

Valley Fever

2013 Annual Report



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Office of Infectious Disease Services
Bureau of Epidemiology and Disease Control
Arizona Department of Health Services



Table of Contents

List of Figures and Tables	3
Executive Summary.....	4
Introduction	5
Epidemiology in Arizona.....	7
Reporting Sources and Changes in Laboratory Reporting Practices.....	10
Geographic Distribution.....	11
Mortality.....	13
Demographics	13
Seasonality	15
Hospitalizations.....	16

List of Figures and Tables

[Figure 1. Areas endemic with valley fever](#)

[Figure 2. Reported cases of valley fever per 100,000 population, Arizona 1990 – 2013](#)

[Figure 3. Cases reported annually by reporting organization, 2007 – 2013](#)

[Figure 4. Cases per 100,000 population by county, 2013](#)

[Figure 5. Percent of total cases reported by month, 2011 – 2013](#)

[Figure 6. Hospitalizations with a primary diagnosis of valley fever, 2003 – 2013](#)

[Table 1. Reported cases of valley fever, 1990 – 2013](#)

[Table 2. Proportion of cases reported by Lab A, 2007 – 2013](#)

[Table 3. Reported cases and rates by county, 2013](#)

[Table 4. Deaths attributable to valley fever by county, 2013](#)

[Table 5. Reported cases and rates by age groups, 2013](#)

[Table 6. Cases by gender, 2013](#)

[Table 7. Race and ethnicity of reported cases, 2013](#)

[Table 8. Hospitalizations with a primary diagnosis of valley fever per 100,000 population by county, 2013](#)

Executive Summary

Valley fever is an infection caused by a fungus that is found in the soil of the southwestern United States, and parts of Mexico, Central and South America. People become infected when they inhale fungal spores made airborne by disturbance of soil by natural or human activity. It is not contagious and cannot be transmitted from animals to humans. Sixty percent of infected persons experience no or mild symptoms. The remaining 40% experience a self-limited respiratory disease with symptoms such as fever, cough, fatigue, chest pain, shortness of breath, and rash. In less than 5% of people with symptoms, it can cause severe respiratory disease or disseminated disease outside of the lungs requiring treatment with antifungal medication. Treatment may need to be continued for many months or possibly for life. A vaccine does not exist for this disease and preventing infection is difficult.

Continued surveillance for valley fever by the Arizona Department of Health Services (ADHS) has demonstrated that:

- Two-thirds of all cases reported nationwide reside in Arizona.
- Valley fever is one of the most commonly reported infectious diseases in Arizona.
- 96% of cases reported in Arizona reside in Maricopa, Pima, and Pinal Counties.
- In the last decade, the incidence of reported valley fever in Arizona has nearly doubled from 47.9 per 100,000 persons in 2003 to 90.2 per 100,000 persons in 2013. Changes in laboratory reporting and testing in 2009 and 2012 have significantly impacted the number of cases reported.

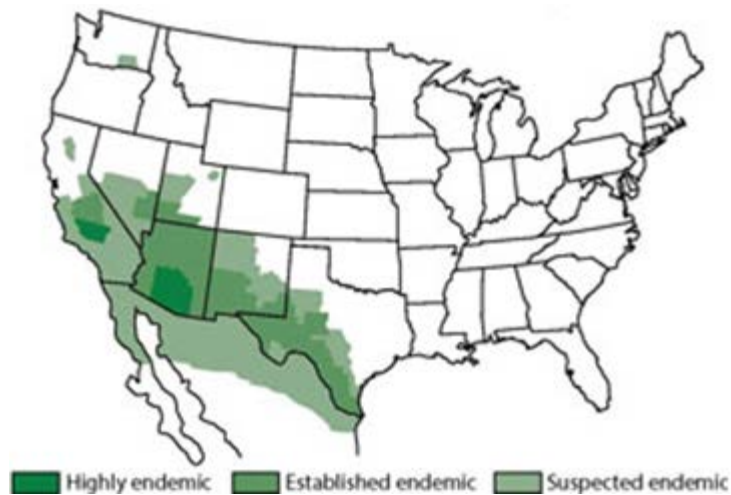
An analysis of valley fever-associated hospitalizations from hospital discharge data noted that:

- In 2013, there were 862 hospitalizations associated with a primary diagnosis of valley fever.
- In 2013, hospitalization charges for Arizona residents with a primary diagnosis of valley fever totaled \$53 million.

