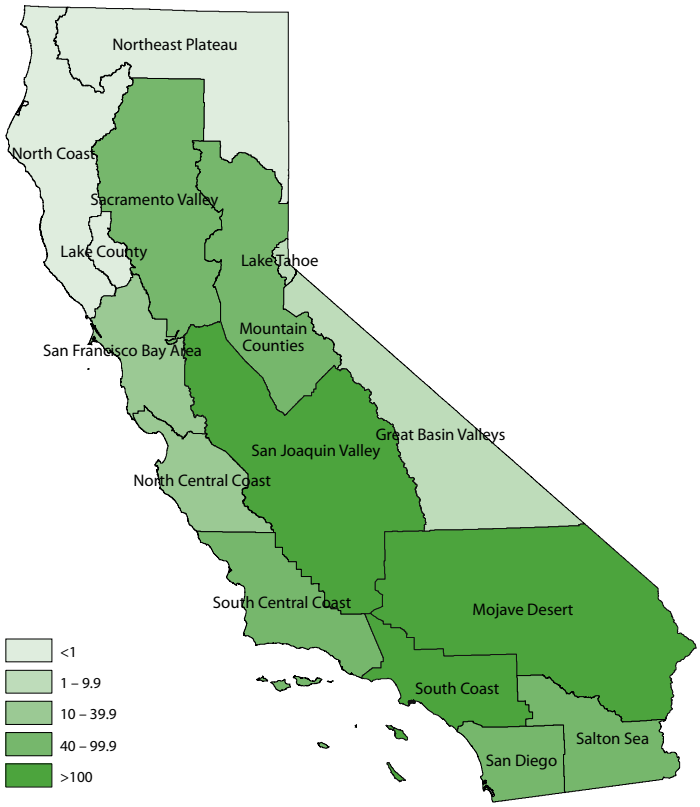
Note: Only two years of data were available for the Northeast Plateau air basin.

Estimated Number of Days per Year Above the U.S. 24-hour PM10 Standard, by Air Basin, California 2008–2010



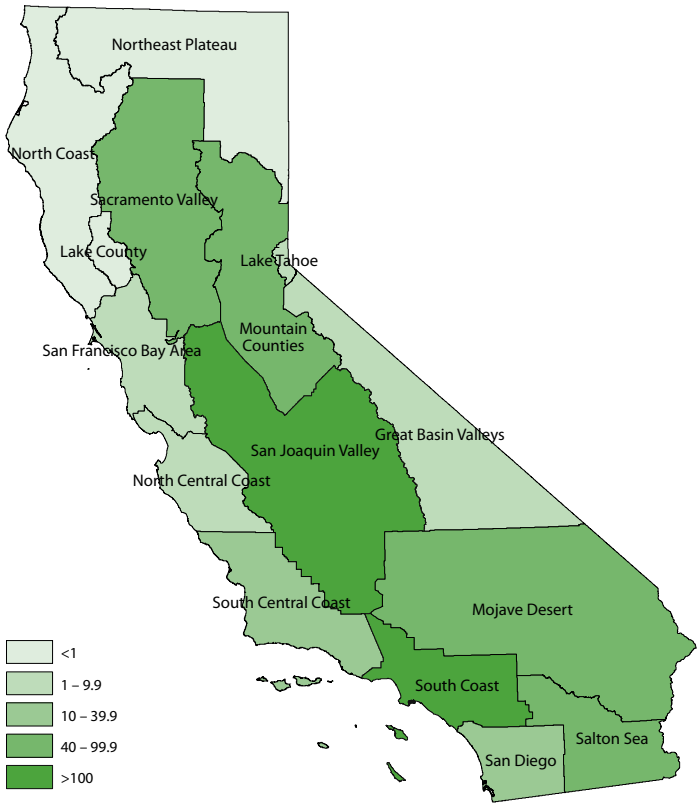
Note: Only two years of data were available for the Mojave Desert and Mountain Counties air basins.

Number of Days per Year Above the California 8-hour Ozone Standard, by Air Basin, California 2008–2010



Note: Only one year of data was available for the Lake Tahoe air basin.

Number of Days per Year Above the U.S. 8-hour Ozone Standard, by Air Basin, California 2008–2010



Note: Only one year of data was available for the Lake Tahoe air basin.

5 Work-Related Asthma (WRA)

Summary

- It is estimated that over 974,000 adults in California have asthma that has been caused or aggravated by their work, but work-related asthma is often not recognized or diagnosed.
- An estimated 40% of adults with current asthma report that their asthma was caused or aggravated by work. Of these, only 28% reported having discussed work exposures with their doctor.
- More women than men are identified as having WRA (63% vs. 37%).
- Asthma impact and impairment are greater for adults with WRA than non-WRA.
- More people with WRA have new asthma from work (56%), as opposed to asthma aggravated by work (44%).
- The majority of people with WRA are unable to do their usual work (56%), report continuing symptoms (56%), and have gone to the emergency department for their WRA (61%).
- Industries and occupations with the highest rates of WRA have been identified.
- People with WRA are most commonly exposed to the following asthma triggers at work: dust, unknown chemicals, cleaning materials, smoke, mold, indoor air pollutants, and paint.
- The WRA asthmagens to which people are most commonly exposed are latex, formaldehyde, glutaraldehyde, diisocyanates, sulfuric acid, rat antigens, epoxies, and California Redwood dust.
- In some industries and occupations, high WRA rates cannot be tied to any specific exposures. Some occupations, however, have very specific exposures associated with the majority of WRA cases, allowing for targeted prevention efforts.

What is work-related asthma?

Work-related asthma (WRA) is caused or aggravated by conditions or substances in the workplace. There are two main types of WRA: 1) new-onset asthma, or asthma that develops from workplace exposures in a person who did not have asthma previously; and 2) work-aggravated asthma, or pre-existing asthma that is made worse by conditions in the workplace. To be considered WRA, there must be a doctor's diagnosis of asthma and symptoms that started after a possible workplace exposure. There are currently about 300 substances documented to be capable of causing new-onset WRA (also called asthmagens).[20] The most important element of treat-

20 AOEC, 2012.

ment for WRA is to identify workplace asthma triggers and eliminate exposure to them.

How do we know about work-related asthma in California?

There are two principal source of data on WRA in California. First, the ACBS survey allows us to estimate how much WRA is in the general population of adults with asthma in California. There are multiple questions on the ACBS that assess WRA by asking if a respondent's asthma was caused or made worse by chemicals, smoke, fumes, or dust in their current or previous job. There are also questions asking if the respondent ever discussed work and its effects on their asthma with their doctor, and if they ever quit a job because of WRA. For more information about the ACBS, please see the Technical Notes section at the end of this report.

It is estimated that over 974,000 adults in California have asthma that has been caused or aggravated by their work, but work-related asthma is often not recognized or diagnosed.

The second data source for information about WRA in California is case-based surveillance, meaning that individual cases of WRA are identified and tracked statewide. This surveillance system has been in place since 1993 in the Work-Related Asthma Prevention Program (WRAPP) of the CDPH Occupational Health Branch. Currently, cases are identified through Doctor's First Reports of Occupational Injury and Illness, as well as from emergency department (ED) and hospital inpatient records, and workers' compensation claims. Each identified case is contacted for follow-up, which consists of a telephone interview to collect additional data and to provide the worker with educational materials and technical assistance. Even though this surveillance system captures only a portion of all WRA cases in California, the detailed data collected are very useful for identifying risk factors, characteristics, and outcomes of people who experience WRA. These data have in turn been used to identify prevention strategies.

How many people in California have work-related asthma?

In California, 40% of adults with current asthma (an estimated 974,000 people) report that their asthma has been either caused or aggravated by a job. This includes an estimated 595,000 adults who have reported new-onset asthma due to exposures at their workplace. However, WRA is often unrecognized and undiagnosed. Research shows that health care providers rarely ask about workplace factors when diagnosing or treating adult asthma.[21] California data show that among adults who report WRA, only about a quarter (28%) ever discussed work-relatedness with their doctor.

21 Sama, 2003

Who gets work-related asthma in California?

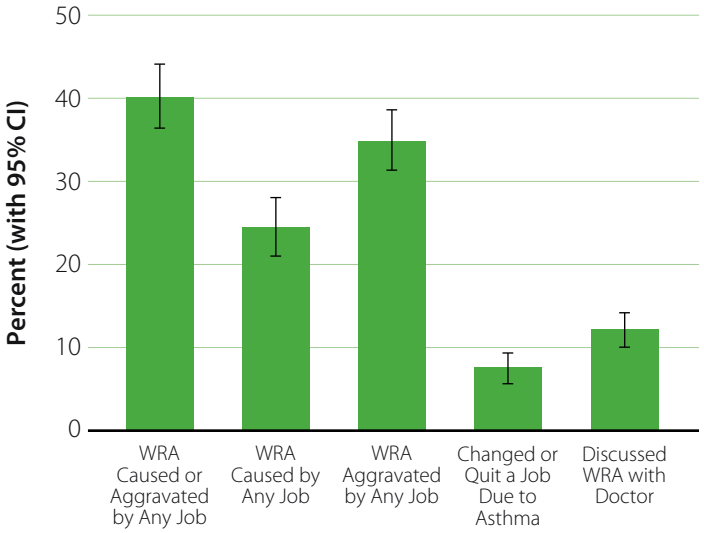
People from all over California in a wide range of industries and occupations have WRA. Case-based surveillance shows that more women than men report WRA (63% vs 37%), and more workers report new-onset WRA compared to work-aggravated asthma. Some industries with the highest rates of WRA include local transit, hospitals, zoos and parks, utilities, social services, manufacturing of lumber and wood products, heavy construction, and electrical equipment manufacturing. Some specific occupations with the highest rates of WRA include firefighters, science technicians, medical assistants, telephone operators, chemical technicians, respiratory therapists, correctional officers, and chemical machine operators. The most common substances that people with WRA report they are exposed to at work are dust, chemicals, smoke, mold, indoor air pollutants, paint, and cleaning materials. The most common asthmagens that people with WRA are exposed to are latex, formaldehyde, glutaraldehyde, diisocyanates, sulfuric acid, rat antigens, epoxies, and California Redwood dust.

How does work-related asthma affect the people who get it?

Among people identified with WRA, 56% were either unable to perform their usual work or had to perform modified work. Among people who were interviewed, 26% said that they were still exposed to the substances associated with their breathing problems. Among those no longer exposed, 29% reported they had left their job, either from being fired/laid off or voluntarily to stop exposure. A majority of interviewed cases (66%) reported that they knew of co-workers also suffering from breathing problems. Over 60% had been to the ED for their asthma since their breathing problems began at work and had needed emergency care a median of 2 times. Among interviewed cases, 14% had been hospitalized for their asthma and more than half (56%) had experienced asthma symptoms in the last two weeks. Among cases who were asked about workers' compensation, 43% had not filed a claim.

Prevalence of Work-Related Asthma (WRA) Among Adults with Current Asthma, California 2006–2009

Among adults with current asthma, 40% reported that their asthma was either caused or made worse by a job. This equates to over 974,000 adults with WRA in California. Yet only 12% of adults with asthma (or 28% of adults with self-reported WRA) had discussed WRA with their doctor. One quarter of adults with current asthma reported that they did not have asthma until it was caused by conditions or substances at a job. Over a third (35%) of adults with current asthma reported that their asthma was aggravated by conditions in a workplace. WRA resulted in 8% of adults with current asthma changing or quitting a job.



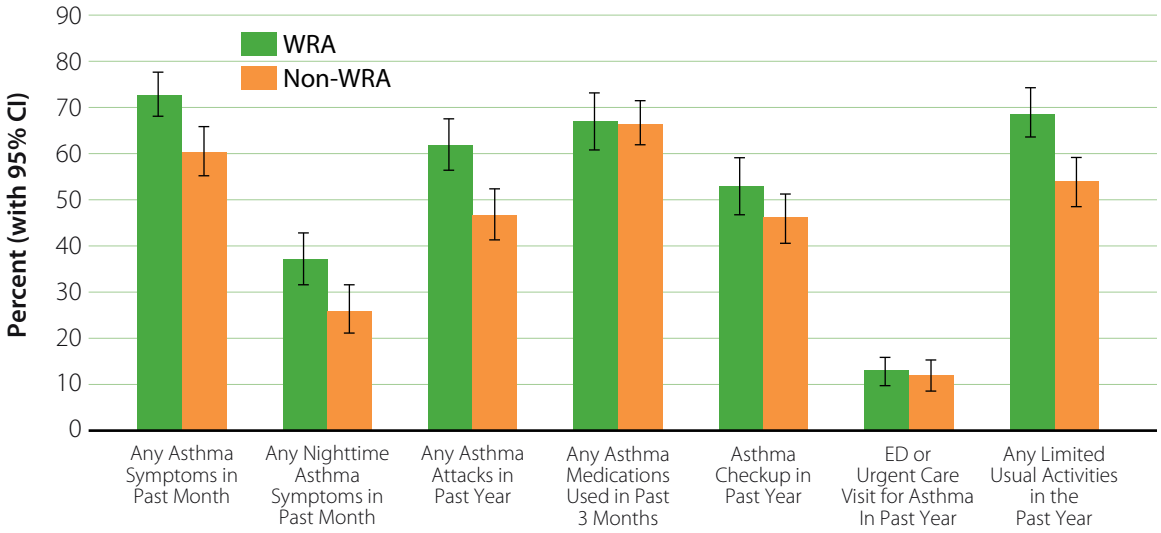
	%	95% CI
WRA caused or aggravated by any job	40.3	(36.4–44.2)
WRA caused by any job	24.6	(21.0–28.2)
WRA aggravated by any job	35.0	(31.5–38.6)
Changed or quit a job due to asthma	7.6	(5.7–9.5)
Discussed WRA with doctor	12.2	(10.0–14.3)

Data Source: Adult ACBS 2006–2009

Asthma Impact/Impairment Among Adults with Current Asthma, by WRA Status, California 2006–2009

The impact and asthma impairment for adults with WRA are greater than for adults with asthma that is not work-related. Several indicators of impact, including symptom frequency, asthma attacks, and limitation of activities, were significantly more common among adults with WRA compared to adults with non-WRA.*

*Chi-square p<0.01

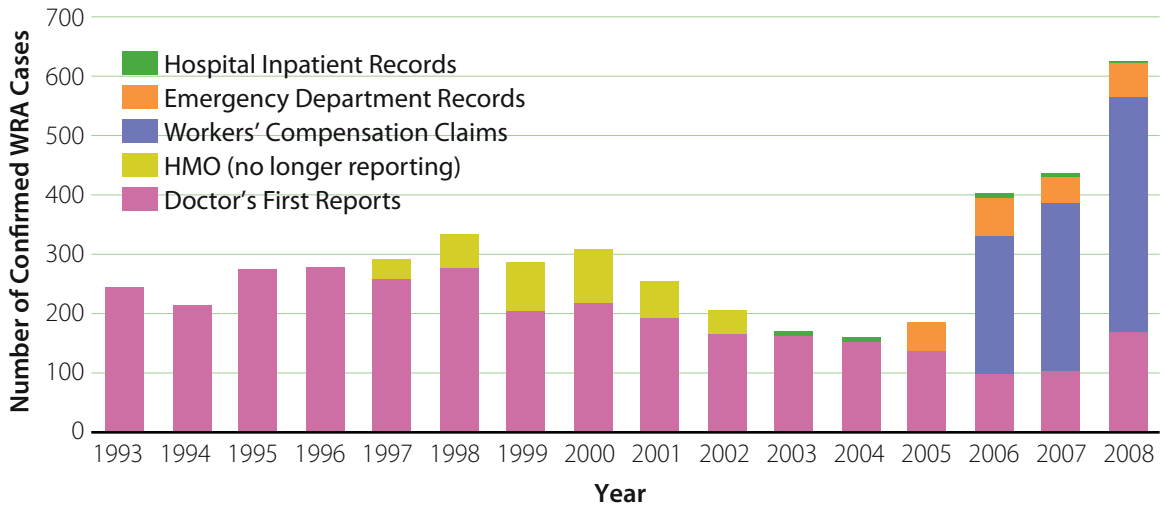


	Adults with WRA		Adults with Non-WRA	
	%	(95% CI)	%	(95% CI)
Any Asthma Symptoms in Past Month	72.9	(68.0–77.8)	60.6	(55.3–65.9)
Any Nighttime Asthma Symptoms in Past Month	37.2	(31.5–42.9)	26.3	(21.2–31.4)
Any Asthma Attacks in Past Year	62.0	(56.5–67.6)	46.9	(41.4–52.3)
Any Asthma Medications Used in Past 3 Months	67.0	(60.7–73.4)	66.7	(61.8–71.7)
Asthma Checkup in Past Year	53.0	(46.7–59.4)	46.1	(40.6–51.6)
ED or Urgent Care Visit for Asthma in Past Year	13.0	(9.8–16.3)	11.9	(8.4–15.5)
Any Limited Usual Activities in the Past Year	69.0	(63.5–74.4)	53.9	(48.5–59.4)

Data Source: Adult ACBS 2006–2009

Number of Confirmed WRA Cases, by Data Source and Year, California 1993–2008

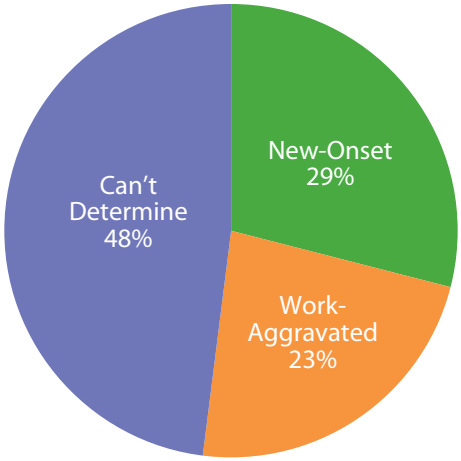
Case-based surveillance has been expanded in recent years to include multiple sources of data. As a result, the number of cases identified per year quadrupled between 2004 and 2008, the most recent complete year of data available.



Data Source: California Work-related Asthma Prevention Program (WRAPP) Surveillance Data, 1993–2008 (N=4,677)

Classification of Confirmed WRA Cases, California 1993–2008

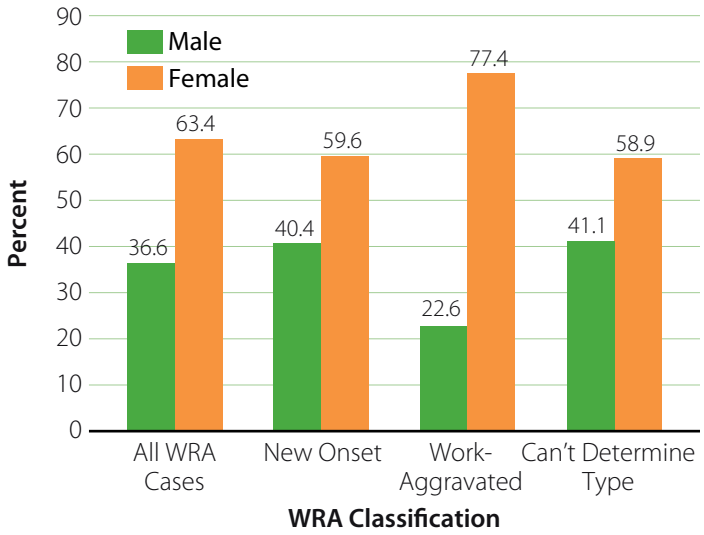
Because many workers identified through case-based surveillance cannot be reached for interview, a large proportion of cases are confirmed, but the subtype of WRA they have cannot be distinguished. Of the WRA cases that can be classified, the majority are new-onset asthma, as opposed to existing asthma made worse by workplace conditions (work-aggravated asthma).



Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

WRA Classification by Sex, California 1993–2008

Consistent with overall adult asthma prevalence, more women than men report WRA (63% vs. 37%). This is true across all WRA sub-classifications, but is particularly pronounced among cases classified as work-aggravated asthma (77% vs. 23%).

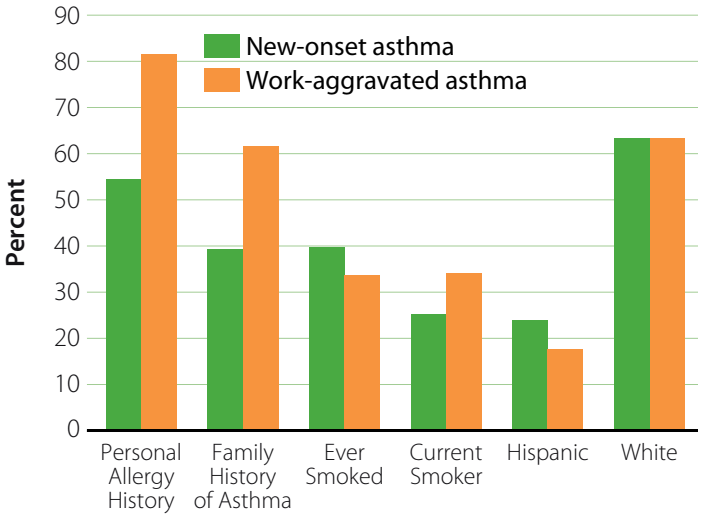


Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

Non-Occupational Risk Factors and Demographics of Interviewed WRA Cases, by WRA Classification, California 1993–2008

WRA cases are asked about demographics as well as non-occupational risk factors. Cases with work-aggravated asthma were significantly more likely to have a medical history of allergies, as well as a family history of asthma.* Over a third of all WRA cases smoked at some point in their lives, with new-onset cases being slightly more likely to have smoked compared with work-aggravated cases. Nearly two thirds (63%) of the cases were White, and about one in five cases was Hispanic. New-onset cases were somewhat more likely to be Hispanic than work-aggravated cases.

