

## 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).<sup>20</sup> The most important element of treat-

<sup>20</sup> 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.

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.<sup>21</sup> California data show that among adults who report WRA, only about a quarter (28%) ever discussed work-relatedness with their doctor.

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.

### Who gets work-related asthma in California?

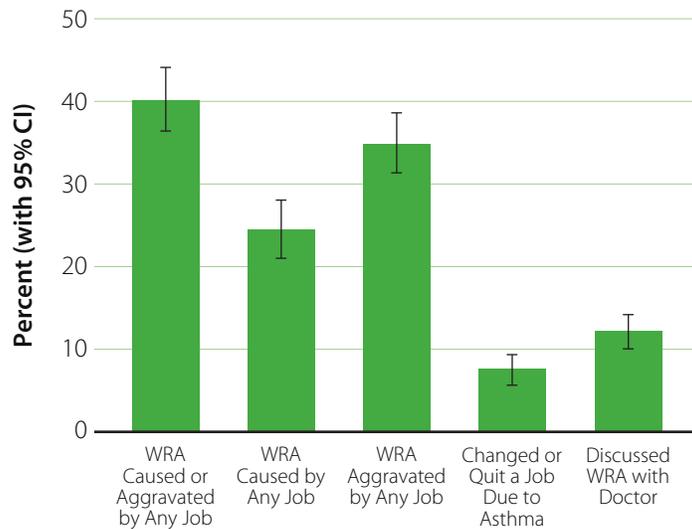
People from all over California in a wide range of industries and occupations have WRA. Case-based surveillance shows that more women than men report WRA (63% vs 37%), and more workers report new-onset WRA compared to work-aggravated asthma. Some industries with the highest rates of WRA include local 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.



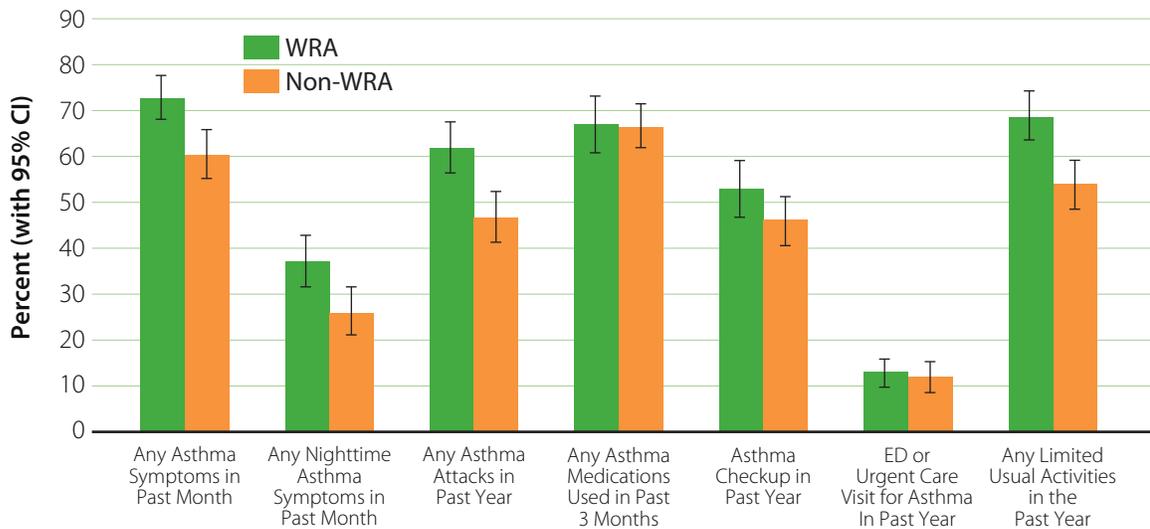
|  | %    | 95% CI      |
|--|------|-------------|
| <b>WRA caused or aggravated by any job</b> | 40.3 | (36.4–44.2) |
| <b>WRA caused by any job</b>               | 24.6 | (21.0–28.2) |
| <b>WRA aggravated by any job</b>           | 35.0 | (31.5–38.6) |
| <b>Changed or quit a job due to asthma</b> | 7.6  | (5.7–9.5)   |
| <b>Discussed WRA with doctor</b>           | 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