Introduction

Valley fever, also known as coccidioidomycosis, is an infection caused by the fungus *Coccidioides* spp. It has affected inhabitants of the Southwestern desert of the United States for thousands of years.¹ The fungus is present in the top 2 – 8 inches of warm, dry soils at lower elevations of the American Southwest, especially Arizona and California, as well as parts of Mexico and Central and South America.

Figure 1. Areas where Valley Fever is endemic



Source: CDC

including cough, fever, fatigue, chest pain, shortness of breath, headaches, rash, and joint and muscle aches. Symptoms generally begin 1 – 4 weeks after exposure and may last for several weeks, causing significant disruption including lost time at work and school. Most cases recover without treatment and become immune for life. However, less than 5% of people experience severe illness in the form of severe respiratory or disseminated disease.

Dissemination is the spread of the infection outside of the lungs. Although nearly any part of the body can become infected, the skin, bones, and central nervous system are the most common sites of dissemination. Risk factors for dissemination include weakening of the immune system due to underlying health conditions (e.g., HIV/AIDS, organ transplant), immunosuppressive medication (e.g., corticosteroids, chemotherapy, biopharmaceuticals for autoimmune diseases), African American or Filipino race, male sex, and pregnancy. Disseminated disease can be deadly and requires treatment. Anti-fungal medications can

When soil is disrupted (e.g., by wind, earthquakes, or human activity), fungal spores become dispersed in the air. Susceptible individuals breathe in the spores resulting in infection. Infection causes mild or no symptoms in about 60% of cases. The remaining 40% experience a flu-like respiratory illness with symptoms

be used to control the infection, but can have side effects. There is no cure or vaccine for valley fever.

Valley fever is a reportable communicable disease in Arizona. Arizona Administrative Code (AAC) R9-6-202, 203, 204, and 205 describe the morbidities, test results, or prescriptions required to be reported by health care providers, administrators of health care facilities, clinical laboratory directors, institutions, schools, pharmacists, and others. Healthcare providers and laboratories are required to report a case of or positive test result for valley fever to the Arizona Department of Health Services within five working days. Arizona requires reporting by both health care providers and clinical laboratories as a dual surveillance measure to increase the sensitivity of the surveillance system and improve the completeness of reporting. Diseases are reported via a secure web system, fax, mail, or telephone systems using the communicable disease report (CDR) form. More information about the current reporting requirements can be found on the Arizona Office of the Secretary of State's website.¹ Additional information on communicable disease reporting as well as reporting can be found on the Office of Infectious Disease Services (OIDS) website.²

Previously, ADHS received a legislative appropriation as well as funding from the Centers for Disease Control and Prevention (CDC) and the Arizona Biomedical Research Commission (ABRC) for valley fever prevention and control activities. Since 2012, ADHS has received funding through the CDC's Epidemiology and Laboratory Capacity program to continue some of these activities.

¹ http://www.azsos.gov/public_services/Title_09/9-06.htm.

² <http://www.azdhs.gov/phs/oids/reporting/>

Epidemiology in Arizona

The first reported case of valley fever in Arizona was described in 1938.³ Arizona accounts for approximately 66% of all valley fever cases reported nationwide.⁴ Thousands of cases of valley fever are reported to ADHS each year. However, public health surveillance only captures a fraction of all infections. Most infected persons do not seek care or may not receive diagnostic testing when they do. Thus, the total number of infections in Arizona is likely several times higher than the number reported to ADHS.

Cases of valley fever have been reported to ADHS for decades. Laboratory reporting of valley fever was mandated in 1997. Since then, reports of valley fever have increased dramatically. In 2009, a major commercial laboratory (Lab A) altered its reporting practices for valley fever, greatly increasing the total number of reported cases. In 2012, a change in testing methods at Lab A contributed to a substantial decline in the number of cases reported in late 2012 and 2013 (Table 1; Figure 2).⁵

In 2013, 5,861 cases of valley fever were reported to ADHS. This is a decrease of 7,059 cases (55%) compared to 2012. A decrease in case counts was also noted by other states in 2013.⁶ Although the laboratory and reporting changes mentioned above may explain much of the recent changes in numbers of reported cases, the causes of variability in reported case counts remains poorly understood. Contributing factors may include:

- Migration of susceptible people to the highly endemic counties in Arizona
- Increased recognition and testing by healthcare providers
- Increased awareness and care-seeking among the general public
- An increase in the number of people with weakened immune systems due to aging, immunosuppressive medications, or underlying health conditions
- Changes in precipitation, dust storms, and other climate-related phenomena that may affect fungal growth, fungal spore formation and dispersal

³ Arizona State Department of Health. Arizona Public Health News: Coccidioidomycosis in Arizona. 1959; Vol 52 No 2.

