VALLEY FEVER

2017 ANNUAL REPORT

ARIZONA DEPARTMENT OF HEALTH SERVICES

Photo credit: Michael Olbinski

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2017 Surveillance Highlights

6,885 reported cases of valley fever

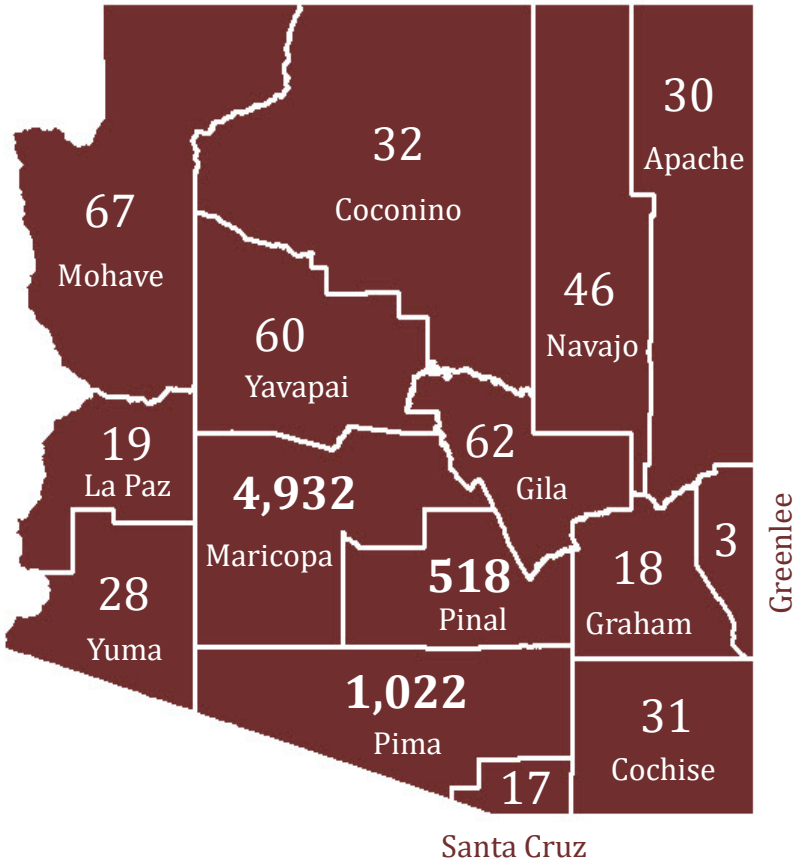
94% of cases were reported in 3 counties