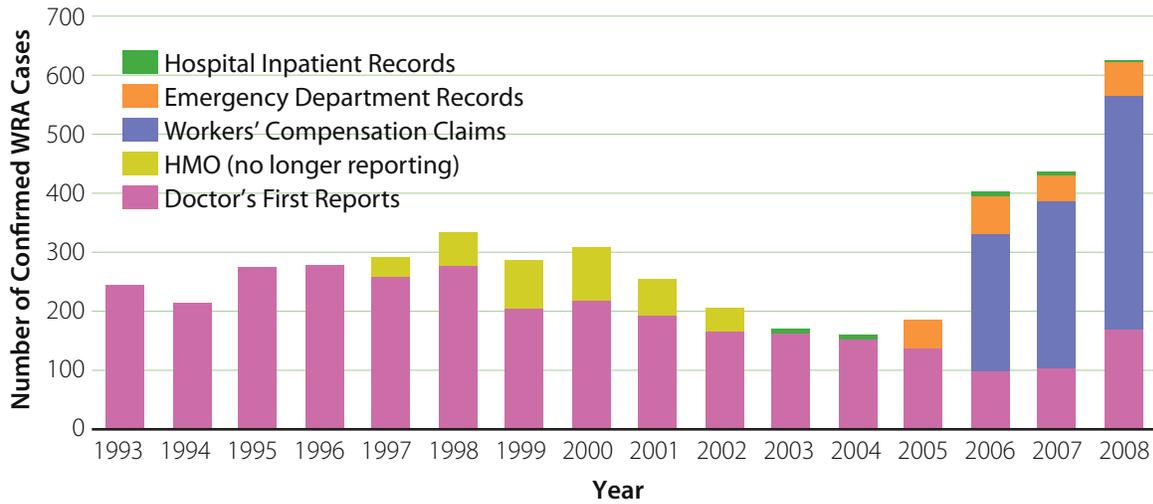


|  | Adults with WRA |             | Adults with Non-WRA |             |
|--|-----------------|-------------|---------------------|-------------|
|  | %               | (95% CI)    | %                   | (95% CI)    |
| <b>Any Asthma Symptoms in Past Month</b>               | 72.9            | (68.0–77.8)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

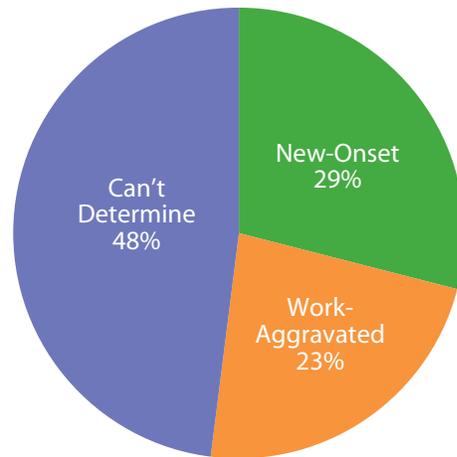
Case-based surveillance has been expanded in recent years to include multiple sources of data. As a result, the number of cases identified per year quadrupled between 2004 and 2008, the most recent complete year of data available.



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

**Classification of Confirmed WRA Cases, California 1993–2008**

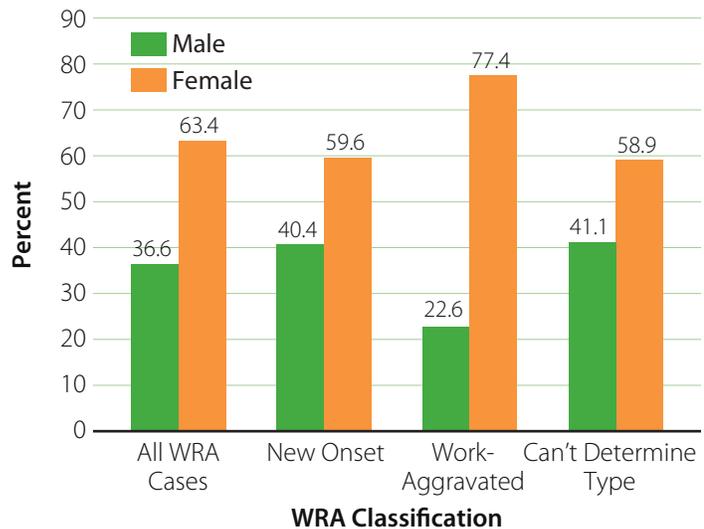
Because many workers identified through case-based surveillance cannot be reached for interview, a large proportion of cases are confirmed, but the subtype of WRA they have cannot be distinguished. Of the WRA cases that can be classified, the majority are new-onset asthma, as opposed to existing asthma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