⁴ Increase in Reported Coccidioidomycosis – United States, 1998 – 2011. MMWR 62(12):217-221.

⁵ All incidence rate calculations included in this report are based on population denominators estimated by the ADHS Health Status and Vital Statistics Section using population projections obtained from the Arizona Department of Administration.

⁶ Provisional cases of selected notifiable diseases, United States (52nd week) MMWR 62(52): ND-719-ND-732.

2013 Valley Fever Annual Report

- Increased construction or desert soil disturbance in areas where the fungus is present

Figure 2. Reported cases of valley fever per 100,000 population, Arizona 1990 – 2013

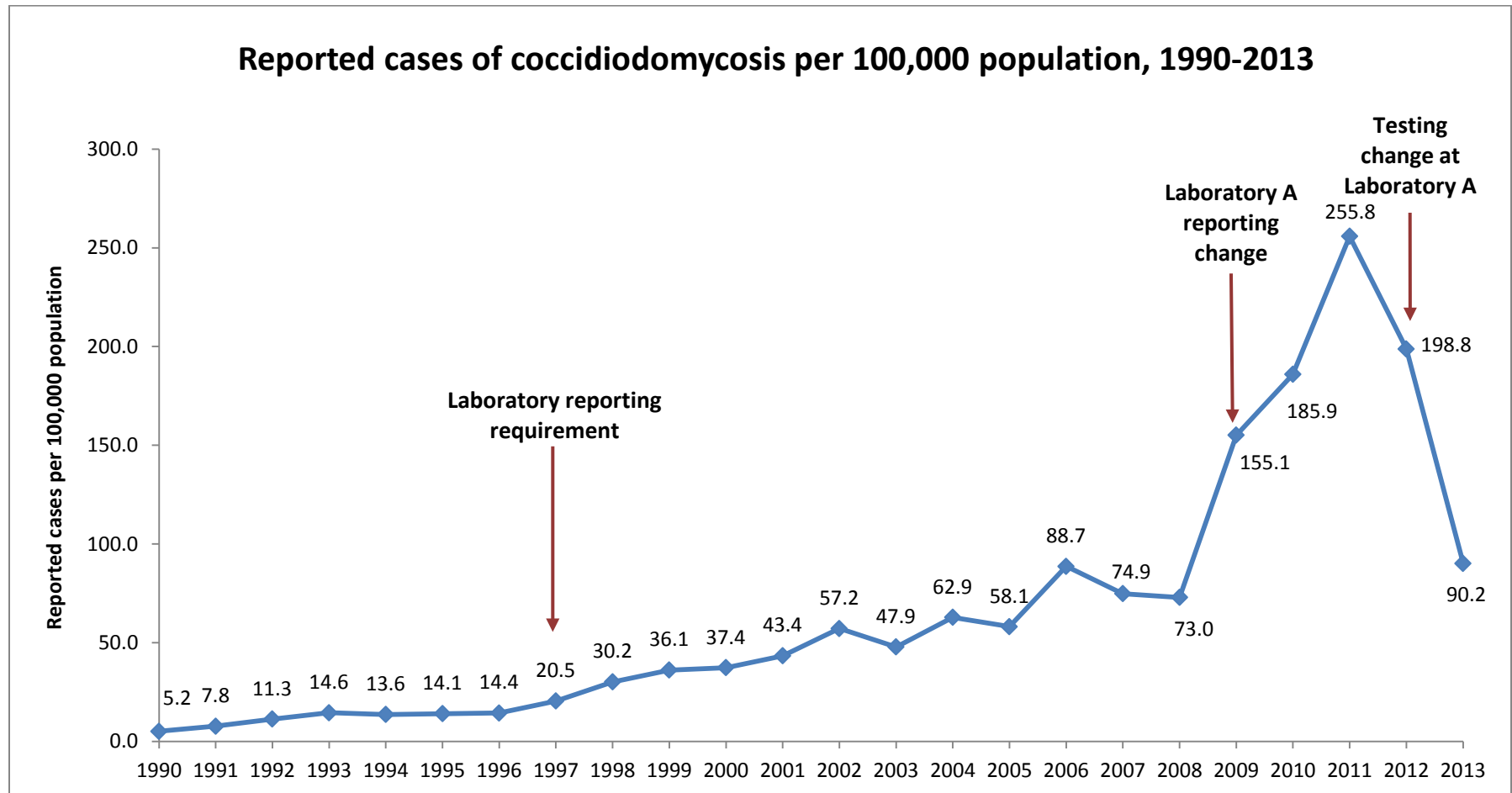


Table 1. Reported cases of valley fever, 1990 – 2013

	Reported Cases	Incidence of Reported Cases per 100,000 population
1990	191	5.2
1991	287	7.8
1992	437	11.3
1993	592	14.6