*Chi-square p<0.0001

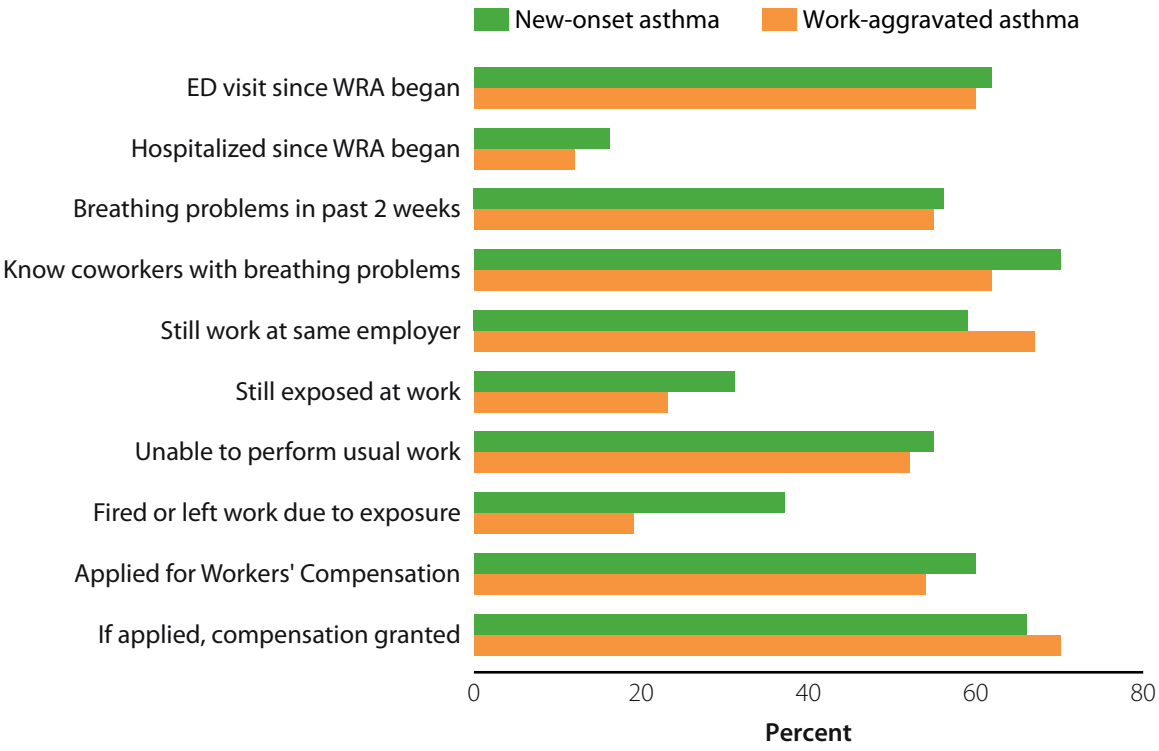


	New-Onset Asthma	Work-Aggravated Asthma	All WRA Cases
Personal Allergy History	54%	82%	62%
Family History of Asthma	39%	62%	46%
Ever Smoked	40%	34%	37%
Current Smoker	25%	34%	29%
Hispanic	24%	18%	21%
Race			
White	62%	63%	62%
Black	12%	14%	13%
Asian/Pacific Islander	6%	6%	7%
American Indian/Alaska Native	3%	4%	3%
Other	15%	12%	13%
Average Years of Education	14.2	14.6	14.4

Data Source: California WRAPP Surveillance Data, 1993–2008 (N=2,145)

Asthma Impact/Impairment Among Interviewed WRA Cases, by WRA Classification, California 1993–2008

WRA has serious consequences: the majority of cases (61%) had been to the ED for their asthma since their work-related breathing problems began, and they had gone a median of 2 times. One in seven had been hospitalized and over half had experienced asthma symptoms in the two weeks prior to their interview, which often took place many months after their case was first reported. Yet only just over half had applied for workers' compensation. Two thirds knew of other people at their workplace who were experiencing breathing problems similar to theirs, and 27% were still exposed to the substances that triggered their WRA in the workplace. Over half were unable to perform their usual work and 37% were fired or left work due to the exposure.



	New-Onset Asthma % (Median)	Work-Aggravated Asthma % (Median)	All WRA Cases % (Median)
ED visit since WRA began	62%	60%	61%
Median number of times in ED	(2)	(1)	(2)
Hospitalized since WRA began	16%	12%	14%
Breathing problems in past 2 weeks	56%	55%	56%
Know coworkers with breathing problems	70%	62%	66%
Median number of coworkers with breathing problems	(2)	(2)	(2)
Still work at same employer	59%	67%	62%
Still exposed at work	31%	23%	26%
Unable to perform usual work	55%	52%	56%
Fired or left work due to exposure	37%	19%	29%
Applied for Workers' Compensation	60%	54%	57%
If applied, compensation granted	66%	70%	68%

Data Source: California WRAPP Surveillance Data, 1993–2008 (N=2,145)

Exposures

A wide variety of substances (exposures) are associated with WRA. Understanding the conditions or substances contributing to asthma symptoms in the workplace is critical for creating effective prevention strategies. The tables below list the most commonly reported WRA exposures. Note that often workers do not know what specific chemical triggered their asthma symptoms, but may know only a general category, such as cleaning products or exposures generated during renovation activities in a workplace. Overall, the most commonly reported exposures include dust, unknown chemicals, cleaning chemicals, smoke, mold, indoor air pollutants, and paint. These exposures were reported for both new-onset and work-aggravated cases. Asthmagens are very specific substances that have been documented to cause new-onset WRA in workers previously free of asthma. The most commonly reported asthmagen exposures were latex, formaldehyde, glutaraldehyde, diisocyanates, sulfuric acid, rat antigens, epoxies, and redwood dust. Examining the most common exposures by occupation can help to focus prevention strategies.

Number and Percent of WRA Cases Reporting Exposures at Work, California 1993–2008

Exposure	N	%
Dust	775	19.1
Chemicals, NOS	681	16.8
Cleaning Chemicals	507	12.5
Smoke, NOS	408	10.0
Mold, NOS	321	7.9
Indoor Air Pollutants	313	7.7
Paint, NOS	254	6.3
Air Pollutants from Construction	170	4.2
Stress	158	3.9
Perfume	152	3.7
Pesticides, NOS	133	3.3
Glues	96	2.4
Cigarette Smoke	83	2.0
Asphalt	83	2.0
Diesel Exhaust	78	1.9
Bleach	77	1.9
Fiberglass	76	1.9

Note: Up to three exposures reported for each case; NOS=Not Otherwise Specified

Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

Number and Percent of WRA Cases Reporting Asthmagen Exposures at Work, California 1993–2008

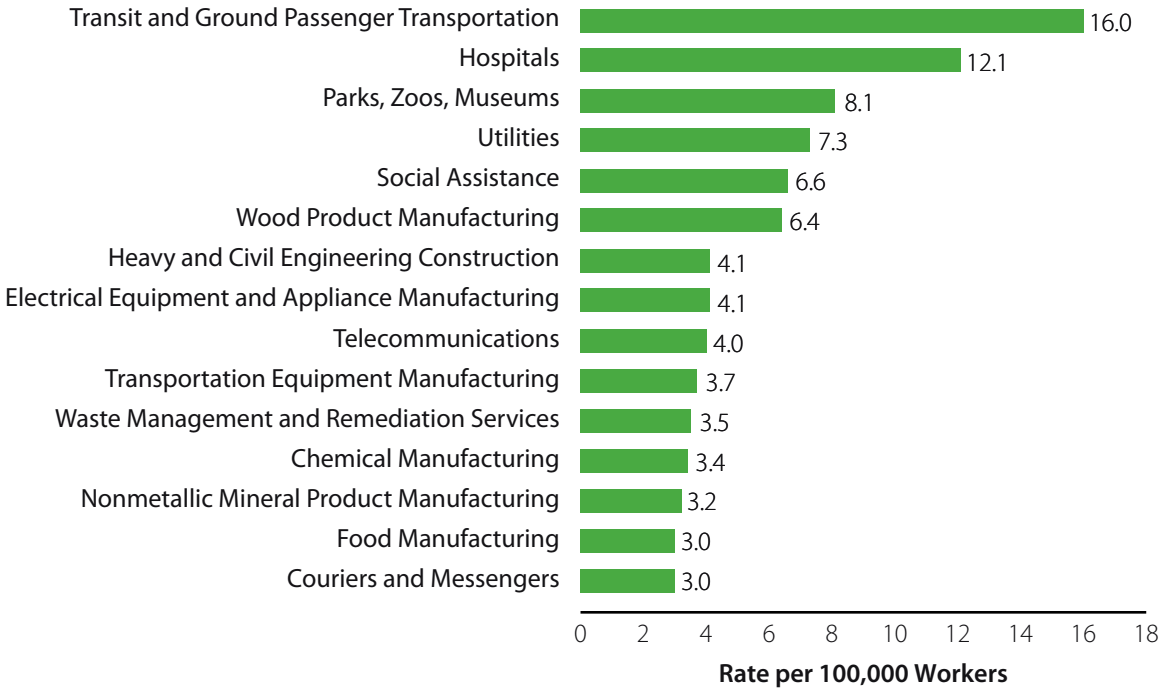
Asthmagen Exposure	N	%
Bleach	77	1.6
Chlorine	59	1.3
Latex	50	1.1
Ammonia	43	0.9
Formaldehyde	37	0.8
Glutaraldehyde	28	0.6
Sulfuric Acid	27	0.6
Diisocyanates	23	0.5
Rat Antigens	22	0.5
Epoxies	19	0.4
California Redwood Dust	17	0.4
Quaternary Ammonium Compounds	16	0.3
X-ray Chemicals	13	0.3
Flour	12	0.3

Note: Up to 3 exposures reported for each case; asthmagens are known asthma inducers as defined by the Association of Occupational and Environmental Clinics, www.aoec.org.

Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

WRA Rates by Industry Subsector (15 Highest), California 1993–2008

The overall reporting rate of WRA in California is 2.0 per 100,000 workers. However, analysis of the extent of underreporting of cases suggests a more accurate rate of WRA to be closer to 8–15 per 100,000 workers. Certain industries have substantially higher rates, including local transit (16.0); hospitals (12.1); parks, zoos and museums (8.1); utilities (7.3); social assistance (6.6); lumber and wood product manufacturing (6.4); heavy construction (4.1); electrical equipment manufacturing (4.1); and others (see below). [Note: The names of industries listed below are based on the National American Industry Classification System (NAICS).]



Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

Other industries are important because they employ large numbers of people with WRA, even though the rate may not be high. The table on the following page illustrates industries that are noteworthy either because they have high rates or high numbers of cases. For example, just over 2% of the employed people in California work in hospitals, but hospitals account for 12% of the WRA cases, indicating a high rate of WRA. Educational Services, on the other hand, has a rate comparable to the overall industry rate, but nearly 1 out of 10 Californians work in education, resulting in large numbers of cases of WRA.

Industries with High Proportions of WRA Cases or High WRA Rates, California 1993–2008

Industry	WRA Cases in Industry (%)	People in CA Working in Industry (%)	WRA Rate per 100,00 Workers
Agriculture	3.0	2.7	2.3
Utilities	1.4	0.4	7.3
Construction	3.5	4.9	1.4
Heavy and Civil Engineering Construction	1.1	0.6	4.1
Specialty Trade Contractors	1.8	3.2	1.2
Manufacturing	12.0	11.6	2.1
Wood Product Manufacturing	0.9	0.3	6.4
Nonmetallic Mineral Product Manufacturing	0.5	0.3	3.2
Computer and Electronic Product Manufacturing	1.8	2.6	1.4
Electrical Equipment and Appliance Manufacturing	0.5	0.3	4.1
Transportation Equipment Manufacturing	1.9	1.0	3.7
Food Manufacturing	1.6	1.1	3.0
Chemical Manufacturing	0.9	0.5	3.4
Retail	5.7	10.7	1.1
Food and Beverage Stores	1.6	2.1	1.6
General Merchandise Stores	1.6	1.8	1.9
Transportation and Warehousing	4.9	3.0	3.3
Transit and Ground Passenger Transportation	1.8	0.2	16.0
Couriers and Messengers	0.7	0.5	3.0
Information	2.5	3.3	1.6
Telecommunications	1.7	0.9	4.0
Finance and Insurance	2.2	3.9	1.1
Professional, Scientific, and Technical Services	2.3	6.1	0.8
Administrative, Support, and Waste Services	4.3	6.2	1.4
Administrative and Support Services	3.8	6.0	1.3
Waste Management and Remediation Services	0.4	0.2	3.5
Educational Services	10.3	9.2	2.3
Health Care and Social Assistance	21.1	8.4	5.1
Ambulatory Health Care Services	2.5	3.5	1.5
Hospitals	13.4	2.3	12.1
Social Assistance	3.9	1.2	6.6
Arts, Entertainment, and Recreation	2.0	1.5	2.7
Parks, Zoos, and Museums	0.3	0.1	8.1
Accommodation and Food Services	2.5	7.9	0.6
Public Administration	14.6	8.6	3.5
ALL INDUSTRIES			**2.0**

Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

WRA Rates by Occupation (16 Highest), California 1993–2008

Certain specific occupations also have high reporting rates of WRA. These include firefighters (22.9 per 100,000), science technicians (15.0), medical assistants (11.4), telephone operators (11.4), chemical technicians (10.2), respiratory therapists (9.9), correctional officers (9.1); and others (see below). Three of the ten occupations with the highest rates are in the health care industry.

Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

Most Common Exposures Among Occupations with the Highest Rates of WRA, California 1993–2008

Occupation	Most Common Exposures
Firefighting Occupations	Smoke
Miscellaneous Science Technicians	Acids, chemicals, indoor air, rat antigens, glues, dust
Medical Assistants and Health Care Support	Glutaraldehyde, chemicals, smoke, latex, dust, perfume, paint
Telephone Operators	Chemicals, perfume, paint, carpet dust
Chemical Technicians	Solvents, acids, chemicals
Respiratory Therapists	Cleaning chemicals, latex, pharmaceuticals
Correctional Officers and Bailiffs	Smoke, chemicals, pepper spray, mace, cleaning chemicals
Chemical Process Machine Operators	Chemicals, solvents, glues
Government Program Eligibility Interviewers	Roofing tar, chemicals, indoor air, toner, perfume, dust
Medical Record and Health Information Technicians	Dust, smoke, perfume
Police Officers	Smoke, pepper spray, dust, indoor air, mold, animal antigens
Lifeguards and Other Protective Services	Smoke, disinfectant chemicals
Molders, Shapers, and Casters	Diisocyanates
Crushing, Grinding, Blending Workers	Chemicals, solvents
Health Technologists and Technicians	X-ray chemicals, smoke, perfume, chemicals, glutaraldehyde
Bus Drivers	Exhaust, chemicals, smoke, perfume, pesticides

Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

6 Asthma Emergency Department Visits

Summary

- In 2010, there were 179,972 asthma emergency department (ED) visits, or an age-adjusted rate of 46.1 per 10,000 residents.
- Data on asthma ED visit rates have only been available in California since 2005 and the overall rate did not significantly increase or decrease from 2005–2010.
- Rates of asthma ED visits in California are lower than rates in the U.S. overall.
- Blacks have consistently had higher rates of asthma ED visits than other races/ethnicities. From 2005–2010, rates among Blacks were 3–4 times higher than among Whites.
- Asthma ED visit rates are highest among children under age five — about 2–3 times higher than among other age groups.
- Among adults, females have higher asthma ED visit rates than males; among children, males have higher rates.
- People who live in areas where the median household income is $20,000 or less visit the ED for asthma at more than 4 times the rate of those living where the median household income is more than $100,000.
- Asthma ED visits vary by season, with lower numbers in the summer.
- Together, Medicare and Medi-Cal covered 50% of asthma ED visits in 2010.

In most cases, when people receive appropriate health care and manage their asthma well, they should not have to go to the emergency department (ED) because of their asthma. Nonetheless, many people with asthma end up at the ED for treatment of asthma symptoms. This may be because they have not received a plan for managing worsening asthma, they lack health insurance or access to a primary health care provider, or they could not manage their asthma appropriately.

How many asthma ED visits occur in California?

In 2010, there were almost 180,000 asthma ED visits in California. This translates to a rate of 46.1 ED visits per 10,000 residents. Data on ED visits have been systematically collected in California since 2005, and the rates of asthma ED visits have not changed significantly since that time.

Are there disparities in who visits the ED for asthma in California?

There are striking disparities in asthma ED rates by race/ethnicity, age, and income. Blacks have the highest asthma ED visit rate — 157.5 per 10,000 residents in 2010. This is almost four times higher than the rate among Whites. Young chil-

dren (ages 0–4) have the highest rate of asthma ED visits, more than two times higher than older age groups. People who live in areas where the median household income is $20,000 or less visit the ED for asthma at a rate 4 times higher than those living in areas where the median household income is more than $100,000.

In 2010, there were almost 180,000 asthma ED visits in California.

The rate of asthma ED visits is almost four times higher in Blacks than Whites.

Technical Notes

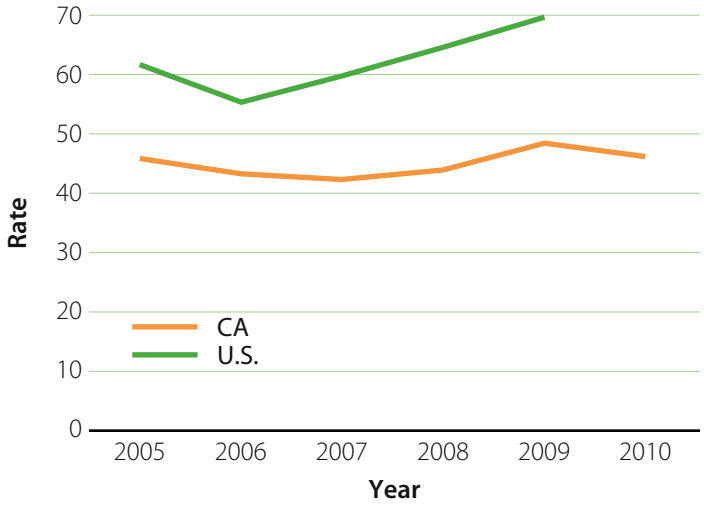
Please note that in the 2007 version of this report, the ED visit rates reported did not include those that resulted in admission to the hospital. In this version, all ED visits are included. Therefore, rates in this version are not comparable to rates in the previous version of this report.

Data on asthma ED visits are from the Emergency Department Database maintained by the California Office of Statewide Health Planning and Development (OSHPD). This dataset has a record for each visit to a licensed ED in California and includes information on age, sex, race/ethnicity, and diagnosis, among other things. Data on charges are not included. ED visits are presented as a rate — the number of asthma-related ED visits per 10,000 California residents. Counts are based on the number of visits, not the number of unique individuals. This means that there were almost 180,000 asthma ED visits in 2010, but not 180,000 different people who had asthma ED visits during that time. Details about the data presented in this chapter can be found in the Technical Notes section at the end of this report.

County-specific data on asthma ED visits can be found in the County Asthma Profiles at www.californiabreathing.org. Please also use this website to request custom asthma ED data, which are available for smaller geographic areas.

Age-Adjusted Asthma ED Visits per 10,000 Residents, California and U.S., 2005–2010

Asthma ED visit rates in California have not changed substantially since 2005, when data were first collected. The rate in 2010 was 46.1 ED visits per 10,000 California residents. Asthma ED visit rates in the U.S. overall have been 30–50% higher than rates in California.

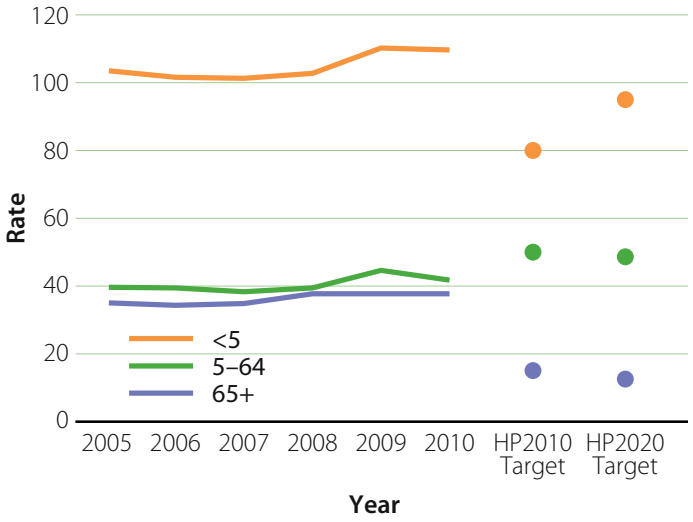


	CA		U.S.
Year	N	Age-adjusted Rate (per 10,000)	Age-adjusted Rate (per 10,000)
2005	168,505	45.8	61.7
2006	160,872	43.2	55.3
2007	160,008	42.3	59.6
2008	167,477	43.8	64.5
2009	187,049	48.4	69.7
2010	179,972	46.1	—

Note: U.S. data not available for 2010; U.S. data are from the National Ambulatory Medical Care Survey, 2005–2009

Asthma ED Visits per 10,000 California Residents by Age, Compared to HP2010 and HP2020 Targets, 2005–2010

Asthma ED visit rates have been consistently highest in children under the age of five — about 2–3 times higher than other age groups and still higher than the Healthy People 2010 and 2020 (HP2010/2020) targets. Rates in the 5–64 age group have met the Healthy People targets since 2005. Rates in the 65 and over group are still 2.5-2.8 times higher than the targets. Asthma ED visit rates have not changed significantly from 2005-2010 for any of the age groups.

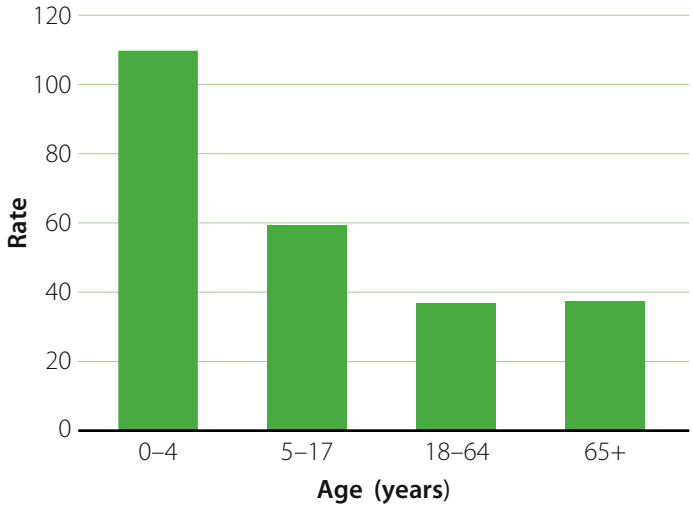


Year	<5 N	<5 Rate (per 10,000)	5–64 N	5–64 Rate (per 10,000)	65+ N	65+ Rate (per 10,000)
2005	27,815	105.7	125,594	41.6	15,096	37.3
2006	26,999	101.4	119,738	39.2	14,135	34.5
2007	27,469	101.3	118,250	38.1	14,289	34.9
2008	27,914	102.5	123,726	39.5	15,837	37.7
2009	30,259	110.2	140,624	44.4	16,166	37.6
2010	30,344	109.5	133,101	41.7	16,527	37.5
HP2010 Targets		80		50		15
HP2020 Targets		95.5		49.1		13.2

Note: Rates for the same age groups on the next page are age-adjusted, causing them to be slightly different.

See Healthy People 2010/2020 section for an explanation of HP2010/2020 objectives. Targets were changed for HP2020; visit www.healthypeople.gov for more information.