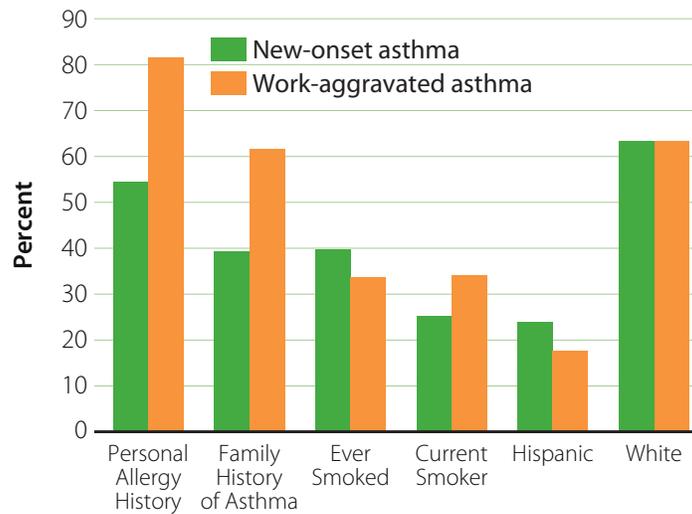


Data Source: California WRAPP Surveillance Data, 1993–2008 (N=4,677)