1994	580	13.6
1995	626	14.1
1996	655	14.4
1997	869	20.5
1998	1,556	30.2
1999	1,813	36.1
2000	1,922	37.4
2001	2,302	43.4
2002	3,118	57.2
2003	2,695	47.9
2004	3,665	62.9
2005	3,515	58.1
2006	5,535	88.7
2007	4,832	74.9
2008	4,768	73.0
2009	10,233	155.1
2010	11,888	185.9
2011	16,472	255.8
2012	12,920	198.8
2013	5,861	90.2

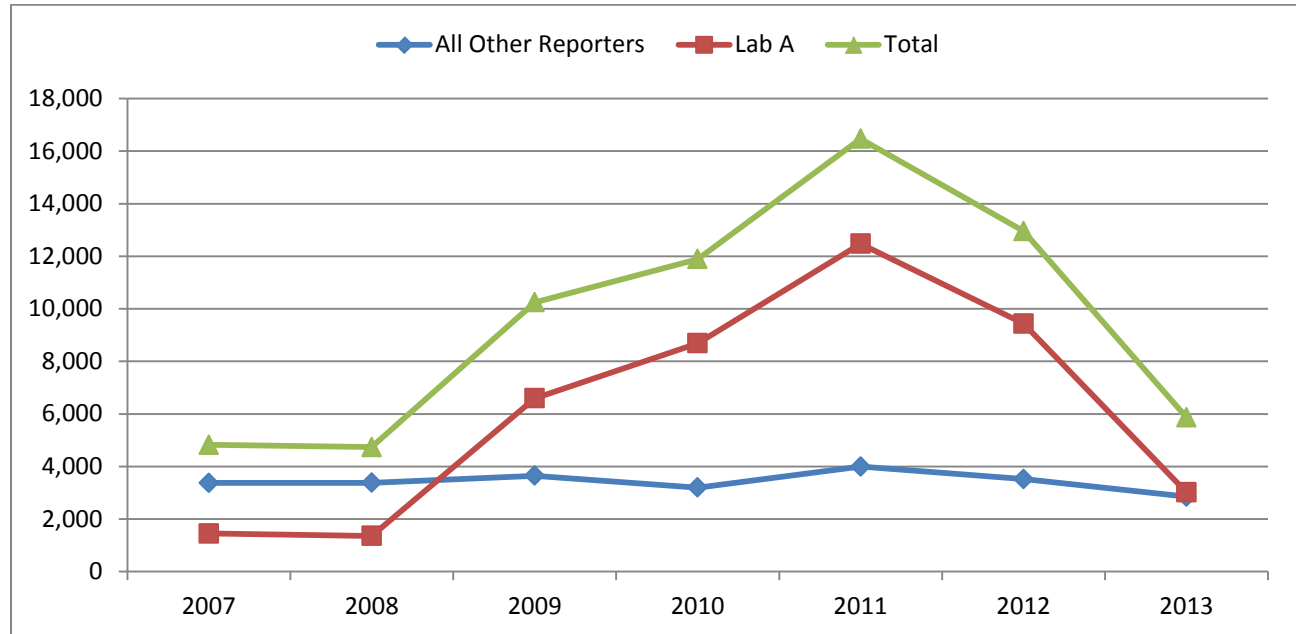
Reporting Sources and Changes in Laboratory Reporting Practices

Ninety-nine percent of cases were reported by laboratories in 2013. The proportion of cases reported by a single major commercial laboratory (Lab A) has increased from 2009 – 2011. In mid-2009, Lab A altered its reporting practices for valley fever, greatly increasing the total number of reported cases (Table 2; Figure 2). However, changes in testing at Lab A led to a significant decline in the number of reported cases from 2011 – 2013.