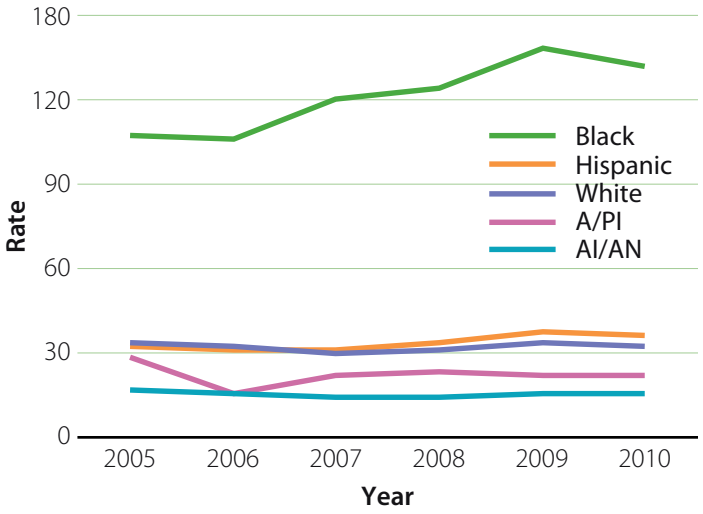
Age-Adjusted Asthma ED Visits per 10,000 California Residents by Age, 2010



	Age (years)	N	Age-Adjusted Rate (per 10,000)
Children	**0–4**	30,344	109.7
	5–17	42,112	59.0
Adults	**18–64**	90,989	36.8
	65+	16,527	37.6
Totals	**0–17**	72,456	72.6
	18+	107,516	36.9
	All Ages	179,972	46.1

Age-Adjusted Asthma ED Visits per 10,000 California Residents by Race/Ethnicity, 2005–2010

Blacks have the highest asthma ED visit rates. From 2005–2010, asthma ED visit rates among Blacks were 3–5 times higher than among Whites. Furthermore, Blacks are the only race/ethnicity group for which these rates have increased significantly over time.* Whites and Hispanics have similar asthma ED visit rates, while Asians/Pacific Islanders (A/PI) have slightly lower rates. (Hospitalization data do not allow for separating Pacific Islanders from Asians.) American Indians/Alaska Natives (AI/AN) have relatively low asthma ED visit rates, but research has shown that many AI/AN patients are misclassified as another race in hospital records, leading to underestimation of their true ED visit rates.[22]



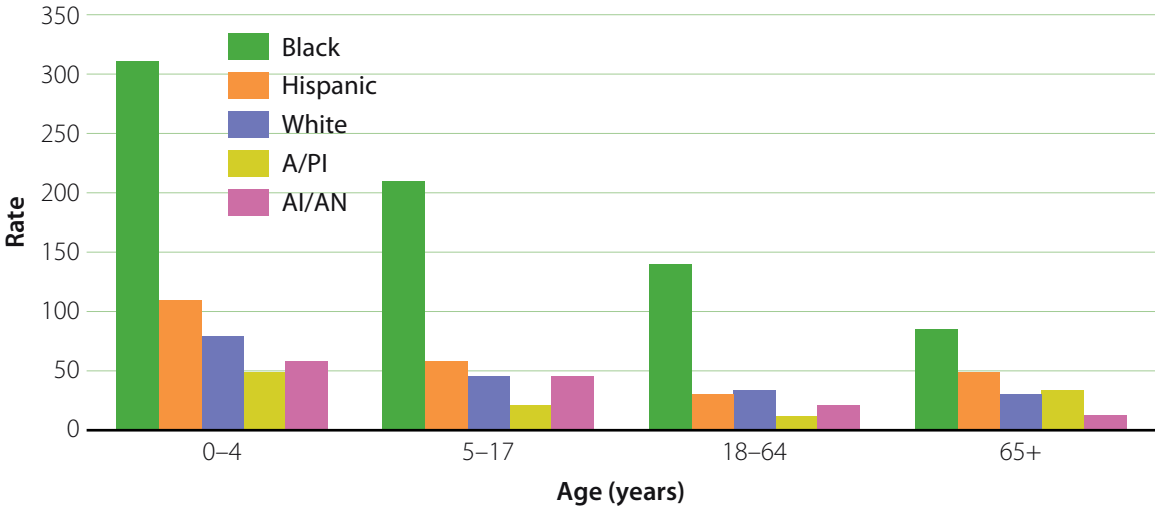
* Increase of 7.5 (per 10,000) per year, p=0.01 (simple linear regression)

	Black		Hispanic		White		A/PI		AI/AN	
Year	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)
2005	31,909	129.0	52,553	39.0	59,603	40.3	8,198	20.3	945	34.0
2006	31,762	126.7	51,826	37.1	56,162	38.2	7,632	18.6	550	18.2
2007	32,450	144.5	53,446	37.6	55,211	35.7	7,453	17.3	522	26.8
2008	33,561	148.9	57,355	39.7	58,188	37.5	7,322	16.5	535	27.6
2009	37,519	165.2	67,250	44.8	62,688	40.8	8,544	18.8	532	26.7
2010	35,869	157.5	66,027	43.2	59,364	38.6	8,374	17.9	550	26.9

[22] Garcia, 2007

Age-Adjusted Asthma ED Visits per 10,000 California Residents by Race/Ethnicity and Age, 2010

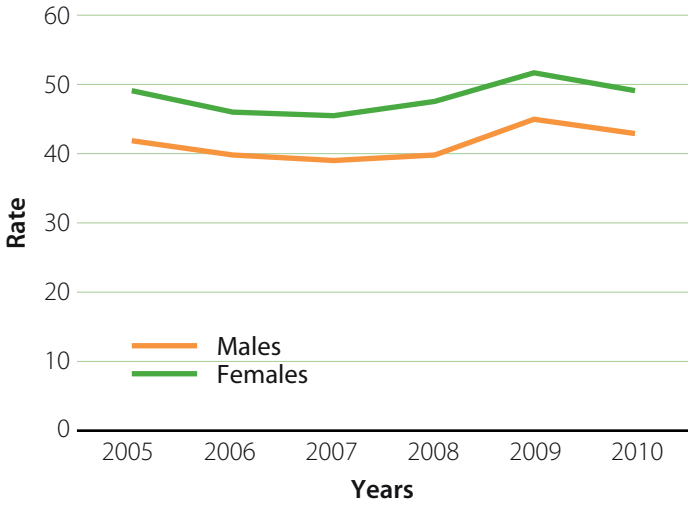
Racial disparities persist across all ages, with Blacks having asthma ED visit rates that are 3–5 times higher than Whites. In the 65+ age group, the A/PI rate is slightly higher than among Whites, whereas their rate is much lower than Whites in all of the younger age groups.



		Black		Hispanic		White		A/PI		AI/AN	
	Age (years)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)
Children	**0–4**	4,917	310.0	15,397	109.7	6,387	78.0	1,518	47.6	70	57.5
	5–17	8,031	209.2	20,222	57.3	9,594	44.3	1,457	20.8	109	46.2
Adults	**18–64**	21,034	139.4	26,643	30.4	35,295	34.2	3,418	10.4	340	20.7
	65+	1,887	85.2	3,765	48.0	8,088	29.6	1,981	33.9	31	11.8
Totals	**0–17**	12,948	236.2	35,619	71.4	15,981	53.4	2,975	28.0	179	49.3
	18+	22,921	130.1	30,408	33.4	43,383	33.4	5,399	14.4	371	19.2
	All Ages	35,869	157.5	66,027	43.2	59,364	38.6	8,374	17.9	550	26.9

Age-Adjusted Asthma ED Visits per 10,000 California Residents by Sex, 2005–2010

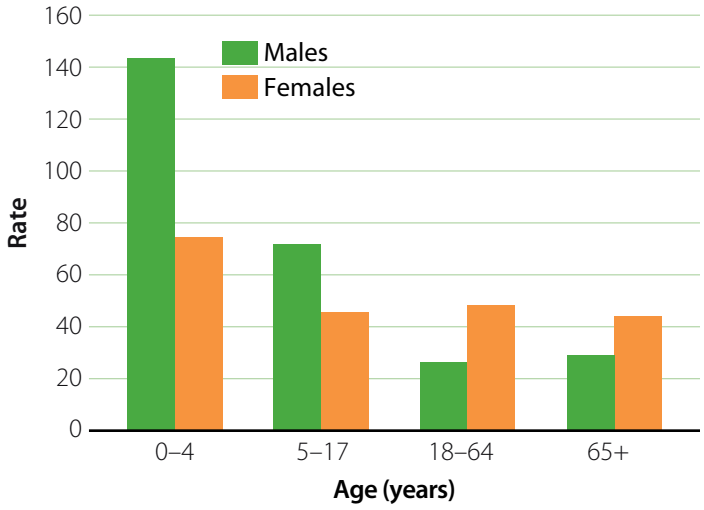
For all ages combined, asthma ED visit rates for females are consistently about 15% higher than for males. Rates have not changed significantly for either sex since 2005.



	Males		Females	
Year	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)
2005	77,580	41.9	90,317	49.1
2006	75,087	40.0	85,769	46.0
2007	74,352	39.0	85,639	45.4
2008	76,825	40.0	90,643	47.4
2009	87,317	44.9	99,729	51.6
2010	84,018	42.9	95,948	49.1

Age-Adjusted Asthma ED Visits per 10,000 California Residents by Sex and Age, 2010

The sex disparity in asthma ED visits varies by age. Among children, males have higher rates than females, while among adults, females have higher rates than males.

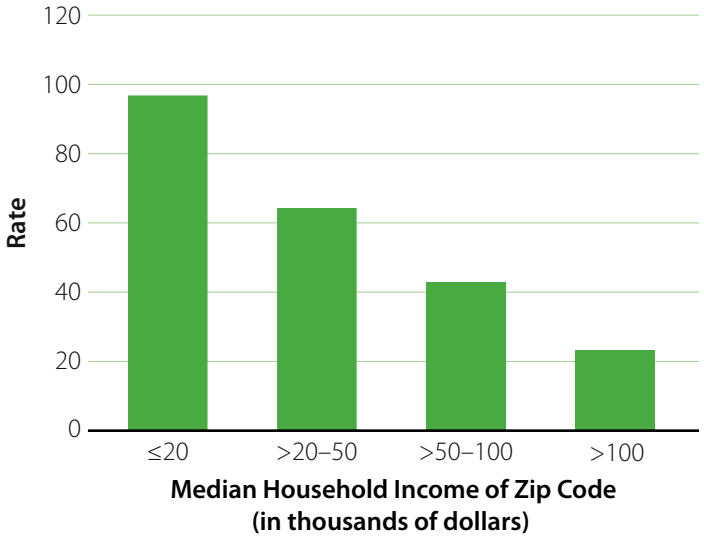


	Age (years)	Males N	Males Age-adjusted Rate (per 10,000)	Females N	Females Age-adjusted Rate (per 10,000)
Children	**0–4**	20,236	143.4	10,105	74.6
	5–17	26,055	71.7	16,057	45.7
Adults	**18–64**	32,257	25.6	58,729	48.2
	65+	5,470	29.0	11,057	44.4
Totals	**0–17**	46,291	90.9	26,162	53.4
	18+	37,727	26.2	69,786	47.6
	All Ages	84,018	42.9	95,948	49.1

Age-Adjusted Asthma ED Visits per 10,000 California Residents by Median Household Income in Zip Code, 2009

Asthma ED visits are associated with income. People who live in areas where the median household income is $20,000 or less visit the ED for asthma at more than four times the rate of those living where the median household income is more than $100,000.

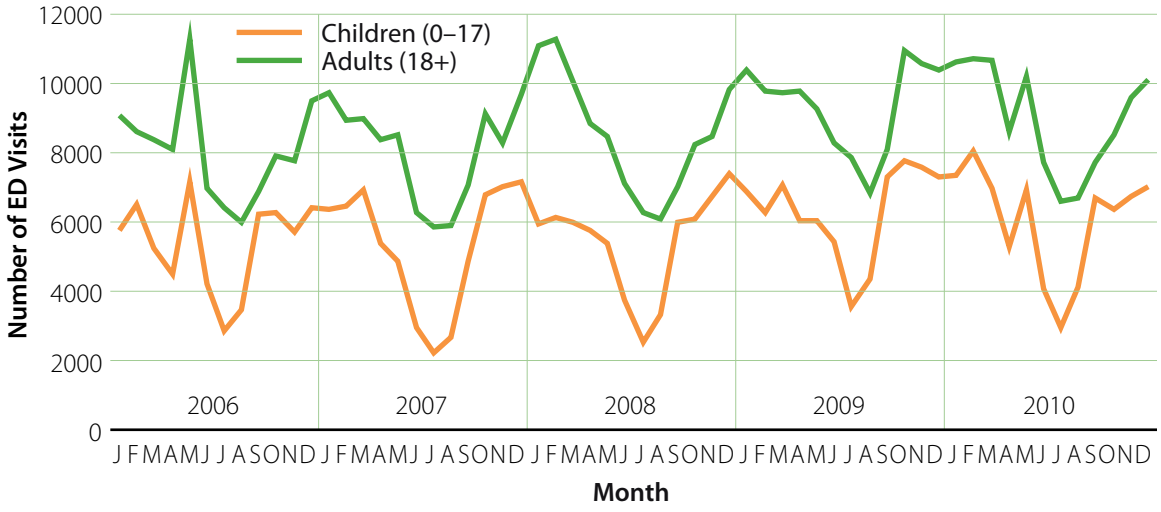
Note: Information on each person's income is not available in ED data, so the median household income in each person's zip code is used as a proxy.



Median Household Income in Zip Code	N	Age-Adjusted Rate (per 10,000)
≤$20,000	856	96.6
>$20,000–$50,000	82,095	64.1
>$50,000–$100,000	92,455	42.7
>$100,000	7,787	23.3

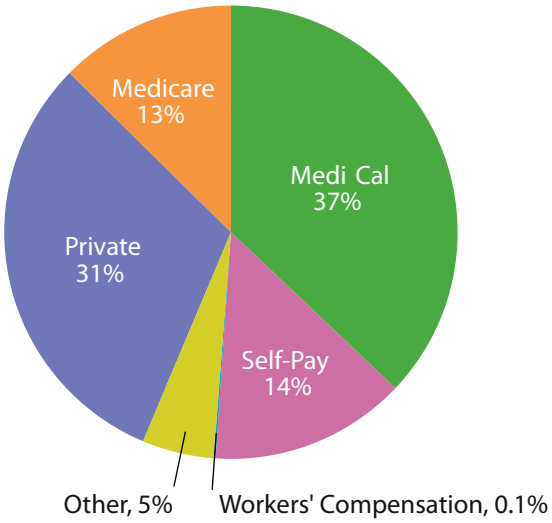
Asthma ED Visits by Month and Age, California 2006–2010

Asthma ED visits show some consistent trends by season. The number decreases in the summer months for both children and adults.



Expected Source of Payment for Asthma ED Visits, California 2010

In 2010, half of all asthma ED visits were covered by large state and federal programs — 37% were covered by Medi-Cal and 13% were covered by Medicare. Another large portion was covered by private insurance (31%).



7 Asthma Hospitalizations

Summary

- In 2010, there were 34,796 asthma hospitalizations in California, or an age-adjusted rate of 9.0 per 10,000 residents.
- Asthma hospitalization rates in California have decreased slightly in the past 16 years and have been consistently lower than overall U.S. rates.
- Blacks have consistently had higher rates of asthma hospitalizations than other races/ethnicities. From 2000–2010, average rates among Blacks were 3.4 times higher than among Whites.
- Asthma hospitalization rates are highest among children under age five, but have been declining in this group. Asthma hospitalization rates are also high among adults over age 65, and have been increasing in this group.
- Among adults, females have higher asthma hospitalization rates than males; among children, males have higher rates.
- People who live in areas where the median household income is $20,000 or less are hospitalized for asthma at almost four times the rate of those living in areas where the median household income is more than $100,000.
- Asthma hospitalizations vary consistently by season, with lower numbers in the summer and higher numbers in the fall and winter.
- Total charges for asthma hospitalizations in California in 2010 were over $1 billion.
- The average charge per asthma hospitalization more than doubled between 1995 ($14,336 in 2010 dollars) and 2010 ($33,749). In contrast, the average length of stay for asthma hospitalizations hardly changed (average 3.4 days from 1998–2010).
- Medicare and Medi-Cal covered 65% of asthma hospitalizations in 2010, or $741 million in charges.
- In 2010, of all people who had an asthma hospitalization, 11.6% came back for at least one subsequent asthma hospitalization during that year. Charges for these repeat hospitalizations were $155.6 million.
- Adults, Blacks, women, and people living in areas with lower income are more likely to have repeat asthma hospitalizations.

Asthma hospitalizations, like asthma emergency department (ED) visits, are often preventable by appropriate asthma management, including: avoidance of triggers, increased patient and family education, use of asthma action plans, appropriate use of controller medications, and proper follow-up care. Being hospitalized for asthma is both very serious and very costly. Data on asthma hospitalizations can

be used to identify groups of people for targeted interventions. The rate of asthma hospitalizations is declining, but significant disparities still exist.

In 2010, there were almost 35,000 asthma hospitalizations in California, with total charges amounting to over $1 billion.

The rate of asthma hospitalizations is over three times higher for Blacks than for Whites.

How many asthma hospitalizations occur in California?

In 2010, there were almost 35,000 asthma hospitalizations in California. This translates to a rate of 9.0 hospitalizations per 10,000 residents. This rate has decreased slightly since 1995. Of all people hospitalized for asthma in 2010, 11.6% had at least one repeat asthma hospitalization during that year, for a total of 4,612 repeat asthma hospitalizations.

Has the rate of asthma hospitalizations been changing?

Even though the percent of people who have asthma has been increasing, the asthma hospitalization rate in California has been going down — decreasing by about 0.3 per 10,000 each year from 1995–2010. The biggest decrease occurred in very young children (ages 0–4), whereas the rate has been increasing in people over age 65.

Are there disparities in who is hospitalized for asthma in California?

There are striking disparities in asthma hospitalization rates by race/ethnicity, age, and income. Similar to rates for ED visits, Blacks have the highest asthma hospitalization rate – 29 per 10,000 residents in 2010. This is more than three times higher than the rate among Whites. The youngest (ages 0–4) and oldest (age 65+) age groups are at the highest risk for asthma hospitalizations, with rates more than two times higher than other ages. People who live in areas where the median household income is $20,000 or less are hospitalized for asthma at almost four times the rate of those living in areas where the median household income is more than $100,000.

What are the costs of asthma hospitalizations?

In 2010, there were over $1 billion in total charges for asthma hospitalizations in California. The average charge for an asthma hospitalization was $33,749. Since 1995, the average charge more than doubled despite the fact that the average length of stay for asthma hospitalizations has not changed significantly. The majority of asthma hospitalizations are paid for through public programs — Medicare and Medi-Cal. (Note: Charges are not necessarily equivalent to the payment received by the hospital or the total costs incurred; however, the OSHPD dataset

only includes the amount charged by the hospital. Kaiser Permanente hospitals do not report charge data; 7.5% of all asthma hospitalizations in 2010 were at Kaiser Permanente hospitals, so total charges reported here are underestimates.)

Technical Notes

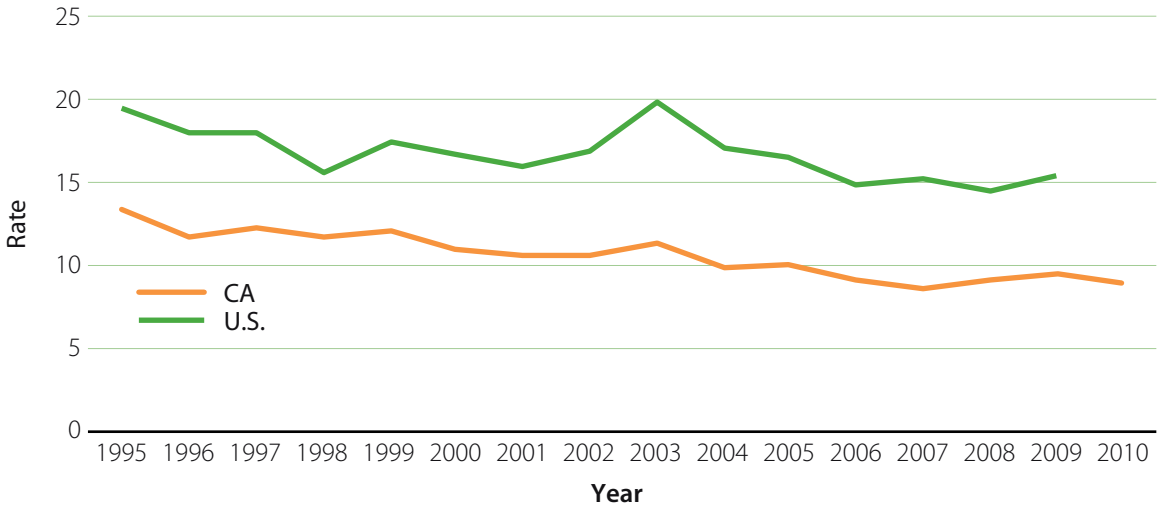
Data on asthma hospitalizations are from the Patient Discharge Database maintained by the California Office of Statewide Health Planning and Development (OSHPD). This dataset has a record for each inpatient discharge from a licensed acute care hospital in California and includes information on age, sex, race/ethnicity, diagnosis, and charges. Hospitalizations are presented as a rate—the number of asthma-related hospitalizations per 10,000 California residents. Except where noted, counts are based on the number of visits, not the number of unique individuals. This means that there were almost 35,000 asthma hospitalizations in 2010, but not 35,000 different people who had asthma hospitalizations during that time. Charges include all charges for services rendered during the length of stay for patient care at the facility, based on the hospital's full established rates (before contractual adjustments). Details about the data presented in this chapter can be found in the Technical Notes section at the end of this report.

County-specific data on asthma hospitalizations can be found in the County Asthma Profiles, at www.californiabreathing.org. Please also use this website to request custom asthma hospitalization data, which are available for smaller geographic areas.

Age-Adjusted Asthma Hospitalizations per 10,000 Residents, California and U.S., 1995–2010

Asthma hospitalization rates in California have been decreasing gradually from 1995–2010.* The rate in 2010 was 9 hospitalizations per 10,000 California residents. Asthma hospitalization rates in the U.S. overall have consistently been about 1.6 times higher than California rates.