### 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  $p < 0.0001$

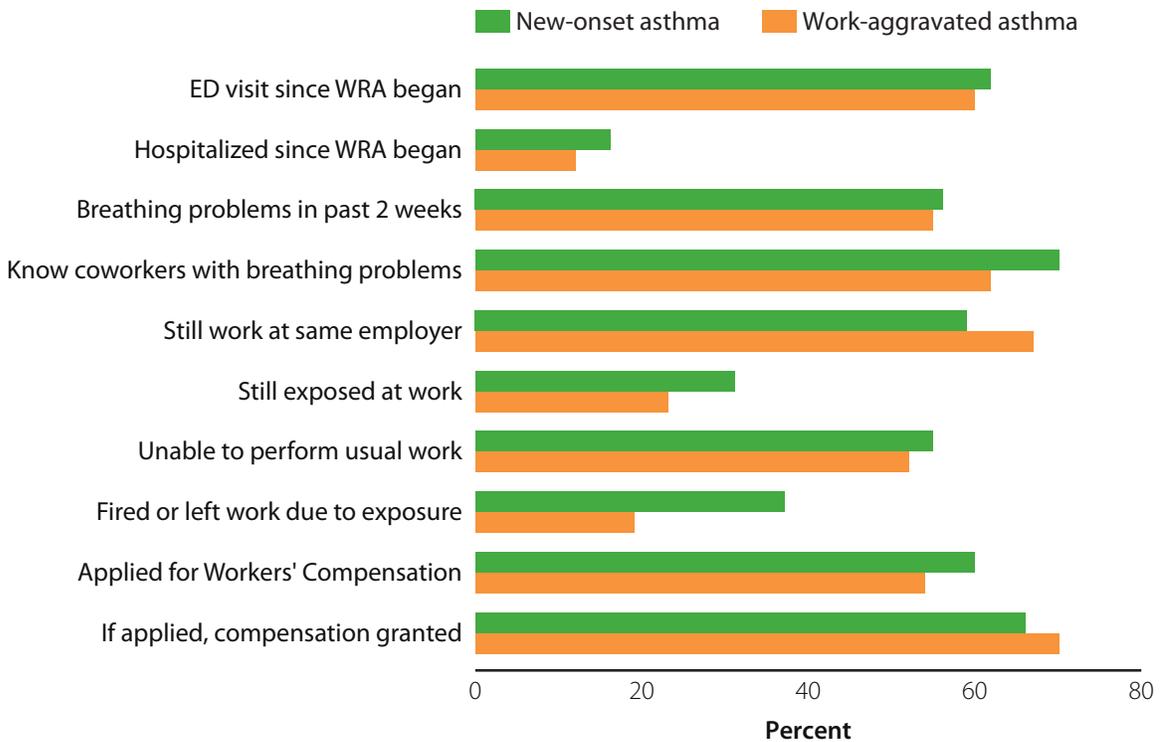


|                                   | New-Onset Asthma | Work-Aggravated Asthma | All WRA Cases |
|-----------------------------------|------------------|------------------------|---------------|
| <b>Personal Allergy History</b>   | 54%              | 82%                    | 62%           |
| <b>Family History of Asthma</b>   | 39%              | 62%                    | 46%           |
| <b>Ever Smoked</b>                | 40%              | 34%                    | 37%           |
| <b>Current Smoker</b>             | 25%              | 34%                    | 29%           |
| <b>Hispanic</b>                   | 24%              | 18%                    | 21%           |
| <b>Race</b>                       |                  |                        |               |
| 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%           |
| <b>Average Years of Education</b> | 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<br>Asthma<br>% (Median) | Work-<br>Aggravated<br>Asthma<br>% (Median) | All WRA<br>Cases<br>%<br>(Median) |
|---|-----------------------------------|---|-----------------------------------|
| <b>ED visit since WRA began</b>                           | 62%                               | 60%   | 61%                               |
| <b>Median number of times in ED</b>                       | (2)                               | (1)   | (2)                               |
| <b>Hospitalized since WRA began</b>                       | 16%                               | 12%   | 14%                               |
| <b>Breathing problems in past 2 weeks</b>                 | 56%                               | 55%   | 56%                               |
| <b>Know coworkers with breathing problems</b>             | 70%                               | 62%   | 66%                               |
| <b>Median number of coworkers with breathing problems</b> | (2)                               | (2)   | (2)                               |
| <b>Still work at same employer</b>                        | 59%                               | 67%   | 62%                               |
| <b>Still exposed at work</b>                              | 31%                               | 23%   | 26%                               |
| <b>Unable to perform usual work</b>                       | 55%                               | 52%   | 56%                               |
| <b>Fired or left work due to exposure</b>                 | 37%                               | 19%   | 29%                               |
| <b>Applied for Workers' Compensation</b>                  | 60%                               | 54%   | 57%                               |
| <b>If applied, compensation granted</b>                   | 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**