Table 2. Proportion of cases reported by Lab A, 2007 – 2013

	2007	2008	2009	2010	2011	2012	2013
Lab A	30.0%	28.7%	64.4%	73.1%	75.8%	72.8%	51.4%
All Other Reporters	70.0%	71.3%	35.6%	26.9%	24.2%	27.2%	48.6%

Figure 3. Cases reported annually by reporting organization, 2007 – 2013

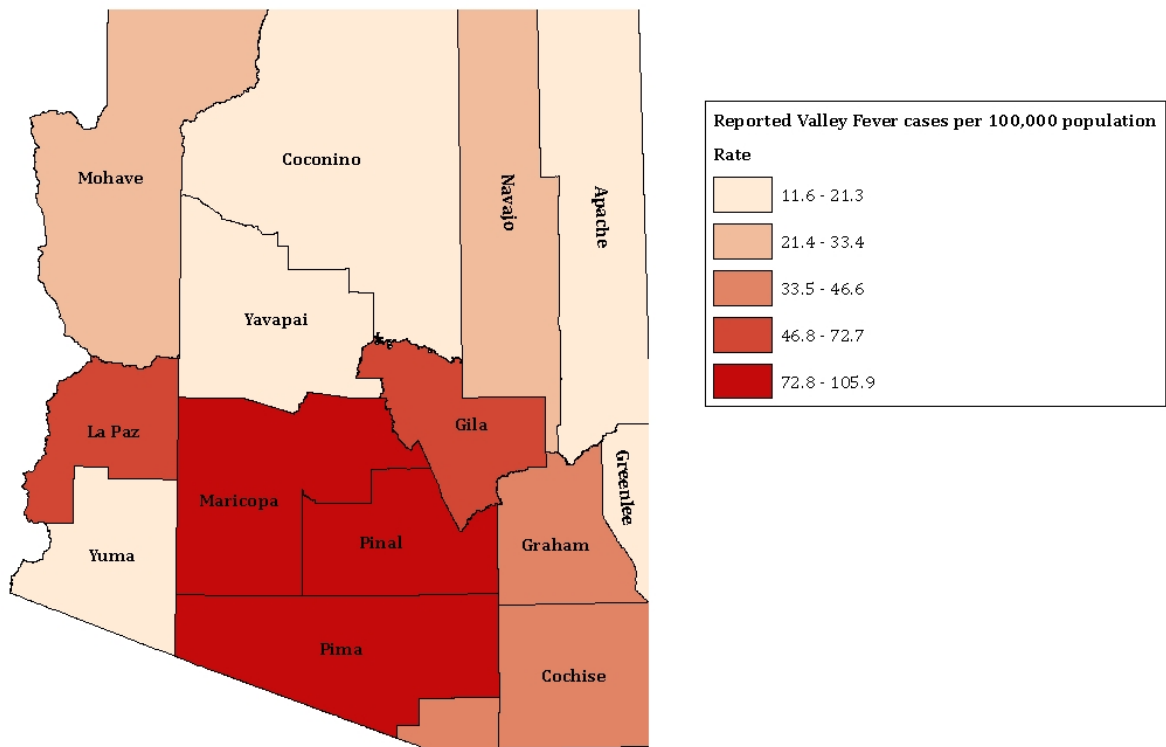


Geographic Distribution

Cases were reported from every county in Arizona in 2013. Rates of reported valley fever were highest in Maricopa, Pima, and Pinal counties. This is consistent with prior years (Table 3; Figure 4).

Table 3. Reported cases and rates by county, 2013

	Cases	Cases per 100,000 population	Average cases per 100,000 population (2007 - 2013)
Apache	14	19.4	18.8
Cochise	61	46.6	33.9
Coconino	21	15.6	22.3
Gila	39	72.7	64.3
Graham	17	45.6	60.2
Greenlee	1	11.6	16.7
La Paz	13	62.2	103.4
Maricopa	4,115	105.9	192.2
Mohave	60	29.5	43.1
Navajo	36	33.4	28.5
Pima	992	100.2	124.5
Pinal	403	103.5	140.9
Santa Cruz	19	39.0	29.5
Yavapai	45	21.3	19.5
Yuma	25	12.2	10.0
Arizona	5,861	90.2	147.7



Mortality

Valley fever is rarely lethal. However, infection in persons who are severely immunosuppressed, for example due to HIV/AIDS, may lead or contribute to death. Based on causes of death listed on death certificates from 2013, valley fever was a primary or contributing cause of death in 50 deaths in Arizona (Table 4). The increase in deaths attributable to valley fever relative to 2012 is due to a change in the classification and definition of valley fever-associated deaths. These data may underreport causes of death and may contain errors. Thus, this is likely an underestimate of the true number of deaths attributable to valley fever.