*Decrease of 0.3 per year, p<0.001 (simple linear regression)



	California		U.S.
Year	Number	Age-adjusted Rate (per 10,000)	Age-adjusted Rate (per 10,000)
1995	42,333	13.3	19.5
1996	37,852	11.8	17.9
1997	39,708	12.2	17.9
1998	37,953	11.7	15.5
1999	39,937	12.1	17.4
2000	37,096	11.0	16.7
2001	36,101	10.6	16.0
2002	36,827	10.6	16.8
2003	39,734	11.3	19.8
2004	34,959	9.8	17.0
2005	36,060	10.0	16.6
2006	33,253	9.1	14.9
2007	32,042	8.6	15.2
2008	34,146	9.1	14.4
2009	36,466	9.5	15.4
2010	34,796	9.0	—

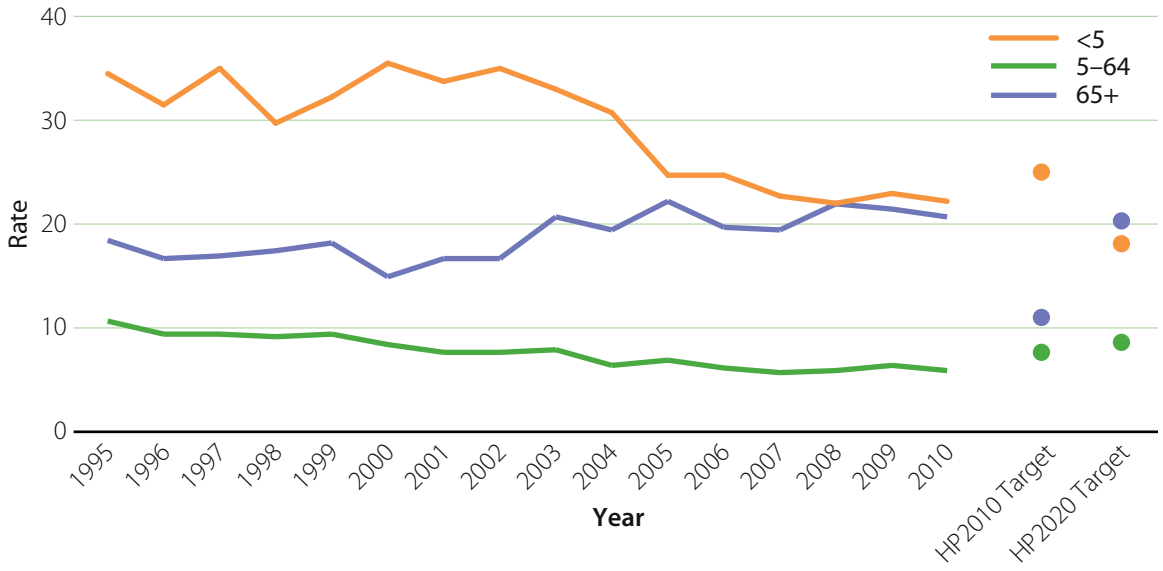
Note: U.S. data not available for 2010; U.S. data are from the National Hospital Discharge Survey, 1995–2009

Asthma Hospitalizations per 10,000 California Residents by Age, Compared to HP2010 and HP2020 Targets, 1995–2010

Asthma hospitalization rates have been consistently highest in children under the age of five, but have been declining in this age group by about one per 10,000 each year.* Rates in the 5–64 age group have decreased gradually over time, and have met both the HP2010 and HP2020 targets. Rates in the 65 and over age group have increased over time and are now close to the rates for children under age five.*

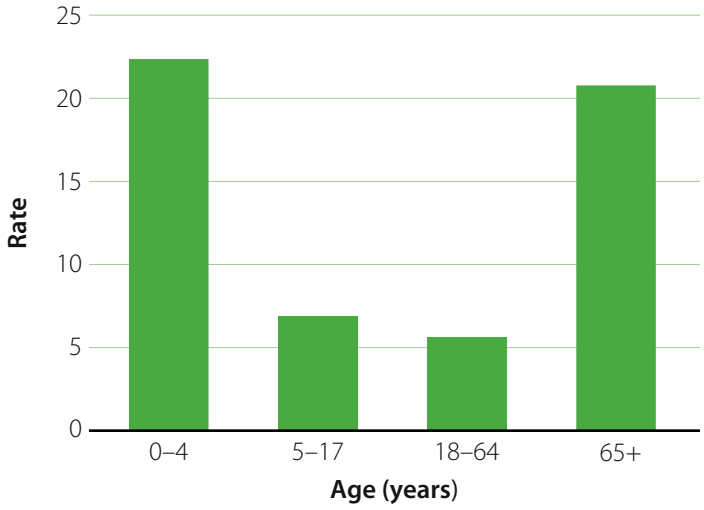
* Age 0-4: decrease of 0.9 (per 10,000) per year, p<0.001; Age 5-64: decrease of 0.3 (per 10,000) per year, p<0.001; Age 65+: increase of 0.3 (per 10,000) per year, p=0.001 (simple linear regression)

Note: See Healthy People 2010/2020 section for an explanation of HP2010/2020 objectives. Targets were changed for HP2020; visit www.healthypeople.gov for more information.



	<5		5–64		65+	
Year	N	Crude Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)
1995	9,694	34.5	26,717	10.6	5,922	18.4
1996	8,586	31.4	23,842	9.4	5,424	16.7
1997	9,371	35.1	24,717	9.5	5,620	17.0
1998	7,753	29.8	24,411	9.2	5,789	17.4
1999	8,210	32.3	25,453	9.4	6,274	18.2
2000	8,830	35.6	22,861	8.3	5,405	14.9
2001	8,367	33.8	21,503	7.6	6,231	16.6
2002	8,710	34.9	21,710	7.6	6,407	16.6
2003	8,363	32.9	23,184	7.9	8,187	20.6
2004	7,973	30.8	19,148	6.5	7,838	19.5
2005	6,522	24.8	20,473	6.8	9,065	22.3
2006	6,555	24.5	18,618	6.1	8,082	19.6
2007	6,179	22.8	17,848	5.7	8,015	19.5
2008	5,995	22.0	18,944	6.0	9,207	21.9
2009	6,288	22.9	20,955	6.5	9,223	21.5
2010	6,187	22.3	19,555	6.0	9,054	20.7
HP2010 Targets		**25.0**		**7.7**		**11.0**
HP2020 Targets		**18.1**		**8.6**		**20.3**

Age-Adjusted Asthma Hospitalizations per 10,000 California Residents by Age, 2010

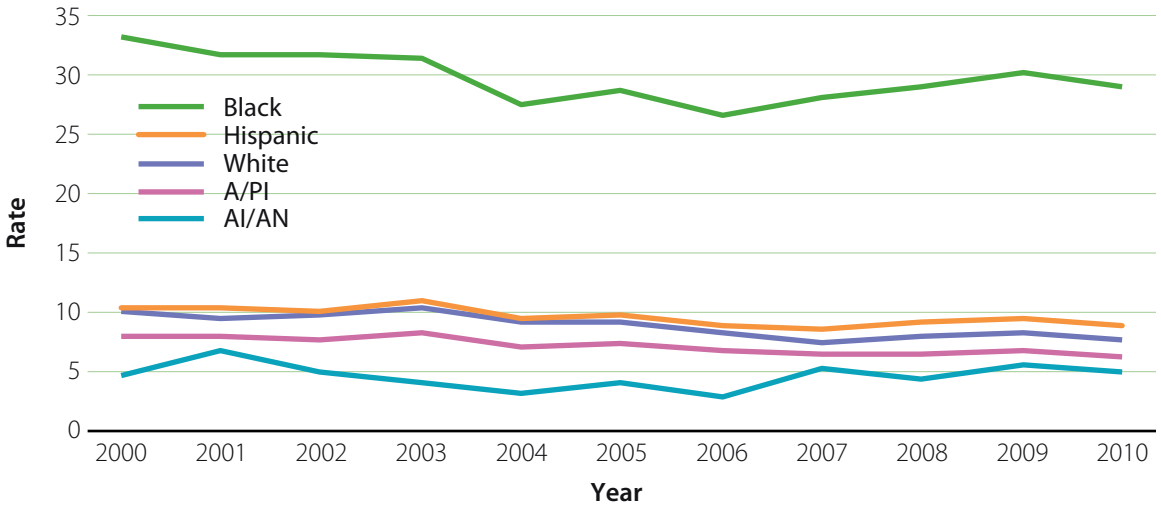


	Age (years)	N	Age-adjusted Rate (per 10,000)
Children	0–4	6,187	22.3
	5–17	4,884	6.9
Adults	18–64	14,671	5.7
	65+	9,054	20.7
Totals	0–17	11,071	11.0
	18+	23,725	8.3
	All Ages	34,796	9.0

Age-Adjusted Asthma Hospitalizations per 10,000 California Residents by Race/Ethnicity, 2000–2010

Blacks have the highest asthma hospitalization rates. From 2000–2010, asthma hospitalization rates among Blacks were 3.4 times higher than among Whites, on average. Whites and Hispanics have similar asthma hospitalization rates, while Asians/Pacific Islanders (A/PI) have slightly lower rates. (Hospitalization data do not allow for separating Pacific Islanders from Asians.) Rates among Blacks, Hispanics, Whites, and A/PI have all decreased slightly over the past ten years (0.2–0.4 per year).* American Indians/Alaska Natives (AI/AN) have the lowest asthma hospitalization rates, but research has shown that many AI/AN patients are misclassified as another race in hospital records, leading to underestimation of their true hospitalization rates.[23]

* Black: decrease of 0.4 (per 10,000) per year, $p<0.05$; Hispanic: decrease of 0.2 (per 10,000) per year, $p<0.01$; White: decrease of 0.3 (per 10,000) per year, $p<0.01$; A/PI: decrease of 0.2 (per 10,000) per year, $p<0.01$ (simple linear regression)



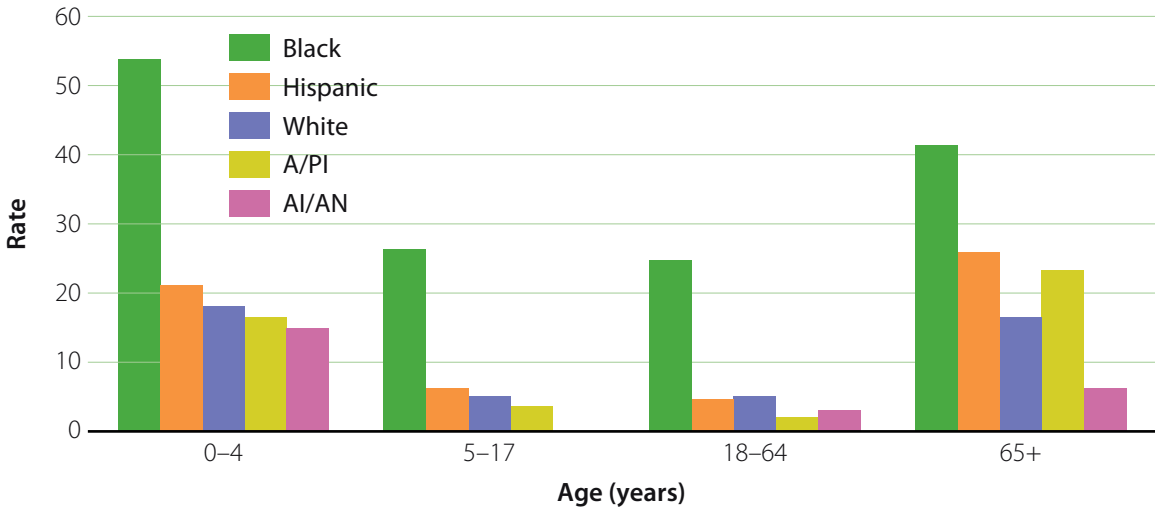
23 Garcia, 2007

Year	Black		Hispanic		White		A/PI		AI/AN	
	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)
2000	7,522	33.3	10,295	10.2	15,440	10.0	2,572	7.8	85	4.5
2001	7,146	31.7	10,275	10.3	14,827	9.4	2,630	7.7	126	6.7
2002	7,273	31.7	10,626	10.0	14,981	9.5	2,659	7.5	90	4.8
2003	7,325	31.4	11,472	11.0	16,672	10.3	2,968	8.2	87	4.0
2004	6,357	27.3	10,141	9.3	14,606	8.9	2,605	6.9	74	3.1
2005	6,770	28.7	10,213	9.7	14,923	8.9	2,805	7.2	99	3.9
2006	6,325	26.4	9,719	8.7	13,228	8.0	2,680	6.6	76	2.7
2007	6,091	28.1	9,421	8.3	12,616	7.3	2,622	6.2	92	5.1
2008	6,256	28.8	10,074	8.9	13,674	7.8	2,736	6.2	86	4.2
2009	6,647	30.2	11,282	9.4	13,954	8.0	3,024	6.6	111	5.4
2010	6,445	29.0	10,751	8.7	13,435	7.6	2,860	6.1	92	4.7

Asthma Hospitalizations

Age-Adjusted Asthma Hospitalizations per 10,000 California Residents by Race/Ethnicity and Age, 2010

Racial disparities persist across all ages, with Blacks having asthma hospitalization rates that are 3–5 times higher than those for Whites. Racial disparities for asthma hospitalizations are somewhat different in the 65+ age group, with Hispanics and A/PI having rates that are 40–60% higher than those for Whites.

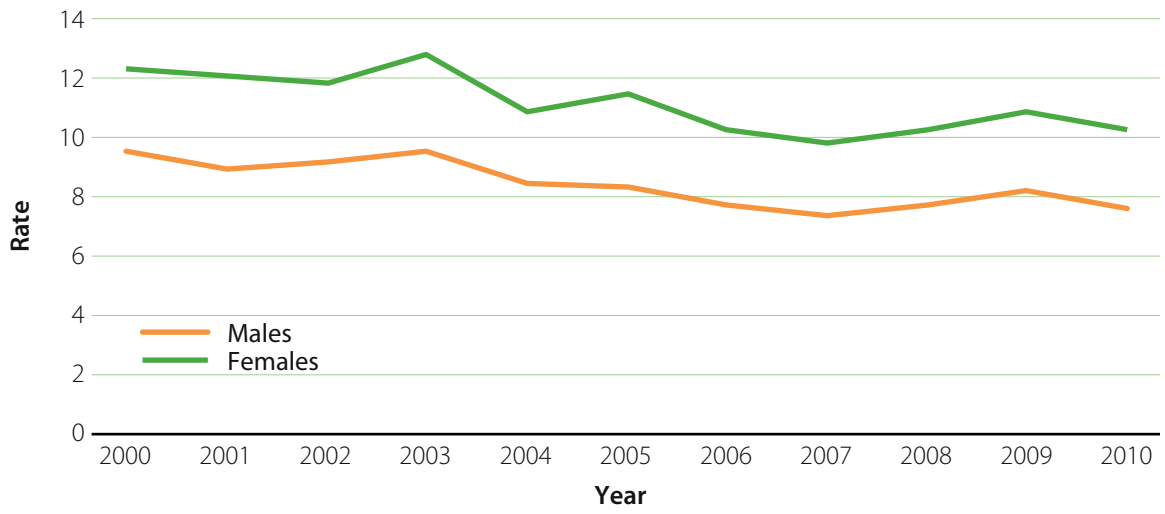


		Black		Hispanic		White		A/PI		AI/AN	
	Age (years)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)
Children	0–4	858	54.0	2,974	21.1	1,485	18.1	520	16.3	18	14.8
	5–17	982	26.2	2,268	6.4	1,104	5.2	262	3.8	10	—
Adults	18–64	3,705	24.6	3,503	4.4	6,321	5.4	726	2.1	48	2.9
	65+	900	41.3	2,006	26.0	4,525	16.6	1,352	23.2	16	6.3
Totals	0–17	1,840	33.6	5,242	10.3	2,589	8.7	782	7.1	28	8.1
	18+	4,605	27.4	5,509	8.1	10,846	7.3	2,078	5.7	64	3.5
	All Ages	6,445	29.0	10,751	8.7	13,435	7.6	2,860	6.1	92	4.7

Age-Adjusted Asthma Hospitalizations per 10,000 California Residents by Sex, 2000–2010

For all ages combined, asthma hospitalization rates for females are consistently about 30% higher than for males. Rates among both males and females have decreased by about 0.2 per year since 2000.*

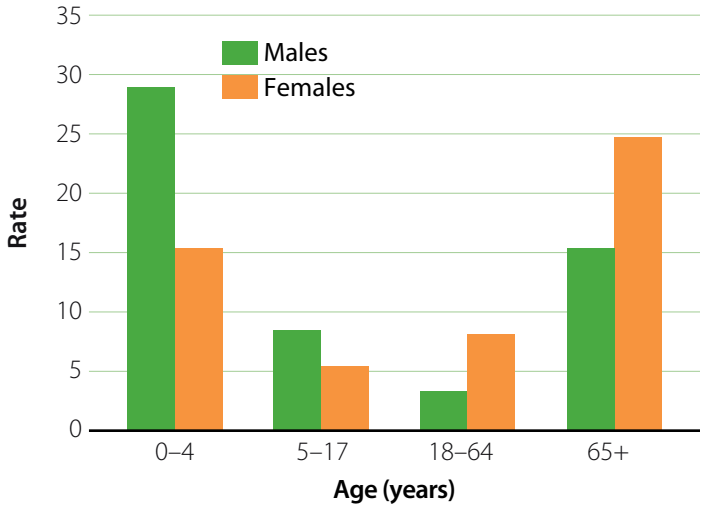
* Males and Females: decrease of 0.2 (per 10,000) per year, p<0.01 (simple linear regression)



	Males		Females	
Year	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)
2000	16,297	9.5	20,739	12.3
2001	15,350	8.9	20,750	12.0
2002	15,987	9.2	20,840	11.8
2003	16,732	9.5	23,000	12.8
2004	14,979	8.5	19,980	10.9
2005	14,671	8.3	21,389	11.5
2006	13,879	7.7	19,376	10.3
2007	13,237	7.3	18,805	9.8
2008	14,001	7.7	20,144	10.3
2009	15,183	8.2	21,283	10.8
2010	14,325	7.6	20,471	10.2

Age-Adjusted Asthma Hospitalizations per 10,000 California Residents by Sex and Age, 2010

The sex disparity in asthma hospitalizations varies by age. Among children, males have higher rates than females, while among adults, females have higher rates than males.

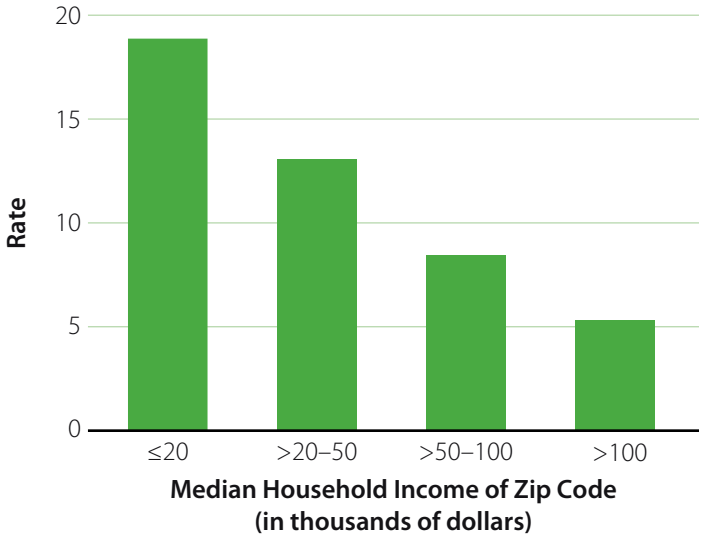


	Males		Females	
Age (years)	N	Age-adjusted Rate (per 10,000)	N	Age-adjusted Rate (per 10,000)
Children				
0–4	4,103	29.0	2,084	15.3
5–17	3,047	8.4	1,837	5.3
Adults				
18–64	4,348	3.4	10,323	8.1
65+	2,827	15.3	6,227	24.8
Totals				
0–17	7,150	13.9	3,921	8.0
18+	7,175	5.4	16,550	10.9
All Ages	14,325	7.6	20,471	10.2

Age-Adjusted Asthma Hospitalizations per 10,000 California Residents by Median Household Income in Zip Code, 2009

Asthma hospitalizations are associated with income. People who live in areas where the median household income is $20,000 or less are hospitalized for asthma at almost four times the rate of those living where the median household income is more than $100,000.

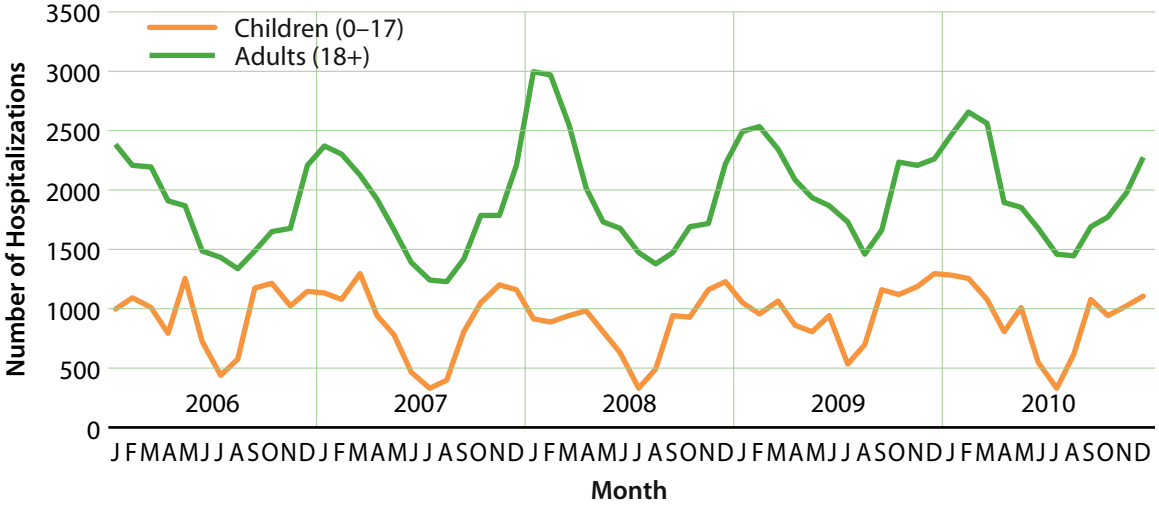
Note: Information on each person's income is not available in hospitalization data, so the median income in each person's zip code is used as a proxy.



Median Household Income in Zip Code	N	Age-adjusted Rate (per 10,000)
≤$20,000	151	18.9
>$20,000–$50,000	15,783	13.1
>$50,000–$100,000	18,064	8.4
>$100,000	1,800	5.2

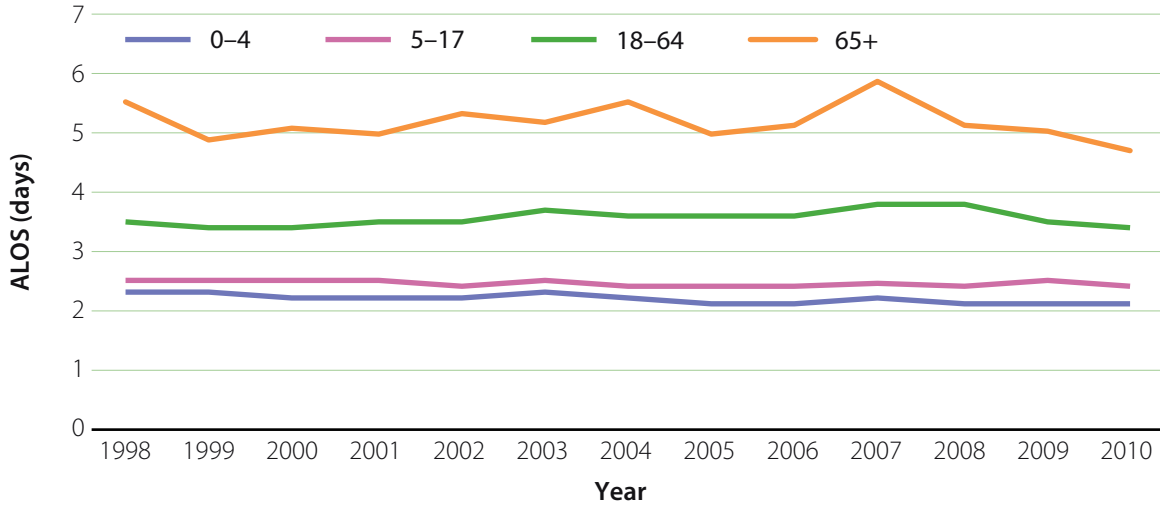
Asthma Hospitalizations by Month of Admission and Age, California 2006–2010

Asthma hospitalizations vary by season. The number decreases in the summer months, with lows in July and August for both children and adults. The number then increases in the fall and winter, with highs in November–December for children and January–February for adults.