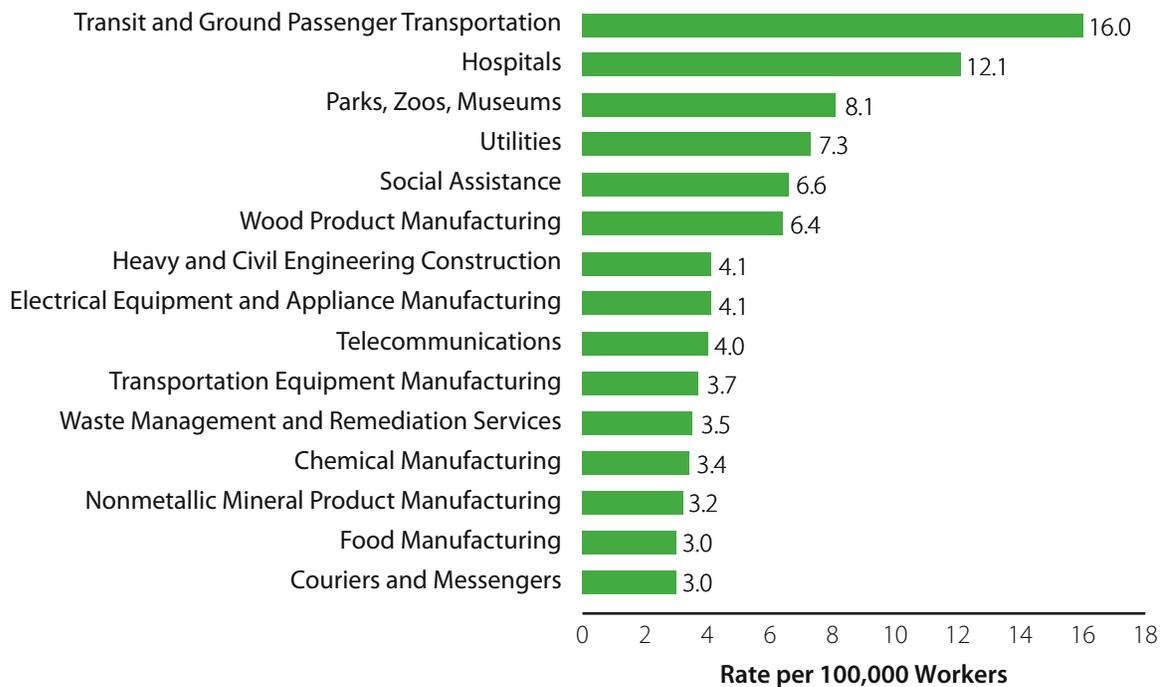
| <b>Asthmagen Exposure</b>            | <b>N</b> | <b>%</b> |
|--------------------------------------|----------|----------|
| <b>Bleach</b>                        | 77       | 1.6      |
| <b>Chlorine</b>                      | 59       | 1.3      |
| <b>Latex</b>                         | 50       | 1.1      |
| <b>Ammonia</b>                       | 43       | 0.9      |
| <b>Formaldehyde</b>                  | 37       | 0.8      |
| <b>Glutaraldehyde</b>                | 28       | 0.6      |
| <b>Sulfuric Acid</b>                 | 27       | 0.6      |
| <b>Diisocyanates</b>                 | 23       | 0.5      |
| <b>Rat Antigens</b>                  | 22       | 0.5      |
| <b>Epoxies</b>                       | 19       | 0.4      |
| <b>California Redwood Dust</b>       | 17       | 0.4      |
| <b>Quaternary Ammonium Compounds</b> | 16       | 0.3      |
| <b>X-ray Chemicals</b>               | 13       | 0.3      |
| <b>Flour</b>                         | 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](http://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<br>in Industry<br>(%) | People in<br>CA Working<br>in Industry<br>(%) | WRA Rate<br>per<br>100,00<br>Workers |
|---|---------------------------------|---|--------------------------------------|
| <b>Agriculture</b>                                      | 3.0                             | 2.7   | 2.3                                  |
| <b>Utilities</b>  | 1.4                             | 0.4   | 7.3                                  |
| <b>Construction</b>                                     | 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                                  |
| <b>Manufacturing</b>                                    | 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                                  |
| <b>Retail</b>   | 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                                  |
| <b>Transportation and Warehousing</b>                   | 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                                  |
| <b>Information</b>                                      | 2.5                             | 3.3   | 1.6                                  |
| Telecommunications                                      | 1.7                             | 0.9   | 4.0                                  |
| <b>Finance and Insurance</b>                            | 2.2                             | 3.9   | 1.1                                  |
| <b>Professional, Scientific, and Technical Services</b> | 2.3                             | 6.1   | 0.8                                  |
| <b>Administrative, Support, and Waste Services</b>      | 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                                  |
| <b>Educational Services</b>                             | 10.3                            | 9.2   | 2.3                                  |
| <b>Health Care and Social Assistance</b>                | 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                                  |
| <b>Arts, Entertainment, and Recreation</b>              | 2.0                             | 1.5   | 2.7                                  |
| Parks, Zoos, and Museums                                | 0.3                             | 0.1   | 8.1                                  |
| <b>Accommodation and Food Services</b>                  | 2.5                             | 7.9   | 0.6                                  |
| <b>Public Administration</b>                            | 14.6                            | 8.6   | 3.5                                  |
| <b>ALL INDUSTRIES</b>                                   |                                 |   | <b>2.0</b>                           |

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

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