Table 4. Deaths attributable to valley fever by county, 2013

County	Primary cause of death	Primary or secondary cause of death
Apache	0	0
Cochise	0	0
Coconino	0	0
Gila	0	0
Graham	0	0
Greenlee	0	0
La Paz	0	0
Maricopa	15	36
Mohave	0	0
Navajo	0	1
Pima	3	11
Pinal	1	1
Santa Cruz	0	0
Yavapai	0	0
Yuma	0	0
Arizona	19	50

Demographics

In 2013, the age of reported valley fever cases ranged from three months to 99 years old with a median age of 51 years. Age could not be determined for 56 cases (approximately 1% of all cases). The highest rates of valley fever occurred among people 85 years and

older; rates of reported infections among Arizonans in this age group are 47% higher than those in the general population (197.3 cases per 100,000 vs. 90.2 per 100,000 respectively) (Table 5).

Table 5. Reported cases and rates by age groups, 2013

Age Group* (Years)	Cases	Cases per 100,000
<5	29	6.4
5-14	243	26.9
15-24	516	57.1
25-34	713	83.2
35-44	767	93.3
45-54	940	111.6
55-64	1,008	138.8
65-74	880	176.7
75-84	507	180.7
85+	204	197.3

*Age could not be ascertained for 54 cases (approximately 0.9% of all cases).

Fifty-two percent of reported cases were female (92.7 cases per 100,000 females), while 47.8% were male (86.6 cases per 100,000 males). Gender was not reported for 34 cases (approximately 0.6 % of all cases) (Table 6). Prior to 2009, the majority of reported cases were male. Reporting and testing changes may have caused this shift.

Table 6. Cases by gender, 2013

	Cases	Percent of total	Cases per 100,000 population
Female	3,026	51.6%	92.7
Male	2,801	47.8%	86.6
Unknown	34	0.6%	--

Only 26.6% of cases reported to ADHS contained information about race or ethnicity. Thus, it was not possible to analyze incidence rates by race or ethnicity.

Table 7. Race or ethnicity of reported cases, 2013

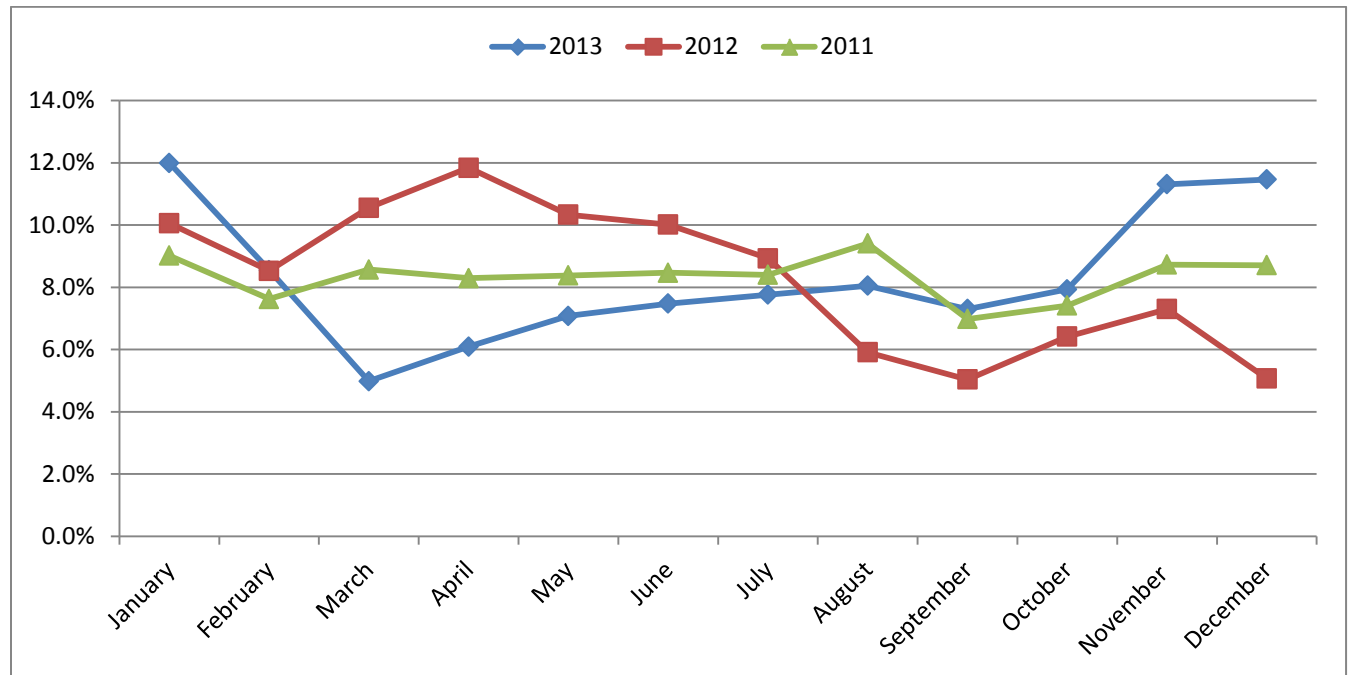
Race or ethnicity	Cases	Percent of total	Percent of cases with known race or ethnicity
Asian or Pacific Islander	41	0.7%	3.0%
Black	110	1.9%	8.0%
Hispanic or Latino	177	3.0%	12.8%
Native American	77	1.3%	5.6%
White	935	16.0%	67.7%
Other	41	0.7%	3.0%
Unknown	4,480	76.4%	--