Average Length of Stay (ALOS) for Asthma Hospitalizations by Age, California 1998–2010

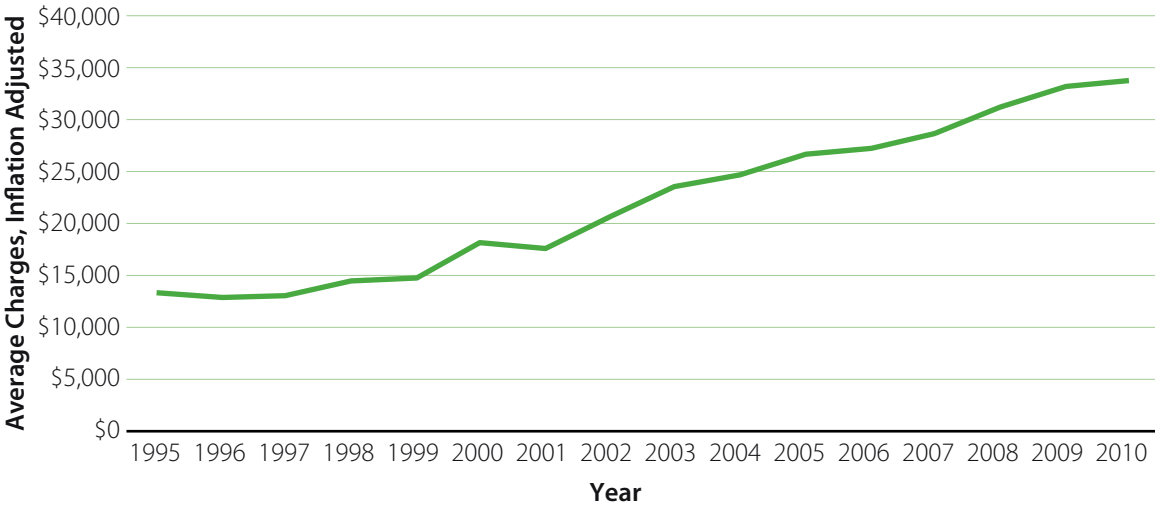
Average length of stay (ALOS) increases with age. ALOS for asthma hospitalizations has not varied much over time. In 2010, the overall ALOS for asthma hospitalizations in California was 3.3 days.



	Age (years)				
Year	0–4	5–17	18–64	65+	Total
1998	2.3	2.5	3.5	5.5	3.3
1999	2.3	2.5	3.4	4.9	3.3
2000	2.2	2.5	3.4	5.1	3.2
2001	2.2	2.5	3.5	5.0	3.3
2002	2.2	2.4	3.5	5.3	3.3
2003	2.3	2.5	3.7	5.2	3.5
2004	2.2	2.4	3.6	5.5	3.5
2005	2.1	2.4	3.6	5.0	3.5
2006	2.1	2.4	3.6	5.1	3.5
2007	2.2	2.5	3.8	5.9	3.8
2008	2.1	2.4	3.8	5.1	3.7
2009	2.1	2.5	3.5	5.0	3.5
2010	2.1	2.4	3.4	4.7	3.3

Average Charge per Asthma Hospitalization, California 1995–2010

Total charges for all asthma hospitalizations in 2010 were over $1 billion. The average charge per asthma hospitalization increased well over twofold since 1995 (or about 8% per year), even after adjusting for inflation. In 1995, the average charge was $9,277 ($13,274 in 2010 dollars), versus $33,749 in 2010. (Note: Kaiser Permanente hospitals do not report charges; 7.5% of all asthma hospitalizations in 2010 were at Kaiser Permanente hospitals.)



Year	Average charges per Asthma Hospitalization	Inflation-adjusted (2010)
1996	$9,265	$12,876
1998	$10,716	$14,336
2000	$14,445	$18,292
2002	$17,024	$20,635
2004	$21,500	$24,818
2006	$25,184	$27,240
2008	$30,766	$31,159
2010	$33,749	$33,749

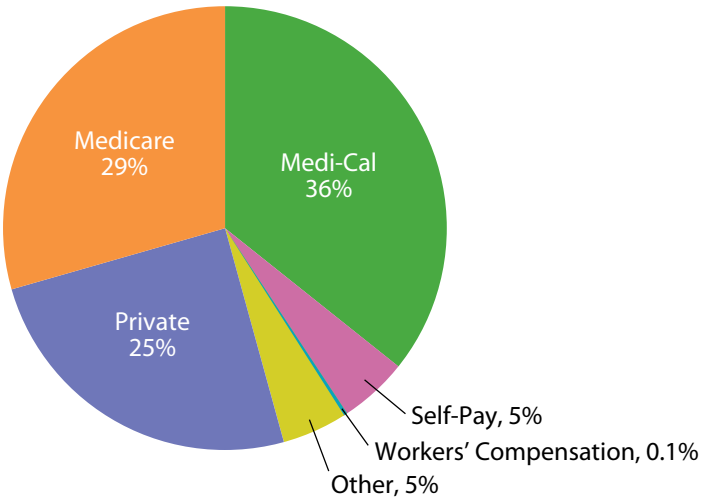
Average Charges per Asthma Hospitalization, by Age, California 2010

Charges for asthma hospitalizations increase with age. The average charge per day for people age 65 and over was about 2.5 times higher than for children.

Age	Average Charges Overall	Average Charges per Day
0–4	$17,985	$8,708
5–17	$21,433	$8,434
18–64	$35,504	$12,850
65+	$50,210	$13,853

Expected Source of Payment for Asthma Hospitalizations, California 2010

In 2010, the majority of asthma hospitalizations were covered by large state and federal programs—29% were covered by Medicare and 36% were covered by Medi-Cal.



Repeat Asthma Hospitalizations

When someone has more than one asthma hospitalization within a certain period, it is called a repeat hospitalization. Repeat hospitalizations for asthma were counted over one-year (2010), two-year (2009–2010), and three-year (2008–2010) periods. Charges for these hospitalizations were also estimated. Interventions targeted at people who are hospitalized for asthma can prevent repeat hospitalizations.

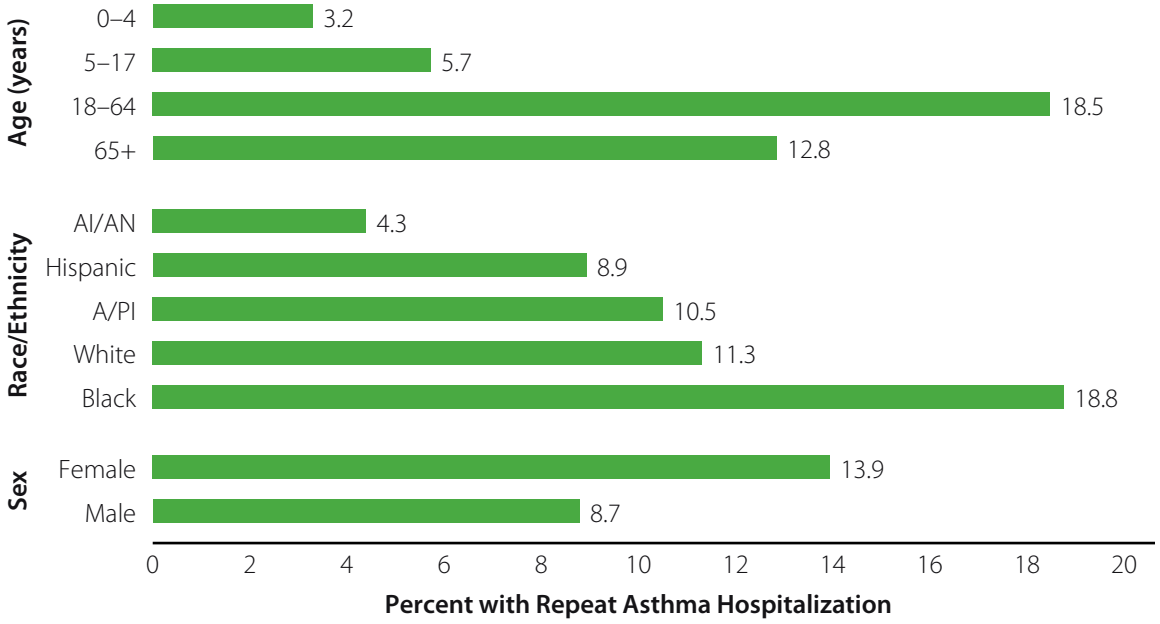
Repeat Hospitalizations for Asthma, California 2008–2010

In 2010, 11.6% of people hospitalized for asthma were re-admitted at least once for asthma during that year, for a total of 4,612 repeat asthma hospitalizations. Charges for repeat hospitalizations in California were $155.6 million in 2010, 34% of which was paid by Medi-Cal and 42% of which was paid by Medicare. The average charge for a repeat hospitalization in 2010 was 20% higher than the overall average for all asthma hospitalizations. Over the two- and three-year periods, a substantially higher percent of people had repeat hospitalizations.

	2010	2009–2010	2008–2010
Number of Repeat Asthma Hospitalizations	4,612	13,027	22,523
(% of All Asthma Hospitalizations)	(13.3%)	(18.3%)	(21.4%)
Number of People with Repeat Asthma Hospitalizations	2,966	7,391	11,742
(% of All People with Asthma Hospitalizations)	(11.6%)	(14.0%)	(15.0%)
Total Charges for Repeat Asthma Hospitalizations	$155.6 million	$435.2 million	$743.1 million
(% of All Asthma Hospitalization Charges)	(15.3%)	(21.4%)	(25.2%)
Total Charges for Repeat Asthma Hospitalizations paid by Medi-Cal	$53.4 million	$156 million	$265.5 million
Total Charges for Repeat Asthma Hospitalizations paid by Medicare	$65.3 million	$186.7 million	$316.8 million
Average Charge for Repeat Asthma Hospitalizations	$40,348	$39,676	$38,833
Average Charge for All Asthma Hospitalizations	$33,749	$33,132	$32,360
Maximum # of hospitalizations by one person	28	35	47

Percent with Repeat Asthma Hospitalizations, Among People Hospitalized for Asthma, by Age, Race/Ethnicity, and Sex, California 2010

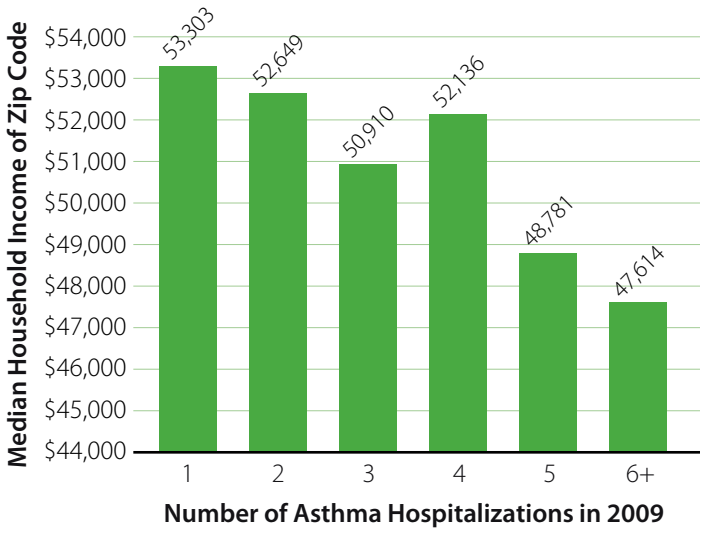
There are disparities in the percentages of people who have repeat asthma hospitalizations by age, race/ethnicity, and sex. Blacks had the highest percentage of people with repeat asthma hospitalizations (18.8%). Adults ages 18-64 also had a high percentage of repeat hospitalizations compared to other age groups. Females had a higher percentage of repeat hospitalizations compared to males.



Zip Code Median Household Income of People Hospitalized for Asthma, by Number of Asthma Hospitalizations, California 2009

Repeat asthma hospitalizations are also associated with income. Individuals with more asthma hospitalizations in 2009 were more likely to be from areas with lower median household income.

Note: Information on each person's income is not available in hospitalization data, so the median income in each person's zip code is used as a proxy. See Technical Notes for more information.



8 Asthma Among Medi-Cal Beneficiaries

Summary

Among Medi-Cal beneficiaries in California:

- About 89% of Medi-Cal Managed Care beneficiaries with persistent asthma got appropriate long-term control asthma medications in 2009.
- In 2010, there were 90,004 asthma emergency department (ED) visits (145.4 per 10,000 beneficiaries) and 14,514 asthma hospitalizations (26.0 per 10,000 beneficiaries).
- Asthma ED visit and hospitalization rates are highest among children under the age of five.
- Asthma ED visit and hospitalization rates are highest for Blacks, Pacific Islanders, and American Indians/Alaska Natives. Asthma hospitalization rates are also high for Filipinos.

Medi-Cal is California's state Medicaid health insurance program, which provides health care services for low-income children and adults, persons with disabilities, and others with specific conditions. Low income is associated with higher asthma severity, poorer asthma control, and higher rates of asthma emergency department (ED) visits and hospitalizations. Therefore, Medi-Cal beneficiaries represent a high-risk population for asthma. However, data on Medi-Cal beneficiaries are not representative of the general population.

How many Medi-Cal beneficiaries with asthma receive appropriate medications?

About 89% of Medi-Cal Managed Care members with persistent asthma received appropriate medications in 2009. This is equivalent to the national Medicaid average of about 89% and slightly lower than the national average among commercial health insurance plans (92.7%).

How many asthma ED visits and hospitalizations occur among Medi-Cal beneficiaries?

In 2010, there were 90,004 asthma ED visits and 14,514 asthma hospitalizations among continuously enrolled Medi-Cal beneficiaries. This translates to a rate of 145.4 asthma ED visits per 10,000 beneficiaries and a rate of 26.0 asthma hospitalizations per 10,000 beneficiaries.

Are there disparities among Medi-Cal beneficiaries with respect to asthma ED visits and hospitalizations?

There are striking disparities in asthma ED visit and hospitalization rates by age and race/ethnicity among Medi-Cal beneficiaries. Both asthma ED visit and hospitalization rates are highest among children under the age of five. Among Blacks, asthma ED visit and hospitalization rates are two times higher than among Whites. Pacific Islander groups and American Indians/Alaska Natives (AI/AN) also have very high rates. For asthma hospitalization rates, Filipinos have the highest rate. Racial/ethnic disparities vary by age group.

In 2009, 88.6% of Medi-Cal Managed Care beneficiaries with persistent asthma receive appropriate medications.

In 2010, there were 90,004 asthma ED visits and 14,514 asthma hospitalizations among continuously enrolled Medi-Cal beneficiaries.

Technical Notes

Appropriate medication use is determined using a measure from the Health Employer Data and Information Set (HEDIS®). Developed by the National Committee for Quality Assurance (NCQA), HEDIS is a nationally recognized, standardized set of performance indicators that measure access, utilization, and quality of health care. See www.ncqa.org for more information.

Data on asthma ED visits and hospitalizations are from the California Department of Health Care Services (DHCS) Medi-Cal Management Information and Decision Support System database. The numerator for the rates is the number of asthma-related ED visits or hospitalizations among Medi-Cal beneficiaries who were continuously enrolled for the 12 months of calendar year 2010. These counts are the total number of visits or hospitalizations, not the number of unique beneficiaries. This means that there were about 90,000 asthma ED visits in 2010, but not 90,000 different beneficiaries who had asthma ED visits during that time. The denominator for the rates is the number of unique beneficiaries who were continuously enrolled for the 12 months of calendar year 2010. Overall rates are age-adjusted to the 2000 U.S. population. Most age-specific rates in this section are also age-adjusted, except for ages 0–4 and 65+. In addition, rates in this section are not age-adjusted using identical groupings as rates in other sections of this report, so rates are not directly comparable. Further details about the data presented in this chapter can be found in the Technical Notes section at the end of this report.

HEDIS — Use of Appropriate Medications for People with Asthma

To assess the quality of care provided by contracted Medi-Cal Managed Care (MCMC) health plans, DHCS requires each plan to report rates for a series of performance measures from HEDIS. The HEDIS measure entitled *Use of Appropriate Medications for People with Asthma* evaluates the proportion of beneficiaries ages 5–56 years with persistent asthma who have been prescribed medications acceptable as primary therapy for long-term control of asthma during the year. For the 2006 measure, HEDIS modified the definition of persistent asthma to better capture patients with poorly controlled asthma. Under the new definition, fewer patients are included in the measure, which created an increase in the percent with appropriate medications. Therefore, data from before 2006 should not be directly compared to subsequent years. Because MCMC performance on this measure has remained steady since 2006, DHCS is discontinuing this measure for 2010, so plans can shift resources to other measures. DHCS intends to collect information for this asthma measure at selected intervals to ensure that plans sustain performance.

Percent of Medi-Cal Managed Care Beneficiaries (Ages 5–56) with Persistent Asthma who were Prescribed Appropriate Medications, 2006–2009

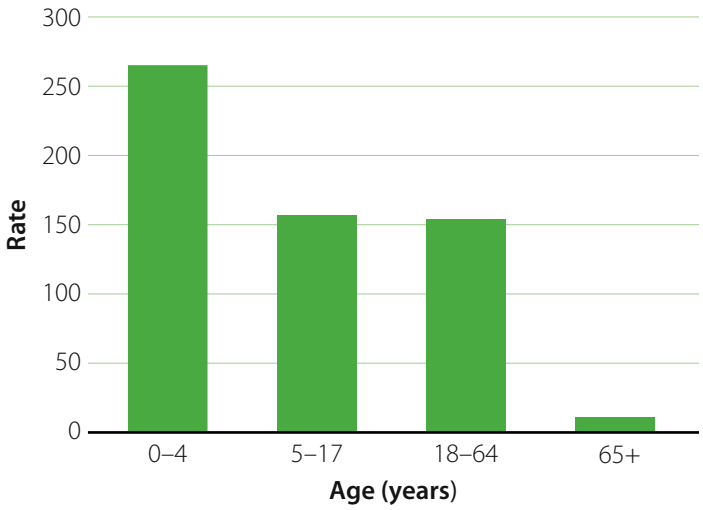
In 2009, 88.6% of Medi-Cal Managed Care members with persistent asthma received prescriptions for appropriate medications. This percentage has stayed relatively stable since 2006.

Year	Medi-Cal Managed Care Average (%)	National Medicaid Average (%)	National Commercial Average (%)
2006	84.5	85.7	89.9
2007	86.8	87.1	91.6
2008	88.8	86.9	92.3
2009	88.6	88.6	92.7

Data Source: California Department of Health Care Services, Medi-Cal Managed Care Division (www.dhcs.ca.gov/dataandstats/reports/Pages/MMCDQualPerfMsrRpts.aspx#hedis) and www.ncqa.org

Medi-Cal Asthma ED Visits per 10,000 Continuously Enrolled Beneficiaries by Age, 2010

In 2010, there were 90,004 asthma ED visits among continuously enrolled Medi-Cal beneficiaries, or an overall rate of 145.4 visits per 10,000 beneficiaries. Asthma ED visit rates among Medi-Cal beneficiaries are highest among children under the age of five, and lowest among adults over age 65.

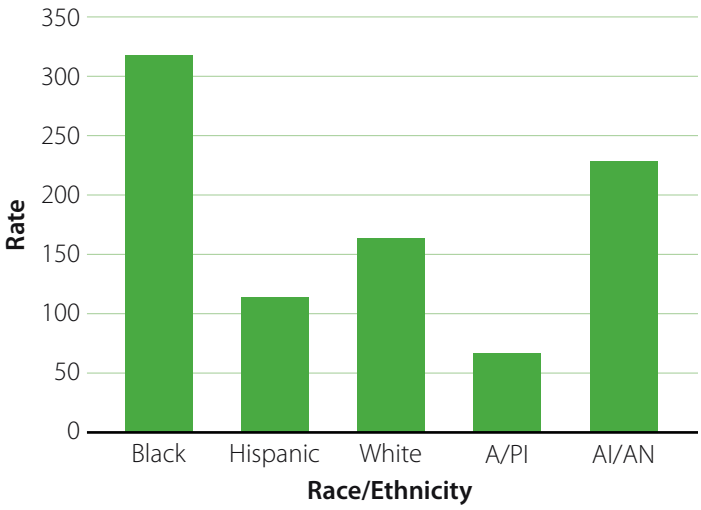


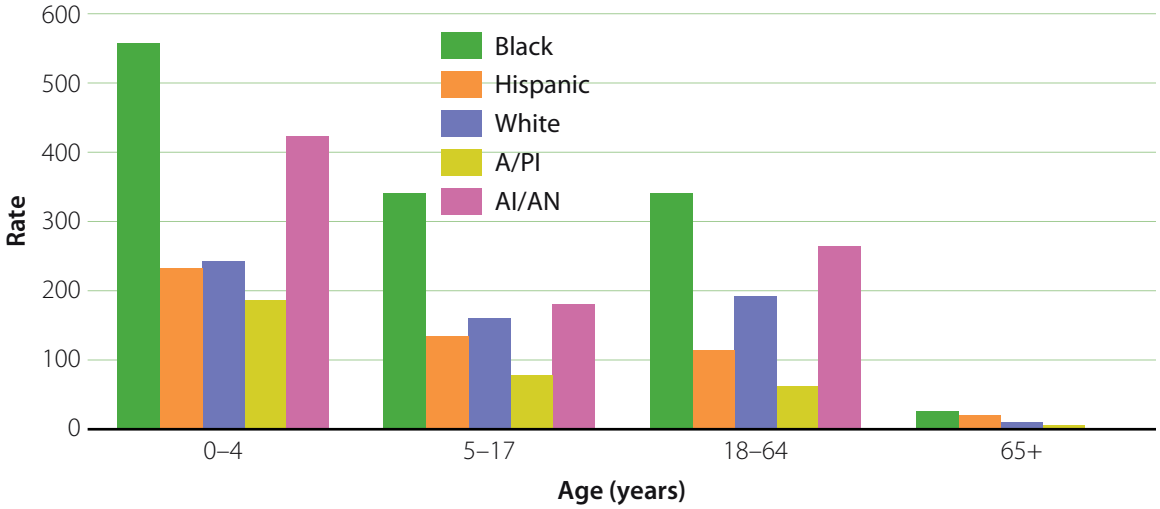
Age (Years)	N	Rate (per 10,000)
Children		
0–4	22,837	264.9
5–17	31,287	157.9
Adults		
18–64	34,838	155.5
65+	1,042	12.6
Totals		
0–17	54,124	186.6
18+	35,880	131.2
All Ages	90,004	145.4

Note: Rates are age-adjusted to the 2000 U.S. population except for ages 0–4 and 65+.

Medi-Cal Asthma ED Visits per 10,000 Continuously Enrolled Beneficiaries by Age and Race/Ethnicity, 2010

The asthma ED visit rate among Medi-Cal beneficiaries is highest for Blacks. The rate for Blacks is about two times higher than for Whites. The rate is also high among American Indians/Alaska Natives (AI/AN). Asians/Pacific Islanders (A/PI) have the lowest overall rate. The rate among Whites is almost three times higher than among the A/PI group. These racial disparities persist across age groups. However, there are some notable differences among the youngest and oldest groups. Among children ages 0–4, the rate in the A/PI group is comparable to that in Whites. Among adults age 65 and over, the rate among Hispanics is two times higher than among Whites.