Seasonality

Seasonal variation in valley fever reports has been consistently noted in past years: numbers of reported cases increase from June through August and November through December. Figure 5 reflects the month in which cases were first reported to a local health department or ADHS from 2007 through 2013. This does not correspond to month of exposure to fungal spores or onset of symptoms. Possible causes of delay between exposure and reporting include the 1 – 4 week incubation period between exposure and symptom onset, delays before seeing a health care provider for the illness, delays in being tested for valley fever, time associated with processing and testing laboratory specimens, and time associated with reporting by a laboratory or healthcare provider to the health department. A previous ADHS study demonstrated that the median time between symptom onset to diagnosis was 55 days.⁷ It is unclear why the temporal distribution of reported cases differed in 2013 from that observed in 2012.

⁷ Tsang CA, Anderson SM, Imholte SB, Erhart LM, Chen S, Park BJ. Enhanced surveillance of coccidioidomycosis, Arizona, USA, 2007–2008. *Emerg Infect Dis.* 2010;16:1738–44.

Figure 5. Percent of total cases reported by month, 2011 - 2013



Hospitalizations

A previous ADHS investigation noted that 40% of reported valley fever cases required hospitalization.⁵ In 2013, there were 862 hospitalizations with a primary diagnosis of valley fever. The rate of hospitalizations with a primary diagnosis of valley fever has increased over time from 13.2 hospitalizations per 100,000 persons in 2003 to a high of 22.6 hospitalizations per 100,000 persons in 2011, falling again to 13.3 hospitalizations per 100,000 persons in 2013. The causes behind this increase are unclear, but may reflect improved diagnosis and recognition by healthcare providers and an increase in the incidence of disease. Pinal County continues to have the highest rate of hospitalizations (Figure 6; Table 8).