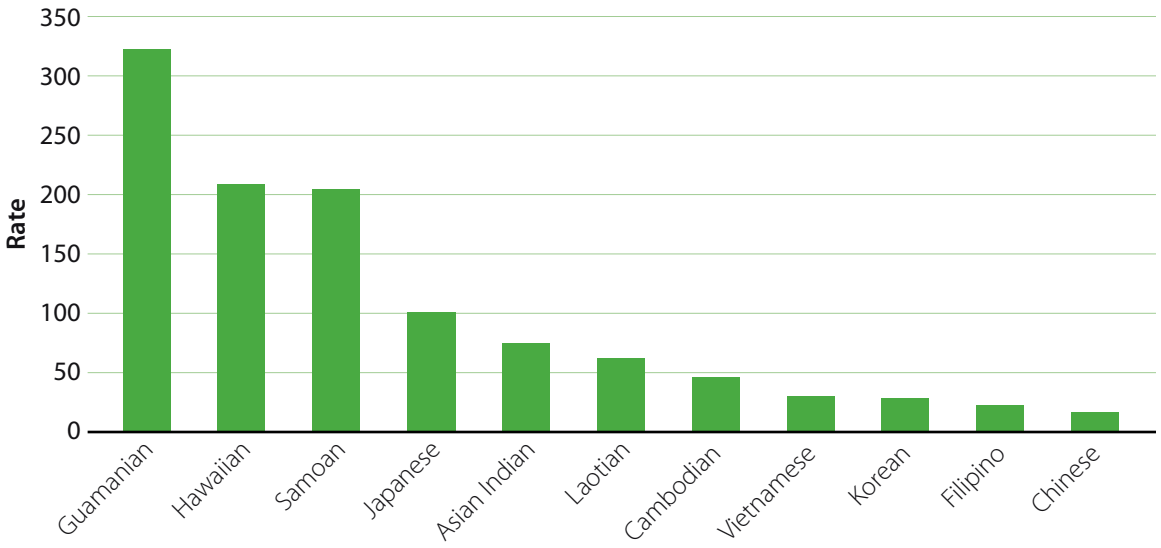


Age (Years)	Black N	Black Rate (per 10,000)	Hispanic N	Hispanic Rate (per 10,000)	White N	White Rate (per 10,000)	A/PI N	A/PI Rate (per 10,000)	AI/AN N	AI/AN Rate (per 10,000)
Children										
0–4	4,150	559.3	13,326	230.1	2,764	242.3	727	168.4	123	426.2
5–17	6,546	339.2	17,332	134.9	4,500	157.8	843	70.4	154	182.7
Adults										
18–64	9,011	342.9	12,456	115.6	10,048	190.5	1,055	56.9	>345	262.2
65+	122	25.5	462	19.6	190	8.5	145	6.4	<5	—
Totals										
0–17	10,696	398.3	30,658	160.4	7,264	180.4	1,570	96.7	277	248.0
18+	9,133	288.8	12,918	99.3	10,238	159.5	1,200	48.3	349	220.7
All Ages	19,829	317.0	43,576	115.1	17,502	164.9	2,770	60.8	626	227.7

Note: Rates are age-adjusted to the 2000 U.S. population except for ages 0–4 and 65+. Counts of less than 5 are not reported due to privacy concerns. Rates based on less fewer 12 events are not calculated due to statistical instability.

Age-Adjusted Medi-Cal Asthma ED Visits per 10,000 Continuously Enrolled Beneficiaries, by Asian and Pacific Islander Subgroup, 2010

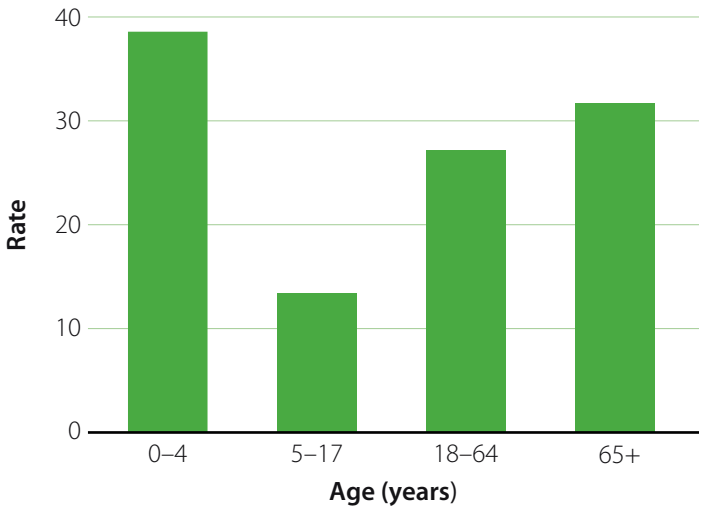
Overall, A/PI have the lowest asthma ED visit rate among Medi-Cal beneficiaries. However, variations among subgroups are masked when all A/PI are combined together. When 2010 rates were calculated for specific subgroups, the highest group rate (Guamanians) was 18.6 times higher than the lowest group rate (Chinese). In 2010, Guamanians, Hawaiians, and Samoans had the highest asthma ED visit rates. The rate among Guamanians was even higher than among Blacks in that year. (Similar data on Hispanic subgroups are not available.)



Asian Subgroup	N	Age-Adjusted Rate (per 10,000)
Guamanian	43	322.8
Hawaiian	91	208.7
Samoan	247	203.9
Japanese	29	99.4
Asian Indian	255	75.4
Laotian	134	62.7
Cambodian	130	47.3
Vietnamese	341	30.4
Korean	29	28.2
Filipino	262	21.8
Chinese	125	17.4

Medi-Cal Asthma Hospitalizations per 10,000 Continuously Enrolled Beneficiaries by Age, 2010

In 2010, there were 14,514 asthma hospitalizations among continuously enrolled Medi-Cal beneficiaries, or an overall rate of 26.0 hospitalizations per 10,000 beneficiaries. Asthma hospitalization rates among Medi-Cal beneficiaries are highest among children under age five, and lowest among children ages 5–17.

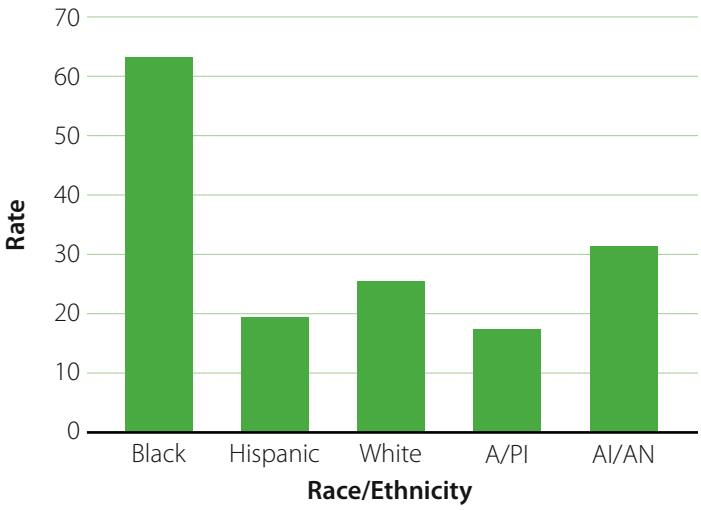


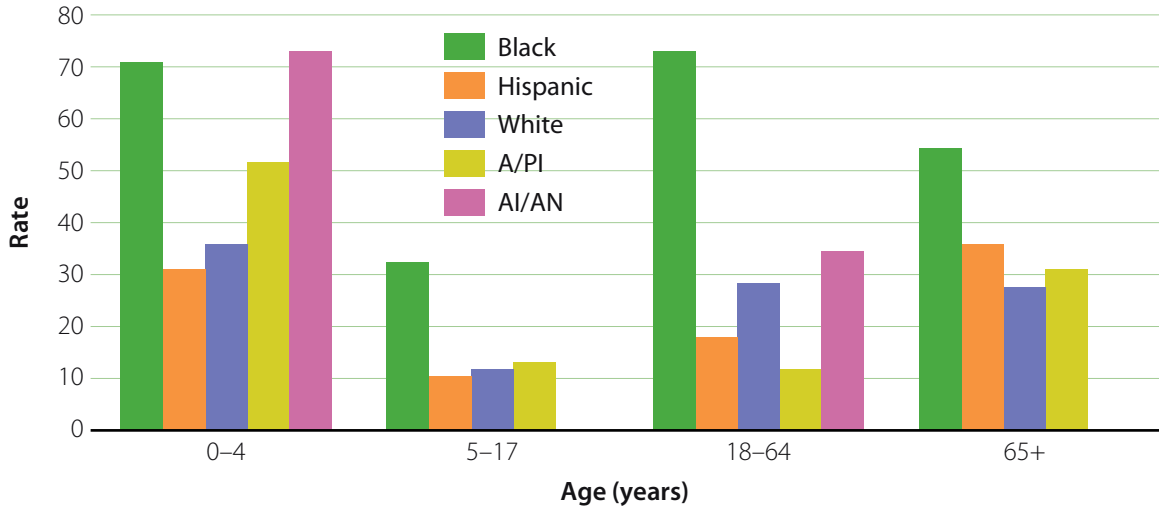
Age (Years)	N	Rate (per 10,000)
Children		
0–4	3,353	38.9
5–17	2,724	13.5
Adults		
18–64	5,811	27.2
65+	2,626	31.7
Totals		
0–17	6,077	20.3
18+	8,437	28.0
All Ages	14,514	26.0

Note: Rates are age-adjusted to the 2000 U.S. population except for ages 0–4 and 65+.

Medi-Cal Asthma Hospitalizations per 10,000 Continuously Enrolled Beneficiaries by Age and Race/Ethnicity, 2010

The asthma hospitalization rate among Medi-Cal beneficiaries is highest for Blacks — about two times higher than for Whites. The disparity for Blacks persists across age groups. Other racial/ethnic disparities vary widely by age. Among adults, AI/AN have a rate that is slightly higher than the rate for Whites, but among children age 0–4 it is two times higher than Whites and even higher than Blacks. The disparity for the A/PI group also varies by age and is especially high among children ages 0–4 (44% higher than among Whites). Hispanics have low asthma hospitalization rates for all age groups except for adults age 65 and over.



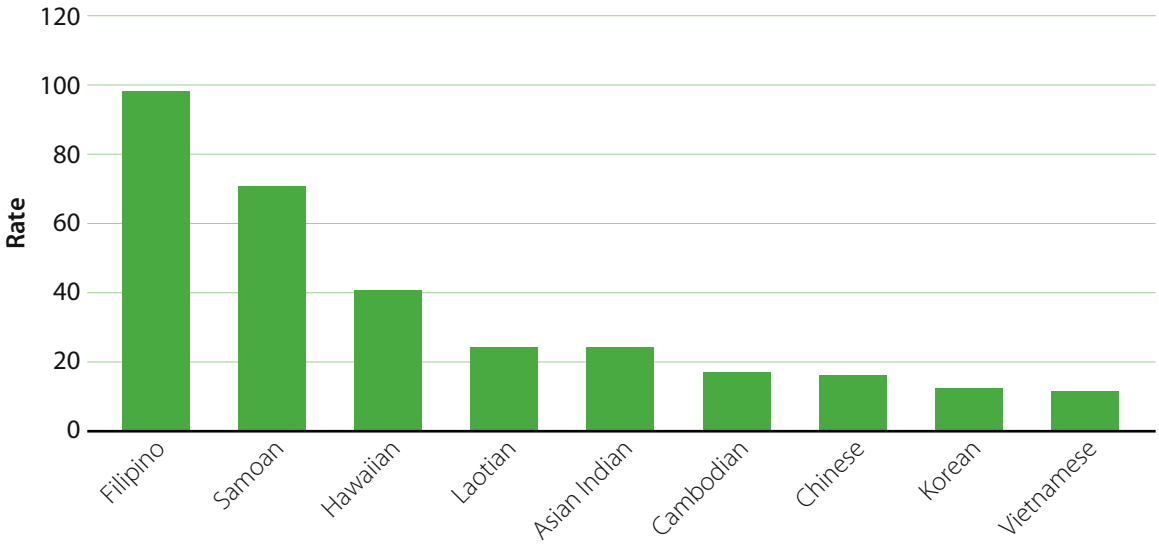


Age (Years)	Black N	Black Rate (per 10,000)	Hispanic N	Hispanic Rate (per 10,000)	White N	White Rate (per 10,000)	A/PI N	A/PI Rate (per 10,000)	AI/AN N	AI/AN Rate (per 10,000)
Children										
0–4	525	70.8	1,813	31.3	409	35.9	223	51.6	21	72.8
5–17	620	32.1	1,375	10.4	327	11.4	159	13.3	10	—
Adults										
18–64	1,946	73.4	1,413	17.6	1,682	28.0	251	11.9	46	34.1
65+	259	54.1	843	35.8	611	27.5	712	31.2	5	—
Totals										
0–17	1,145	42.5	3,188	16.0	736	18.0	382	23.6	31	27.8
18+	2,205	70.1	2,256	20.7	2,293	27.9	963	15.2	51	32.3
All Ages	3,350	63.0	5,444	19.5	3,029	25.3	1,345	17.4	82	31.1

Note: Rates are age-adjusted to the 2000 U.S. population except for ages 0–4 and 65+. Rates based on fewer than 12 events are not calculated due to statistical instability.

Age-Adjusted Medi-Cal Asthma Hospitalizations per 10,000 Continuously Enrolled Beneficiaries, by Asian Subgroup, 2010

Overall, A/PI have the lowest asthma hospitalization rate among Medi-Cal beneficiaries. However, variations among subgroups are masked when all A/PI are combined together. When 2010 rates were calculated by subgroups, the highest group rate (Filipinos) was 8.7 times higher than the lowest group rate (Vietnamese). In 2010, Filipinos, Samoans, and Hawaiians had the highest asthma hospitalization rates. The rates among Filipinos and Samoans were even higher than among Blacks in that year. (Guamanian and Japanese groups were not included because there were fewer than 12 visits. Similar data on Hispanic subgroups is not available.)



Asian Subgroup	N	Age-Adjusted Rate (per 10,000)
Filipino	550	98.4
Samoan	49	70.8
Hawaiian	15	40.7
Laotian	56	24.4
Asian Indian	81	24.2
Cambodian	41	16.7
Chinese	209	15.7
Korean	34	12.4
Vietnamese	153	11.4

9 Asthma Mortality

Summary

- In 2009, there were 415 deaths due to asthma, or a rate of 11 per million California residents.
- In 2009, asthma deaths were estimated to have resulted in 7,038 years of potential life lost or 17 years lost per person.
- The rate of asthma deaths in California has been decreasing from 2000 to 2009, similar to national trends.
- Blacks have consistently had the highest asthma death rate — two to three times higher than Whites.
- Among children and young adults, asthma deaths are very rare, but are not decreasing and have not met the Healthy People 2010 targets.
- Asthma death rates are highest among adults over age 65, but they are also decreasing more than in any other age group.
- Among adults, females have higher asthma death rates than males; among children, males have higher rates than females.

Although it is rare, death due to asthma does occur. Asthma deaths are especially tragic because most can be prevented by appropriate asthma management.[24] The rate of asthma deaths is declining, but significant racial/ethnic disparities still exist. Many factors are associated with a higher risk of asthma death, including, among others: lack of appropriate medications, lack of a written asthma action plan, over-reliance on reliever inhalers, lack of insurance coverage, poverty, severe asthma, prior hospitalizations for asthma, cigarette smoking, illegal drug or alcohol abuse, obesity, and stress.[25]

How many people in California die from asthma?

In 2009, there were 415 deaths due to asthma in California, or a rate of 11 deaths per million residents (this is also called the mortality rate). From 2000–2009, the average annual number of asthma deaths was 474, and the average mortality rate was 13.8 per million residents. These deaths resulted in an estimated 10-year average of 16 years of potential life lost per person.

24 Akinbami, 2011; Rosenman, 2007; Wijesinghe, 2011
25 Von Behren, 2004; Mitchell, 2002

Has the rate of asthma deaths been changing?

Even though the percentage of people who have asthma has been increasing, the asthma death rate in California has been going down — it decreased by about one per million (or about five percent) each year from 2000–2009. Death rates from asthma in California are comparable to rates in the U.S. overall, and the decline in asthma death rates seen in California has also been observed nationally and internationally. Researchers have suggested that the decline in asthma deaths is due to improved disease management, such as inhaled corticosteroid therapy, use of peak flow meters, and written asthma action plans.[26]

In 2009, there were 415 deaths due to asthma in California. The rate of asthma deaths in California is declining, but asthma mortality among Blacks continues to be nearly three times higher than among Whites.

Are there disparities in who is dying from asthma in California?

The most striking disparities in asthma death rates are by race/ethnicity. Similar to rates for hospitalizations and emergency department (ED) visits, Blacks have the highest asthma death rate — 30.6 per million residents in 2009. This is three times higher than the rate among Whites. The rate among Pacific Islanders is also high — two times higher than among Whites. For Hispanics and Asians, we have presented overall asthma death rates, but these rates differ substantially by subgroup. For example, rates among Mexicans are lower than among Whites, while rates among Puerto Ricans are higher. Rates among Filipinos are higher than among Whites, while rates among Japanese and Koreans are lower.[27]

Technical Notes

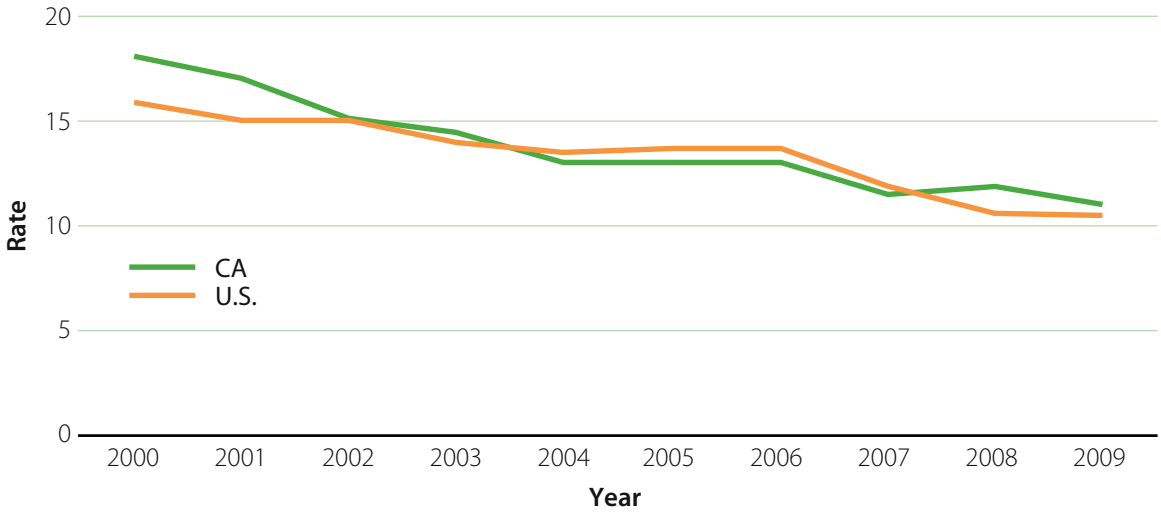
California data on asthma deaths come from the Office of Health Information and Research of the California Department of Public Health (CDPH). U.S. data are from the CDC National Center for Health Statistics. Details about the data presented in this chapter can be found in the Technical Notes section at the end of this report. Data on asthma deaths for each county can be found in the County Asthma Profiles, at www.californiabreathing.org. The numbers of asthma deaths are too small to calculate reliable statistics for smaller geographic areas, such as zip codes.

26 Von Behren, 2004; Mitchell, 2006
27 Homa, 2000; California Breathing, 2009

Age-Adjusted Asthma Deaths per 1,000,000 Residents, California and U.S., 2000–2009

Asthma death rates in California decreased by about one per million each year from 2000–2009.* The rate in 2009 was 11.0 deaths per million California residents. California's asthma death rate has been comparable with the U.S. rate since 2002, and U.S. rates have also been decreasing.

*Decrease of 0.7 per million per year, p<0.001 (simple linear regression)



	California		U.S.
Year	N	Age-adjusted Rate (per 1,000,000)	Age-adjusted Rate (per 1,000,000)
2000	555	18.1	15.9
2001	543	17.0	15.0
2002	496	15.1	15.0
2003	497	14.5	14.0
2004	450	13.0	13.5
2005	460	13.0	13.7
2006	471	13.0	13.7
2007	417	11.5	11.9
2008	440	11.9	10.6
2009	415	11.0	10.5

Note: U.S. data are from the CDC National Center for Health Statistics

Average Age of Death and Years of Potential Life Lost (YPLL) for Asthma Deaths, 2000–2009

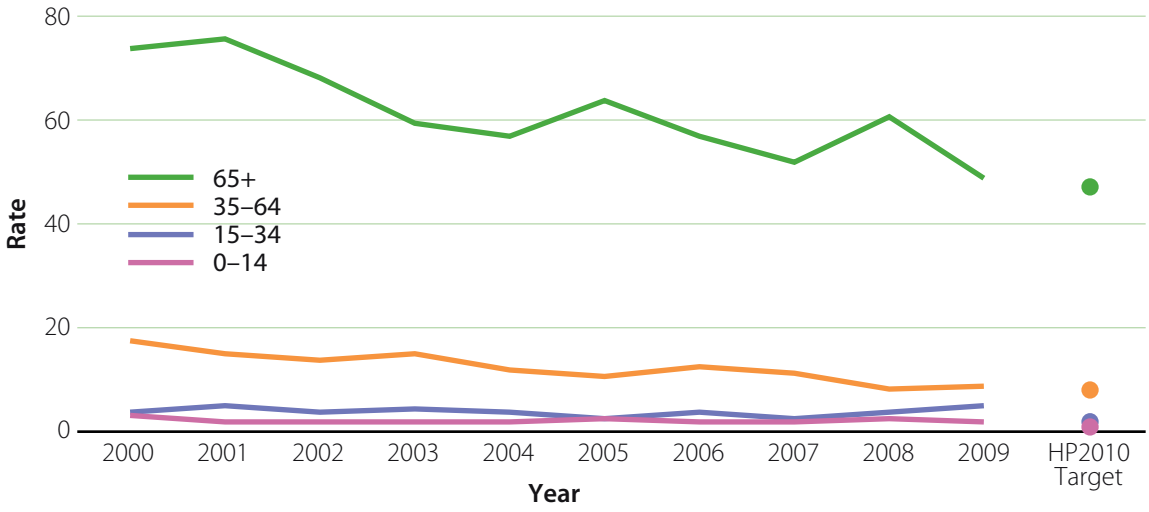
One way to measure the impact of asthma deaths is to count the number of years lost prematurely due to each death from asthma. This is also called years of potential life lost (YPLL). Using a life expectancy of 75 years, there was an average of 16 years of potential life lost per person and an average of about 7,600 total years of life lost per year from 2000–2009.

Year	Number of Deaths	YPLL Total	Average YPLL Per Person	Average Age at Death
2000	555	9,470	17.1	61.3
2001	543	8,737	16.1	62.6
2002	496	7,742	15.6	62.9
2003	497	8,485	17.1	61.6
2004	450	7,351	16.3	62.6
2005	460	6,802	14.8	64.8
2006	471	7,683	16.3	62.7
2007	417	6,401	15.4	63.9
2008	440	6,480	14.7	65.7
2009	415	7,038	17.0	62.3
Total 2000–2009	4,744	76,189	16.0	63.0

Asthma Deaths per 1,000,000 California Residents by Age, Compared to HP2010 Targets, 2000–2009

Asthma death rates increase with age and are highest among adults 65 and over. Death rates have not achieved HP2010 targets in any age group, but are close in the 35–64 and 65+ age groups. Among adults, asthma death rates decreased from 2000–2009* — about one per million each year among the 35–64 age group and 2.5 per million each year among the 65+ age group. Among other age groups, asthma death rates did not change significantly.

*Ages 35–64: decrease of 0.9 (per million) per year, p<0.001; Ages 65+: decrease of 2.5 (per million) per year, p=0.002 (simple linear regression)



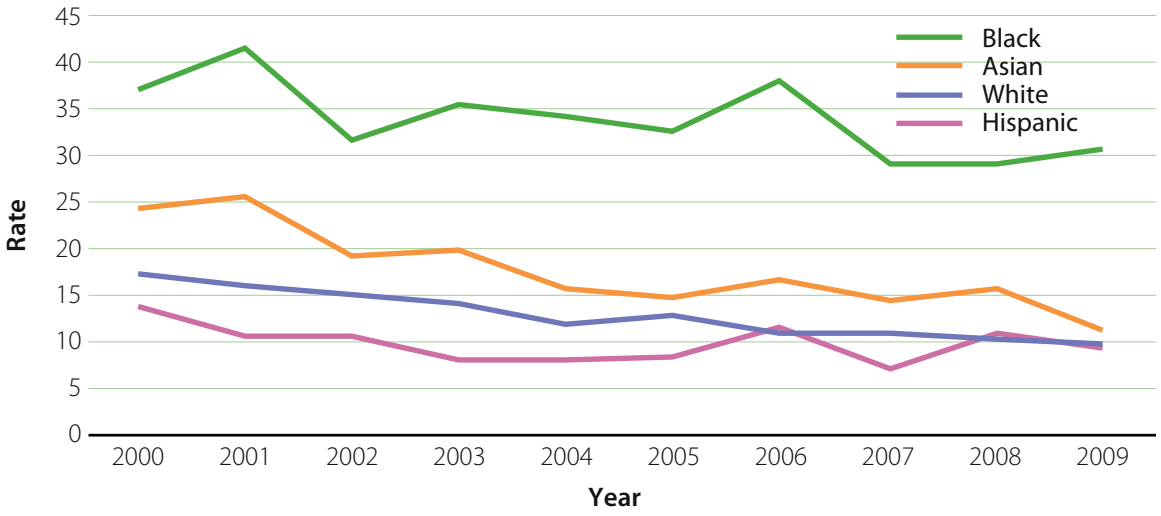
	0–14		15–34		35–64		65+	
Year	N	Rate (per 1,000,000)	N	Rate (per 1,000,000)	N	Rate (per 1,000,000)	N	Rate (per 1,000,000)
2000	26	3.3	40	4.0	221	17.7	267	73.6
2001	15	1.9	50	4.9	195	15.1	283	75.7
2002	15	1.9	39	3.8	179	13.5	263	68.3
2003	17	2.1	45	4.3	201	14.8	234	59.2
2004	17	2.1	39	3.7	167	12.0	227	56.9
2005	19	2.4	30	2.8	154	10.8	257	63.5
2006	15	1.9	38	3.5	185	12.7	233	56.8
2007	14	1.7	26	2.4	165	11.1	212	51.7
2008	18	2.2	43	4.0	124	8.2	255	60.7
2009	15	1.8	53	4.8	137	9.0	210	48.8
Targets		0.9		1.9		8.0		47.0

Note: For asthma mortality, HP2020 targets were only set for two age groups. See Healthy People 2010/2020 section for more information.

Age-Adjusted Asthma Deaths per 1,000,000 California Residents by Race/Ethnicity, 2000–2009

Blacks have the highest asthma mortality rates. From 2000–2009, mortality rates among Blacks were 2.6 times higher than among Whites, on average. This disparity is similar to the U.S. overall.[28] Blacks, Asians, and Whites had decreases in asthma mortality of about one per million each year from 2000–2009.* Hispanic rates did not significantly change. (Data on American Indians/Alaska Natives and Pacific Islanders are not shown by year because the numbers are too small to produce reliable rates.)

*Decrease of 0.8 (per million) per year for Whites (p<0.001), 0.9 (per million) per year for Blacks (p=0.03), and 1.4 (per million) per year for Asians (p <0.001) (simple linear regression)

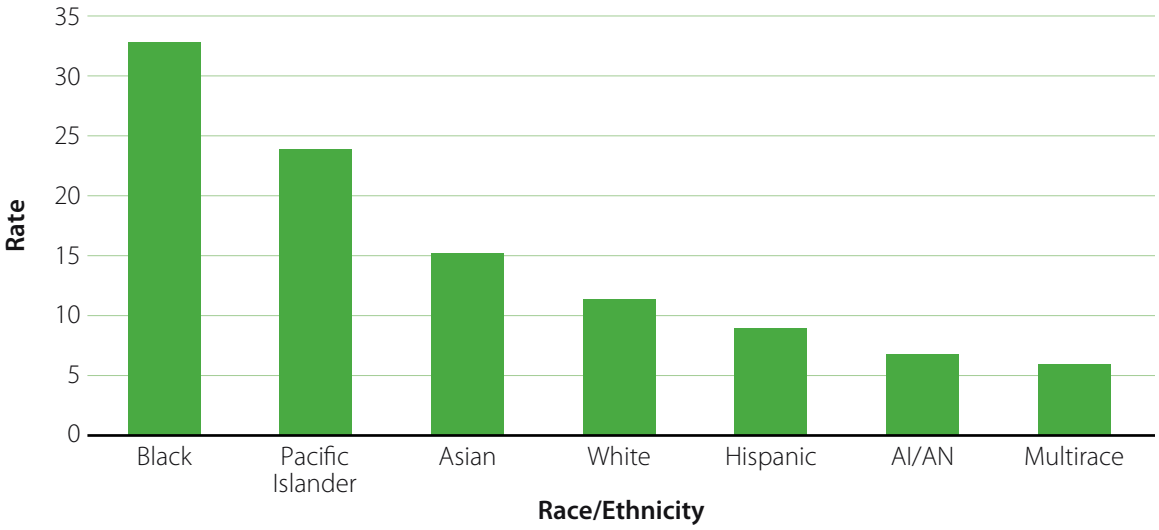


	Hispanic		White		Asian		Black	
Year	N	Age-Adjusted Rate (per 1,000,000)	N	Age-Adjusted Rate (per 1,000,000)	N	Age-Adjusted Rate (per 1,000,000)	N	Age-Adjusted Rate (per 1,000,000)
2000	69	13.6	331	17.3	70	24.3	76	37.1
2001	62	10.7	312	16.0	77	25.5	80	41.5
2002	61	10.4	299	14.9	61	19.0	68	31.5
2003	58	8.1	285	13.9	70	19.9	77	35.4
2004	61	8.1	247	11.8	57	15.5	76	34.1
2005	55	8.3	267	12.9	55	14.8	72	32.4
2006	79	11.4	232	11.0	67	16.5	89	37.9
2007	55	6.9	231	10.9	60	14.3	64	29.0
2008	82	10.7	223	10.3	67	15.5	62	28.9
2009	82	9.4	204	9.7	49	11.1	68	30.6

28 Akinbami, 2011

Age-Adjusted Asthma Deaths per 1,000,000 California Residents by Race/Ethnicity, 2003–2009 Aggregated

There are large disparities in asthma death rates by race/ethnicity, with Blacks having the highest rate — more than two times higher than that for Whites. During this time period, Pacific Islanders also have a high asthma death rate — two times higher than that for Whites and 1.6 times higher than that for Asians. This illustrates that combining Pacific Islanders and Asians into one race/ethnicity group masks important differences. Rates among AI/AN are relatively low during this time period, but there is evidence of significant racial misclassification in this group.

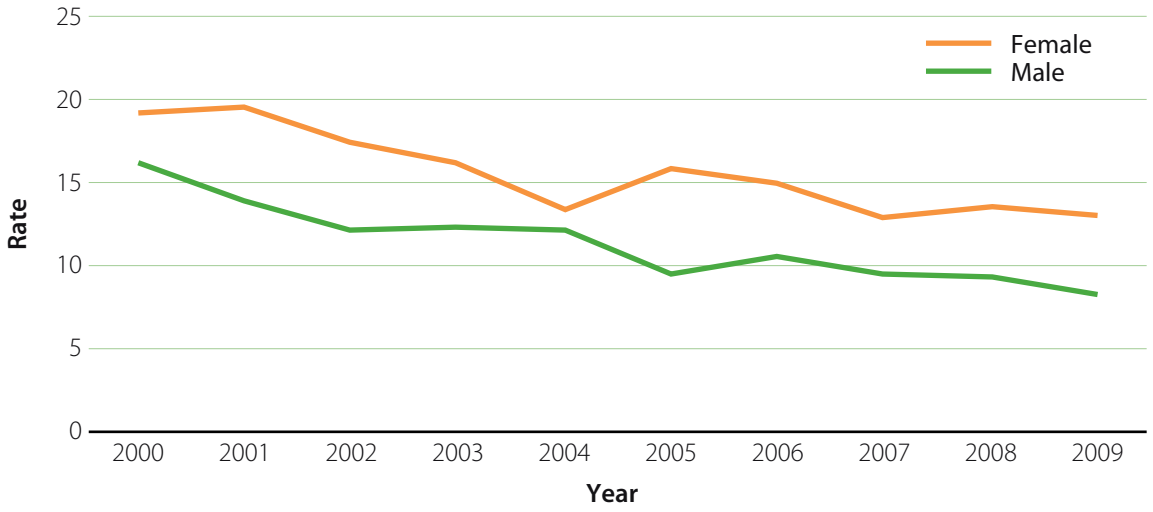


Race/Ethnicity	N	Age-adjusted Rate (per 1,000,000)
Black	508	32.7
Pacific Islander	17	23.9
Asian	425	15.2
White	1,689	11.5
Hispanic	472	9.0
AI/AN	12	6.8
Multirace	26	6.0

Age-Adjusted Asthma Deaths per 1,000,000 California Residents by Sex, 2000–2009

Asthma mortality is consistently about 40% higher among females than males. This disparity is similar to the U.S. overall,[29] and is dependent on age (see next page). For both women and men, the asthma mortality rate decreased by about one per million each year from 2000–2009,* similar to the decrease in California overall.

*Decrease of 0.7 (per million) per year for females and 0.8 (per million) per year for males, p<0.001 for both (simple linear regression)

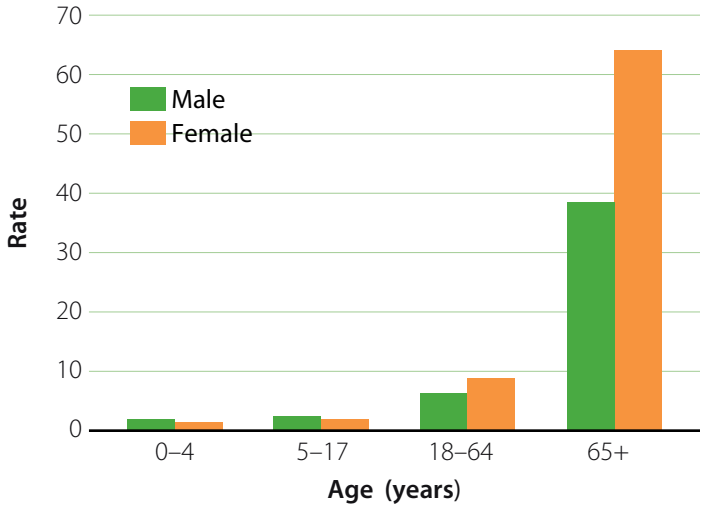


	Male		Female	
Year	N	Age-adjusted Rate (per 1,000,000)	N	Age-adjusted Rate (per 1,000,000)
2000	227	16.2	327	19.2
2001	199	13.9	344	19.5
2002	181	12.1	315	17.4
2003	195	12.4	302	16.1
2004	193	12.2	257	13.5
2005	150	9.5	310	15.8
2006	171	10.5	300	15.0
2007	157	9.5	260	12.9
2008	154	9.3	286	13.6
2009	142	8.2	273	13.1

29 Akinbami, 2011.

Age-Adjusted Asthma Deaths per 1,000,000 California Residents by Age and Sex, 2005–2009 Aggregated

The male/female disparity in asthma mortality varies by age, similar to asthma prevalence and hospitalization/ED visit rates. Females have higher mortality rates than males among adults; however, they have lower mortality rates than males among children.



		Male		Female	
	Age (Years)	N	Age-adjusted Rate (per 1,000,000)	N	Age-adjusted Rate (per 1,000,000)
Children	0–4	15	2.2	9	—
	5–17	45	2.4	33	1.9
Adults	18–64	385	6.3	549	9.0
	65+	329	38.6	838	64.1
Totals	0–17	60	2.4	42	1.7
	18+	714	11.8	1,387	18.3

Healthy People 2010/2020

What is Healthy People 2010/2020?

The United States Department of Health and Human Services developed Healthy People 2010 and 2020 as a set of disease prevention and health promotion objectives to be achieved every 10 years. These objectives are national benchmarks that are used to direct public health efforts and measure progress over time. Healthy People objectives cover a wide range of health topics, including asthma. Both the objectives and the targets have changed over time. The tables in this section compare California data to both Healthy People 2010 (HP2010) and 2020 (HP2020) objectives to assess both whether HP2010 objectives were met and progress toward HP2020 objectives. Only objectives for which we have data available are included, although there are other asthma-related objectives. For more information on the Healthy People initiative, visit www.healthypeople.gov.

How does California compare to the Healthy People 2010/2020 targets?

California has already achieved HP2010 targets for the following measures: asthma hospitalization rates among people ages 0–4 and 5–64; asthma emergency department (ED) visit rate among people ages 5–64; and the percentage of people with current asthma who have received education on how to respond to an asthma episode, and either recognize early signs and symptoms or monitor peak flow results.

For other measures, the rates are on track to achieve the HP2010/2020 targets based on the most current data or rate of decline (in some cases the most current data are from before 2010). These on-track measures include: asthma death rates among people ages 35–64 and 65+; the percentage of people with asthma who miss school or work days due to asthma; and the percentage of people with current asthma who have taken a course or class on how to manage asthma.

However, some California asthma measures need substantial improvement in order to achieve the HP2010/2020 targets. The asthma hospitalization rate for adults age 65+ is close to the HP2020 target, but it has been increasing over the past 10 years and will not achieve the target if those increases continue. Among people ages 0–4 and 65+, the asthma ED visit rates are higher than the HP2010/2020 targets, and recent trend data do not show any significant decrease in these rates. The percentage of people with current asthma who have ever received a written asthma management plan, and the percentage who use a prescription inhaler and have received instruction on how to use it are still slightly below the HP2010/2020 targets. The percentage of people with current asthma who have been advised by a health professional to change their environments is still 10–15 percentage points lower than the HP2010/2020 targets.

Based on comparisons to HP2010/2020 objectives, California should focus asthma efforts on:

- decreasing asthma hospitalizations among older adults (65+);
- decreasing asthma ED visits among young children (0–4) and older adults (65+);
- increasing the number of health providers who advise patients with asthma to make changes to their environments to avoid exposure to irritants or allergens;
- increasing the number of health providers who provide a written asthma management plan; and
- increasing the number of health providers who instruct patients on how to use prescription asthma inhalers properly.

Reduce Asthma Deaths
(HP2010 Objective 24-1, HP2020 Objective RD-1)

Age	California, 2009 (per million)	HP2010 Target (per million)	HP2020 Target (per million)
0–14	1.8	0.9	NA
15–34	4.8	1.9	NA
35–64	9.0	8.0	6.0
65+	48.8	47.0	22.9

Data Source: Office of Health Information and Research, 2009

Reduce Hospitalizations for Asthma
(HP2010 Objective 24-2, HP2020 Objective RD-2)

Age	California, 2010 (per 10,000)	HP2010 Target (per 10,000)	HP2020 Target (per 10,000)
0–4	22.3	25.0	18.1
5–64	6.0	7.7	8.6
65+	20.7	11.0	20.3

Data Source: OSHPD, 2010

Reduce Hospital Emergency Department Visits for Asthma

(HP2010 Objective 24-3, HP2020 Objective RD-3)

Age	California, 2010 (per 10,000)	HP2010 Target (per 10,000)	HP2020 Target (per 10,000)
0–4	109.5	80.0	95.5
5–64	41.7	50.0	49.1
	37.5	15.0	13.2

Data Source: OSHPD, 2010

Reduce the Proportion of Persons with Asthma Who Miss School or Work Days

(HP2020 Objectives RD-5.1 and RD-5.2)

Among people reporting an asthma episode or attack in the past year	California, 2009		HP2010 Target	HP2020 Target
	%	95% CI	%	%
Missed any school days due to asthma in past year, Ages 5–17	48.4	(40.2–56.5)	NA	48.7
Missed any work days due to asthma in past year, Ages 18–64	20.0	(15.1–25.0)	NA	26.8

Data Source: CHIS, 2009

Increase the Proportion of Persons with Current Asthma who Receive Formal Patient Education

(HP2010 Objective 24-6, HP2020 Objective RD-6)

Among people with current asthma	California, 2009		HP2010 Target	HP2020 Target
	%	95% CI	%	%
Have ever taken a formal course or class on how to manage asthma	16.1	(12.2–19.9)	38.0	14.1

Data Source: ACBS, 2006–2008

Increase the Proportion of Persons with Current Asthma who Receive Appropriate Asthma Care According to NAEPP Guidelines

(HP2010 Objective 24-7, HP2020 Objective RD-7)

	California, 2006–2008		HP2010 Target	HP2020 Target
Among people with current asthma	%	95% CI	%	%
Have ever received a written asthma management plan from their health care provider	31.9	(27.4–36.4)	40.0	36.8
Use a prescription asthma inhaler and have received instruction on how to use it properly	95.4	(93.4–97.4)	98.8	NA
Have received education on how to respond to an asthma episode, and either how to recognize early signs and symptoms or how to monitor peak flow results	71.4	(67.4–75.3)	68.0	68.5
Have been advised by a health professional to change their home, school, or work environment to reduce exposure to irritants or allergens	39.5	(35.2–43.8)	50.0	54.5

Data Source: ACBS, 2006–2008

Technical Notes

How to Interpret Confidence Intervals

Percentages estimated from survey data (also called point estimates) have a known margin of error that results from sampling the population since not all households in California are interviewed. For example, from survey data, we estimate that the prevalence of lifetime asthma among adults in California is 13.1%. This is the point estimate — it is our best approximation of the true value for the California population — but it may not be the actual true value simply because not all people were interviewed. In order to express our level of certainty about this point estimate, we calculate a confidence interval. The confidence interval is a range with lower and upper limits that are calculated based on the margin of error of the estimate. The 95% confidence interval (95% CI) means that we are 95% confident that this range contains the true population value because with repeated sampling, 95% of the confidence intervals will contain the true value. In the example of lifetime asthma among adults in California, the 95% CI is 12.4-13.9. So, our best estimate of lifetime asthma prevalence among adults in California is 13.1%, but we are 95% certain that the true value is at least 12.4% and at most 13.9%.

The width of the confidence interval provides useful information about the stability or reliability of the point estimate. A narrower confidence interval means that there is less variability within the sample of people surveyed and/or there is a larger sample size. A wider confidence interval indicates more variability and/or a smaller sample size. In this report, we also use a more precise tool for assessing the reliability of an estimate — the relative standard error (RSE). The RSE tells us how large the margin of error is in relation to the estimate itself. It is calculated by dividing the standard error of the point estimate by the point estimate itself, then multiplying that result by 100. For example, if the estimate of asthma prevalence is 20% and the standard error is 3%, the RSE is (3/20)x100, or 15%. Estimates with large RSEs are considered less reliable than estimates with small RSEs. This report follows guidelines from the National Center for Health Statistics recommending that estimates with RSEs above 30% should be considered unstable. When the RSE of an estimate is 30–50%, we mark these estimates with an asterisk (*) to denote that they are unstable and should be interpreted with careful attention to the confidence intervals. When the RSE of an estimate is greater than 50%, the estimates are too unstable to even present and are marked with a dash (—).

Significance Testing

When confidence intervals from two groups do not overlap, the difference between the two groups is considered to be statistically significant and not likely due to chance. When they do overlap, we cannot conclude that they are significantly

different — further statistical testing is needed to make this determination. In this report, we use chi-square tests to assess whether the differences between groups are statistically significant. The chi-square test is a commonly used statistical tool that produces a p-value. The p-value (e.g., $p<0.01$) is a statement of the probability that the difference observed could have occurred by chance if the groups were really alike. In this report, as is common in epidemiology, a probability of 5% or less is considered sufficiently unlikely to have occurred by chance, and therefore $p<0.05$ is considered 'statistically significant.' Differences that are not statistically significant are not specifically identified in this report.

To test for trends over time, we use simple linear regression. This method fits the best straight line to the data and determines the slope of that line, which in this case is the average change in the estimate per year. This test also produces a p-value for the probability that the non-zero slope could have occurred by chance, and again, we consider $p<0.05$ to be statistically significant. For example, when we apply a simple linear regression to the asthma mortality rate in California from 2000–2009, we estimate that the rate decreased by about 0.7 per year (or 0.7 deaths per million residents per year). The p-value for this trend is less than 0.001, so we consider this decrease statistically significant.

Behavioral Risk Factor Surveillance System

Description

The California Behavioral Risk Factor Surveillance System (BRFSS) is an annual survey that is a collaboration between the California Department of Public Health (CDPH), the Public Health Institute, and the Centers for Disease Control and Prevention (CDC). The BRFSS monitors health-related factors contributing to the leading causes of morbidity and mortality in California's population. The survey is conducted by the Survey Research Group (SRG) of the CDPH Cancer Surveillance Section and has been administered in California since 1984. It is a statewide, random digit dial telephone survey conducted with adults age 18 and over. Data are collected monthly from a random sample of California non-institutionalized adults living in households with landline telephones. Participation in the BRFSS is voluntary and anonymous. The survey is offered in English, Spanish, Mandarin, and Cantonese. The sample size and response rate vary annually (with a trending increase in sample size and decrease in response rate) — in 2010, the sample size was 17,955 adults and the response rate was 41%. BRFSS respondents differ to some extent from the California population by age, sex, and race/ethnicity. As a result, the sample is weighted so that the age, sex, and race/ethnicity composition in the data reflects that of the 2000 California adult population, thereby making the results generalizable to the California adult population. Specific survey questions and other information about BRFSS can be found at www.cdc.gov/brfss or www.surveyresearchgroup.org/.

The BRFSS questionnaire is administered in all states in the U.S., but the survey content differs somewhat among the states – the survey consists of a "core," which is administered in all states, and also of optional modules and state-added questions, which are administered only in some states to address issues of local concern and meet the data needs of specific users. There are two core questions about adult asthma prevalence (lifetime and current). These are: "Have you ever been told by a doctor or other health professional that you had asthma?" and "Do you still have asthma?" Questions about childhood asthma prevalence are part of an optional module administered in California. These questions are: "Has a doctor, nurse or other health professional ever said that the child has asthma?" and "Does the child still have asthma?" To administer this set of questions, one child from each household with children is randomly selected and an adult (usually a parent) responds about the child in question. The California BRFSS survey includes three tracks — some questions (including all core questions) are asked on all three tracks (i.e., to all survey respondents), whereas other questions are asked only on one track (i.e., to approximately one-third of survey respondents).

Limitations

Data are self-reported; respondents may inaccurately recall past events, tell interviewers what they think they want to hear, or be afraid to reveal information that is too personal. The survey response rate, or the percentage of people who participated in the survey, was rather low in 2010 at 41%. Also, the BRFSS excludes households without landline phones, people living in institutionalized settings (e.g., college dorms and nursing homes), and people who speak languages other than those offered. Due to these factors, there is the possibility of bias if the people who answered the survey are different from those who refused and/or those who were not reached. Because survey results have a degree of uncertainty, estimates are shown along with confidence intervals (explained earlier in this appendix). Sample size constraints limit the amount of analysis that can be done by geographic and demographic subgroups. A comparison of asthma prevalence from BRFSS and the California Health Interview Survey (CHIS) is included in the CHIS section of these Technical Notes.