Figure 6. Hospitalizations with a primary diagnosis of valley fever, 2003 – 2013

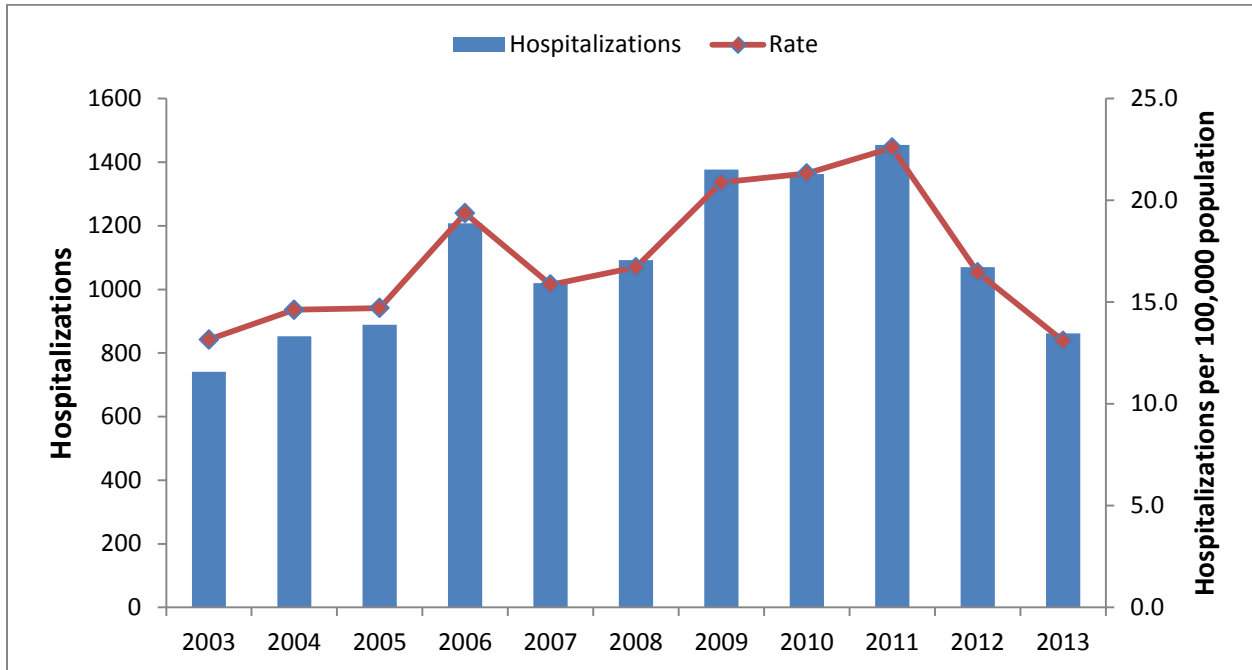


Table 8. Hospitalizations with a primary diagnosis of valley fever per 100,000 population by county, 2013

County	Hospitalizations per 100,000 population (2013)
Apache	2.8
Cochise	4.6
Coconino	3.0
Gila	3.7
Graham	13.4
Greenlee	0.0
La Paz	0.0
Maricopa	14.9
Mohave	8.9
Navajo	5.6
Pima	13.3
Pinal	24.7
Santa Cruz	6.2
Yavapai	2.4
Yuma	1.5
Arizona	13.3

Valley fever continues to be a costly disease. A previous investigation noted that total charges, which do not necessarily reflect actual payments, for Arizona residents hospitalized with a primary or secondary diagnosis of valley fever at non-federal facilities in Arizona were \$86 million in 2007.⁵ In 2013, hospitalization charges for Arizona residents with a primary diagnosis totaled \$53 million with a median of \$40,321 in total charges per hospitalization. Medicare was the most frequently listed expected source of payment (23.8%), followed by Health Maintenance Organizations (HMO) (23.2%), the Arizona Healthcare Cost Containment System (AHCCCS) (18.2%), Preferred Provider Organizations (PPO) (9.5%), self-pay (8.0%), and Medicare Risk HMOs (7.0%). Total charges associated with hospitalizations for which Medicare and AHCCCS were listed as sources of payment were \$20 million and \$13 million, respectively. The total healthcare costs attributable to valley fever are greater due to the exclusion of the cost of outpatient care and non-acute inpatient care in these figures.

Additional analysis was performed for hospitalizations with a primary diagnosis of valley fever in 2013. In contrast to the gender distribution observed in reported cases, 58.8% of hospitalizations in 2013 involved a male patient. The age distribution of hospitalized patients was as follows: 13% <25 years old, 28.1% 25 – 44 years old, 33.9% 45 – 64 years old, 22.9% 65 – 84 years old, and 2.2% 85 years or older. The median age was 52 years. Approximately 42% of these hospitalizations involved an intensive care unit (ICU) admission. Median length of stay was 4 days. Approximately 63% of these hospitalizations were associated with primary pulmonary coccidioidomycosis; 8% were associated with coccidioidal meningitis. Thirteen percent of patients were readmitted to the hospital with a primary diagnosis of valley fever. Twelve (1.4%) patients died during a hospitalization.

Acknowledgements

Case reporting by providers and laboratories is the key to Arizona's infectious disease surveillance system. All staff within the ADHS Office of Infectious Disease Services and local health departments are acknowledged for their contributions to data collection, data entry and data analysis. Funds and technical assistance from the ABRC, CDC, and the University of Arizona Valley Fever Center for Excellence (VFCE) supported this work. The contents of this report are solely the responsibility of the authors and do not represent the official views of the ABRC, the CDC, or the VFCE.

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