Adult and Child BRFSS Asthma Call-Back Surveys

Description

The Child and Adult BRFSS Asthma Call-Back Surveys (ACBS) are follow-up telephone surveys to the BRFSS. These two surveys have been administered by SRG in California since 2006 and also represent a collaboration between CDPH, the Public Health Institute and CDC. The ACBS allows states to examine socioeconomic, environmental and behavioral associations with asthma prevalence and control and to better understand the health care experiences of persons with asthma. All adult BRFSS respondents reporting lifetime asthma are asked to par-

ticipate in the Adult ACBS, and those who consent are called back within approximately two weeks and asked a wide range of additional questions pertaining to asthma. For children, the same protocol is employed, with a parent or legal guardian responding about the child in question. The sample sizes and response rates of the ACBS vary by year, though response rates tend to decrease over time. The chart below outlines the sample sizes and response rates of the Child and Adult ACBS by year:

	2006	2007	2008	2009
Adult ACBS				
Sample size	353	286	600	707
Response rate	53.7%	51.4%	41.1%	40.2%
Child ACBS				
Sample size	92	80	73	NA*
Response rate	51.4%	47.9%	36.0%	

*The 2009 Child ACBS was improperly administered and the data are not usable.

ACBS topics include age of diagnosis, recent history of asthma symptoms, effects of asthma on normal activities, health care utilization and costs, medication use, knowledge of asthma self-management practices, home environmental asthma triggers, work-related asthma, co-morbid conditions, and complementary and alternative therapies. Because the ACBS can be linked to the BRFSS, all topics included in the BRFSS can also be examined for ACBS respondents.

Because of differences in who agrees to participate in the follow-up survey, ACBS respondents differ by age, sex, and race/ethnicity to some extent from the California BRFSS lifetime asthma respondents. Weighting of the ACBS builds off the weighting previously described for the BRFSS. The ACBS records are weighted so that the age, sex, and race/ethnicity composition in the data set reflects that of the California adult and child population with lifetime asthma, making the results generalizable to the California population with asthma. More information about the ACBS can be found at www.cdc.gov/brfss/acbs/index.htm or by emailing asthmacallbackinfo@cdc.gov.

Years of Data Analyzed — Child vs. Adult

Adult and child ACBS data were analyzed separately in this report, primarily because data from comparable time periods were not available for these two groups. The annual sample size of the Child ACBS is very small, with fewer than 100 survey respondents per year. This limitation requires that multiple years (ideally three or more) of Child ACBS data be aggregated in order for most analyses to generate stable estimates. Unfortunately, due to an error in the 2009 Child ACBS administration, 2009 child data are not usable. Therefore, the most recent

three-year time period available for analysis of Child ACBS data is 2006–2008, and this is what is presented throughout the report. On the other hand, the annual sample size of the Adult ACBS is much larger — in 2006 and 2007, it was about 300, and it doubled to approximately 650 in 2008 and 2009. Therefore, Adult ACBS data are presented in this report either from 2009 only or from 2006–2009 aggregated when larger sample sizes were needed.

Level of Asthma Control

The National Heart, Lung, and Blood Institute's *Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma*, defines asthma control as the degree to which the manifestations of asthma are minimized by the appropriate management and treatment of asthma.[30] The EPR-3 guidelines define a patient's asthma control level based on several elements including symptom frequency, nighttime awakenings, and short-acting beta agonist (SABA) medication use. (SABAs are typically used as rescue medications to provide quick relief of asthma symptoms.) Patients are classified as well controlled, not well controlled, or very poorly controlled based on the element with the most severe level of impairment.

Because the ACBS includes questions on asthma symptoms, nighttime awakenings, and medication use, survey respondents can be classified into similar levels of control. However, the time periods used to describe the frequencies of symptoms and medication use differ in the EPR-3 guidelines and the ACBS survey questions. For example, EPR-3 defines nighttime awakenings as the number of times per week or month, whereas the ACBS asks about the number of times in the last 30 days. A workgroup of asthma epidemiologists from the CDC and state asthma programs convened to work through these discrepancies and develop an algorithm that would most closely classify ACBS survey respondents into appropriate categories of asthma control. In order to do this, two main assumptions were made: (1) that each month is 30 days, and (2) that events occurring over a 30 day period are evenly spread out over that time period. With these assumptions, the cut-points from the ACBS used to determine survey respondents' level of asthma control can be seen in the chart on the following page:

30 NHLBI, 2007.

Classification of Impaired Asthma Control using Three Elements from the Asthma Call-Back Survey

	Age Group	Well Controlled	Not Well Controlled	Very Poorly Controlled
Symptoms*	All ages	≤8 days in past 30 days	>8 days in past 30 days but not throughout the day	Every day in the past 30 days and throughout the day
Nighttime Awakenings†	0–4	≤1 time in past 30 days	≥2 and ≤4 times in the past 30 days	≥5 times in the past 30 days
	5–11	≤1 time in past 30 days	≥2 and ≤8 times in the past 30 days	≥9 times in the past 30 days
	12+	≤2 times in past 30 days	≥3 and ≤12 times in the past 30 days	≥13 times in the past 30 days
SABA Medication Use‡	All ages	≤0.29 uses per day	>0.29 and <2.00 uses per day	≥2.00 uses per day

* Symptom frequency was determined using the following two questions: (1) "During the past 30 days, on how many days did you have any symptoms of asthma?" and (2) if 30 days, "Do you have symptoms all the time? 'All the time' means symptoms that continue throughout the day. It does not mean symptoms for a little while each day."

† Nighttime awakening frequency was determined using the question: "During the past 30 days, on how many days did symptoms of asthma make it difficult for you to stay asleep?"

‡ Frequency of Short-Acting Beta Agonist (SABA) medication use was determined as follows: for each inhaled (not nebulized) SABA medication taken in the past 3 months, the number of uses per day or week was converted to a number of uses per day and summed across all SABA medications taken (though any SABA medication used only for treatment before exercise was excluded, as per EPR-3 guidelines).

Limitations

All limitations of the BRFSS described above also apply to the ACBS. In addition, low response rates introduce the possibility that those BRFSS respondents who go on to participate in the ACBS may differ systematically from non-participants with respect to demographic characteristics and asthma experiences. Another important limitation of the ACBS is the small annual sample size. While stable estimates can be generated on a variety of measures for the population as a whole, stratified analyses of these data require multiple years of ACBS data to be combined in order to produce stable estimates. Finally, only a limited number of ACBS questions have been validated. Because survey results have a degree of uncertainty, estimates are shown along with confidence intervals (explained earlier in this appendix). Sample size constraints limit the amount of analysis that can be done by geographic and demographic subgroups.

California Health Interview Survey

Description

The California Health Interview Survey (CHIS) is a population-based telephone survey of California's non-institutionalized population conducted every other year since 2001. CHIS is the largest health survey conducted in any state and one of the largest health surveys in the nation. CHIS is conducted by the UCLA Center for Health Policy Research (UCLA-CHPR) in collaboration with CDPH, the California Department of Health Care Services, California Department of Mental Health, First 5 California, The California Endowment, the National Cancer Institute, and Kaiser Permanente. CHIS collects extensive information for all age groups on health status, health conditions, health-related behaviors, health insurance coverage, access to health care services, and other health and health-related issues. Adults (18+) and adolescents (12–17) are interviewed directly; for children (<12), the adult most knowledgeable about the child's health is interviewed as a proxy. The CHIS includes a variety of questions related to asthma. Those used to estimate asthma prevalence are: "Has a doctor ever told you (or your parent) that you have asthma?"; "Has a doctor ever told you that (CHILD) has asthma?"; "Do you still have asthma?/Does {he/she} still have asthma?"; and "During the past 12 months, have you (or has {he/she}) had an episode of asthma or an asthma attack?" The 2009 CHIS sampled landline and cellphone numbers. It is administered in five languages: English, Spanish, Chinese (Mandarin and Cantonese dialects), Vietnamese, and Korean. CHIS data are weighted to reflect the non-institutionalized population of California. The sample is designed to provide estimates for California's overall population, large and medium-sized counties, and groups of the smallest counties, as well as many major racial and ethnic groups and several ethnic subgroups. The sample size and response rate vary annually — in 2009, the sample sizes were 47,600 adults, 3,400 adolescents and 9,000 children. In 2009, the landline sample household response rate was 19.7%, and the cellphone sample response rate was 11.1%. More information about CHIS can be found at www.chis.ucla.edu.

Limitations

Data are self-reported; respondents may inaccurately recall past events, tell interviewers what they think they want to hear, or be afraid to reveal information that is too personal. The survey response rate was rather low at 19.7% and 11.1% for landline and cellphone surveys, respectively. Telephone surveys exclude households without phones, people living in institutionalized settings (e.g., college dorms and nursing homes), and people who speak languages other than those offered. Due to these factors, there is the possibility of bias if the people who answered the survey are different from those who refused and/or those who were not reached. Because survey results have a degree of uncertainty, estimates are shown along with confidence intervals (explained earlier in this appendix).

Overall estimates of asthma prevalence from CHIS and BRFSS are generally very similar. In most years, they differ by about one percentage point and the confidence intervals are highly overlapping. However, these estimates do differ, and this is due to a variety of factors including differing samples, designs, methodology, etc. In addition, the survey questions are slightly different.

Asthma Emergency Department Visits and Hospitalizations

Description

Data on asthma emergency department (ED) visits and hospitalizations (i.e., patient discharges) are obtained from the California Office of Statewide Health Planning and Development (OSHPD). All non-federal hospitals in California are required to submit ED and patient discharge data (PDD) on a quarterly basis to OSHPD. These records are compiled into databases that are estimated to include 98% of all ED visits and patient discharges in California (federal facilities are excluded). The 2010 ED database contains approximately 9.7 million ED visit records. The 2010 PDD database contains approximately 4 million inpatient hospitalization records. The ED and PDD databases include the following variables used in this report: ICD9-CM codes for principal diagnosis, expected source of payment, date of service/discharge, and demographic data such as age, sex, and race/ethnicity. The PDD database also includes the length of stay and total charges. More information on OSHPD data can be found at www.oshpd.ca.gov.

Data Specifications

Asthma ED visits and hospitalizations are identified where the primary diagnosis is listed using ICD9-CM code 493. Counts are based on the number of visits, not the number of unique individuals. Non-California residents are excluded. ED visit counts and rates include ED visits that resulted in an admission to the hospital. Transfers from one hospital to another appear as two separate visits. Rates are calculated using yearly population estimates as the denominator, as provided by the California Department of Finance. Where noted, rates are age-adjusted using the direct method to the 2000 U.S. population, using 23 age categories: <2, 2–4, 5, 6–8, 9, 10–11, 12–14, 15–17, 18–19, 20–84 in 5-year age groups, and 85 and over. For rates by income, where zip code data are used, rates are age-adjusted using 19 age categories: <5, 5–9, 10–14, 15–17, 18–19, 20–84 in 5-year age groups, and 85 and over. Rates based on small numbers are very unstable; therefore, any rate based on fewer than 12 events is omitted from tables and figures. Please note that data on asthma ED visits are calculated differently from the previous version of this report (June 2007), so the rates cannot be directly compared between the two reports.

Data on household income are not available for each ED and hospitalization record. To approximate income, each record is assigned the median household income of its associated zip code. Zip code income data come from estimates in

the 2009 ESRI Demographic Update. The numerator for rates by income is the number of asthma visits with each assigned income level, and the denominator is the total population with that same income level. These population denominators also come from 2009 ESRI Demographic Update estimates.

Expected source of payment is the source from which the facility expects to receive payment for charges incurred from the visit. For this report, sources of payment were grouped as follows:

Medicare = Medicare Part A or Part B, including Medicare HMO

Medi-Cal = Medi-Cal, including Medi-Cal Managed Care

Private insurance = All private coverage, including Blue Cross/Blue Shield and other commercial insurance companies, HMO, PPO, POS, EPO, and automobile medical

Self-Pay = Self-Pay

Workers' Compensation = Workers' Compensation Health Claim

Other = County indigent programs, CHAMPUS, Veterans Affairs Plan, disability, Title V, other federal/government programs, other non-federal programs, and all other/invalid/unknown/blank responses

Charges include all charges for services rendered during the length of stay for patient care at the facility, based on the hospital's full established rates (before contractual adjustments). Hospital-based physician fees are excluded. Prepayments are not deducted. Average charges only approximate the average cost associated with each hospitalization-they are not necessarily equivalent to the payment received by the hospital or the total costs incurred. It is important to note for average charge estimates that not all hospitals report charges to OSHPD. Kaiser Foundation and Shriner's Hospitals are exempt from reporting charges. The Consumer Price Index from the U.S. Bureau of Labor Statistics (www.bls.gov/cpi) was used to adjust hospitalization charges for inflation.

Repeat Hospitalizations

A hospitalization is considered a repeat hospitalization when an individual patient has more than one hospitalization for asthma within a certain time period; in this analysis, repeat hospitalizations were counted over one-year (2010), two-year (2009–2010), and three-year (2008–2010) time periods. Hospitalization records were identified as belonging to the same individual using probabilistic matching software (Link Plus 3.0, CDC) and three matching variables: sex, date of birth, and social security number. In cases where these variables were closely, but not exactly matched, a set of defined rules was used to identify matches (based on input from experts in record matching). By definition, repeat hospitalizations occur at different times; accordingly, the age of an individual often changes over multiple hospitalizations. To present repeat hospitalization data by age group, each individual was assigned the age at their first hospitalization during the time period. The age at the earliest hos-

pitalization was chosen because an intervention to prevent repeat hospitalizations should ideally be done as early as possible. Other rules were developed for reconciling discrepancies in race/ethnicity data. Please contact California Breathing for more information on any of these rules or the matching criteria.

Limitations

Federal hospitals are not included. Race/ethnicity data have not been validated. Records are visit-based, not person-based and require a "de-duplication" process to generate person-based counts and rates. Hospitalization data are abstracted from health care provider notes for billing purposes; therefore there is the potential for incorrect diagnoses and inconsistent coding. Charge data are not provided for inpatient visits at Kaiser and Shriner hospitals, which together comprised 12.4% of asthma hospitalizations in 2010.

Workers' Compensation Information System (WCIS)

Description

The WCIS collects First Reports of Occupational Injury or Illness, Subsequent Reports of Occupational Injury or Illness, and Medical Bill Payment Reports for all sick or injured workers statewide. Data are collected continually by the WCIS for administrative purposes. Computerized records are submitted by workers' compensation insurers or third party administrators, so the WCIS has 100% coverage of submitted workers' compensation claims. An estimated 750,000 workers' compensation claims are entered into the WCIS annually. Variables useful for identifying cases of work-related asthma (WRA) for surveillance purposes include a 150-character memo field for accident description; codes for nature of injury, cause of injury, and body part; and ICD9-CM codes. In 2008, 428 previously unidentified potential cases of WRA were identified using an algorithm involving the above variables, and 395 (92%) were confirmed using telephone interviews or medical record review. These data are analyzed by the Occupational Health Branch of CDPH to estimate the burden of WRA in the state.

Limitations

Work-related illnesses and injuries are under-diagnosed and under-reported, making it likely that WCIS data provide an underestimate of the true number of WRA cases. The WCIS dataset is complicated to access and is very incomplete for some variables. There are no codes specific to asthma other than the ICD9-CM code, which is only available for about 25% of the records, depending on the year. This should improve in subsequent years as medical data become more complete.

Doctor's First Report of Occupational Injury and Illness (DFRs)

Description

For any treated injury or illness that is suspected to be work-related, every health care provider in California is required to complete a DFR and submit it to the workers' compensation insurer of the patient's employer, or to the employer if the patient is self-insured. The submission of the DFR within five days of treatment is tied to compensation of the health care provider, so theoretically the coverage of California workers who see a health care provider for a work-related condition should be 100%. The DFR is then submitted by the insurer/employer to the California Department of Industrial Relations (DIR). Approximately 850,000 DFRs are filed annually with DIR. DFRs are paper forms that include demographics of the patient; the patient's occupation and industry; the patient's description of the incident; and the health care provider's subjective and objective findings, diagnosis, and treatment. The forms are completed either by hand or computer and tend to include detail about exposures in the workplace. DFRs are reviewed by the Occupational Health Branch at CDPH and are selected if they meet case ascertainment criteria for work-related asthma (i.e., they document symptoms consistent with asthma and an association between these symptoms and work). Approximately 120–320 potential WRA cases per year are identified through DFRs, over 80% of which are confirmed through telephone interviews or medical record review.

Limitations

The use of DFRs is very labor-intensive, as all collected paper DFRs (~850,000) must be manually reviewed in order to identify ~250 WRA cases each year. They are likely not representative of all injured or ill workers, as many workers may not seek medical care or acknowledge that their condition is work-related for fear of reprisal in the workplace. Also, an evaluation of DFRs demonstrated that only about 1/3 submitted by a major HMO to insurers were ever received by DIR.

Medi-Cal Data

HEDIS

Use of Appropriate Medications for People with Asthma Data are from the California Department of Health Care Services (DHCS) Medi-Cal Managed Care Division (MMCD) Performance Measurement (HEDIS) Reports, available at www.dhcs.ca.gov/dataandstats/reports/Pages/MMCDQualPerfMsrRpts.aspx. In 2011, DHCS held contracts with 20 full-scope health plans, three specialty plans, and one pre-paid health plan to provide health care services to approximately 4.1 million members enrolled in the Medi-Cal Managed Care (MCMC) Program. According to federal requirements, states must measure and report on performance to assess the quality and appropriateness of care and services provided to these members. The DHCS designates performance measures on an annual basis and requires plans to report on them. The DHCS bases all selected performance measures on the Health-

care Effectiveness Data and Information Set (HEDIS) developed by the National Committee for Quality Assurance (NCQA). One of the HEDIS measures is Use of Appropriate Medications for People with Asthma. DHCS reported on this measure from 2001 to 2009. This report includes data from 2006–2009; the previous version of this report (June 2007) included 2001–2005. Members included in this measure are between the ages of 5 and 56, must have at least a two-year continuous enrollment, and are identified as having persistent asthma. The definition of persistent asthma is an approximation based on the patient's previous year's service and medication utilization rather than a clinical measure of severity.

Asthma Hospitalizations and Emergency Department Visits among Medi-Cal Beneficiaries

Medi-Cal hospitalization and emergency department (ED) data are from the MMCD's Management Information System/Decision Support System (MIS/DSS), which is the DHCS relational database where files are merged from the following sources: services billed to and paid by the Medi-Cal Fee-For-Service (FFS) program, encounter data reported by Medi-Cal Managed Care Plans, and eligibility as it appears on the Medi-Cal Eligibility Data System (MEDS). The database contains detailed records of health encounters for Medi-Cal enrollees in the state. In fiscal year 2009-2010, there were approximately 8.9 million Medi-Cal beneficiaries enrolled for at least one month. Enrollment fluctuates month-to-month, with an average of about seven million per month. The Medi-Cal encounters database includes: 1) monthly eligibility records for each enrollee, including demographics and codes for why each person is eligible; 2) claims records for each single health care and pharmacy encounter, including various details such as dates, locations, diagnostic codes, provider information, etc. Data in this report were accessed through a secure web-based data query system that uses Business Objects Intelligence software to mine MIS/DSS data. Data are updated monthly, with a typical three-month lag.

Asthma ED visits and hospitalizations are identified where the primary diagnosis is listed as ICD9-CM code 493. The numerator for hospitalization and ED rates is the number of asthma-related ED visits or hospitalizations among Medi-Cal beneficiaries who were continuously enrolled for the 12 months of calendar year 2010. Dual eligibles and those who have not met share of cost are excluded. These counts are the number of ED visits or hospitalizations, not the number of unique beneficiaries. The denominator for the rates is the number of unique beneficiaries who were continuously enrolled for the 12 months of calendar year 2010. Where noted, rates are age-adjusted using the direct method to the 2000 U.S. population, using 11 age categories: 0–4, 5, 6–8, 9–11, 12–14, 15–17, 18–19, 20–44, 45–54, 55–64, and 65+. The subgroups used for age-adjustment are not identical to those used in other chapters of this report, so rates are not directly comparable. Please note that data on Medi-Cal ED visits and hospitalizations are calculated differently from those in the previous version of this report (June 2007), so the rates also cannot be directly compared between the two reports.

Asthma Mortality Data

Description

Data for asthma deaths are obtained from the Death Statistical Master File (DSMF), collected by the Office of Health Information and Research at CDPH. The DSMF data file contains data from all the death certificates registered in California and data from all death certificates for California residents who died out-of-state. Coverage is theoretically 100%. The 2009 DSMF contains 234,620 death records. All deaths after 1999 have been assigned ICD10 codes to reflect the Underlying Cause of Death (including asthma: ICD10 = J45 or J46). Also included are a variety of demographic variables of interest, such as sex, age, and race/ethnicity.

Data Specifications

Rates were calculated using the number of deaths due to asthma in the numerator and yearly population estimates in the denominator, as provided by the California Department of Finance. Non-California residents are excluded. Where noted, rates are age-adjusted using the direct method to the 2000 U.S. population, using 23 age categories: <2, 2–4, 5, 6–8, 9, 10–11, 12–14, 15–17, 18–19, 20–84 in 5-year age groups, and 85 and over. The years of potential life lost (YPLL) index estimates the total years of life lost among decedents who did not reach a particular age cutoff. YPLLs were calculated for California using the cutoff of age 75. The age at death of each individual was subtracted from 75 and the sum of those numbers is the YPLL for the year or combined time period. Individuals over the age of 75 were not included in the calculation.

Limitations

Because of changes in ICD death coding in 1999, caution must be taken when assessing asthma mortality trends across 1999. There is potential for incorrect coding on the death certificate for cause of death and other demographic variables that could lead to inaccurate counts of deaths overall and by demographic group.

Acronyms

A/PI	Asian/Pacific Islander
AAQS	Ambient Air Quality Standards
ACBS	Asthma Call-Back Survey
ACIP	Advisory Committee on Immunization Practices
ADAM	Aerometric Data Analysis & Management
AI/AN	American Indian/Alaska Native
ALOS	Average length of stay
BMI	Body Mass Index
BRFSS	Behavioral Risk Factor Surveillance System
CARB	California Air Resources Board
CDC	Centers for Disease Control and Prevention
CDHCS	California Department of Health Care Services
CDPH	California Department of Public Health
CHHC	California Healthy Housing Coalition
CHIS	California Health Interview Survey
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
DEODC	Division of Environmental and Occupational Disease Control
ED	Emergency department
HEDIS	Healthcare Effectiveness Data and Information Set
HP2010/2020	Healthy People 2010/2020
IAQ	Indoor air quality
ICS	Inhaled corticosteroids
MCMC	Medi-Cal Managed Care
N	Number
NAAQS	National Ambient Air Quality Standards
NAEPP	National Asthma Education and Prevention Program
NCQA	National Committee for Quality Assurance
NIOSH	National Institute for Occupational Safety and Health
OSHPD	Office of Statewide Health Planning and Development

PM	Particulate matter
PPM	Parts per million
SHS	Secondhand smoke
SPAC	Strategic Plan for Asthma in California
WRA	Work-related asthma
WRAPP	Work-Related Asthma Prevention Program
YPLL	Years of potential life lost
µg/m^3	Micrograms per cubic meter

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