725 hospitalizations with a primary diagnosis of valley fever

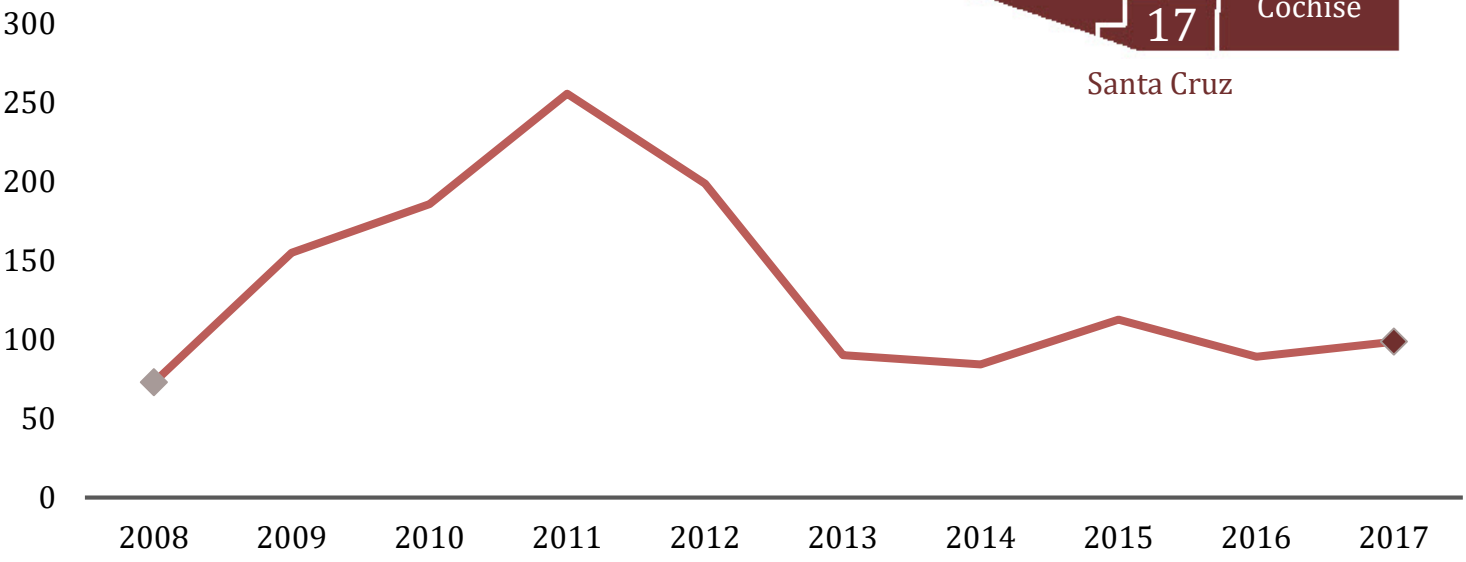
$50.6 million in total hospitalization charges for Arizonans with a primary diagnosis of valley fever

48 deaths attributable to valley fever

Case Distribution Across the State



In the last decade, the incidence* of reported valley fever in Arizona has increased from **73.0 per 100,000 population in 2008** to **98.8 per 100,000 population in 2017**.**

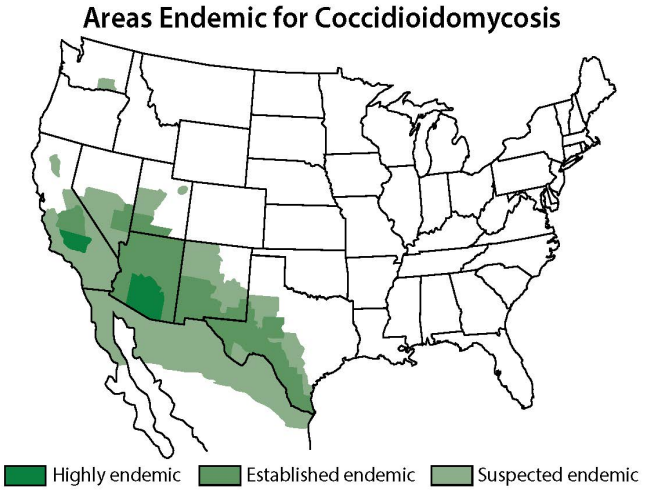


*All incidence rate calculations included in this report are based on population denominators estimated by the ADHS Health Status and Vital Statistics Section using population projections obtained from the Arizona Department of Administration.

**Changes in reporting and testing practices at Laboratory A in 2009 and 2012 significantly impacted the number of reported cases.

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 U.S. 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, Central and South America. The fungus has also recently been found in south-central Washington.[2]



When soil is disrupted (e.g., by wind, earthquakes, human activity, etc.), 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 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 hardship 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.

Coccidioidomycosis (or "**cocci**" for short) is the medical name for valley fever.

The *Coccidioides* fungus was recently found in Washington state.

Wet the ground before disturbing the soil.

Endemic area:
An area where the fungus grows in the soil

Highlighted symptoms:
- Cough
- Fever
- Fatigue

Disseminated valley fever occurs when the fungus spreads from the lungs to other parts of the body.

Antibiotics do not work for fungal diseases.

There is no cure or vaccine for valley fever.

A.A.C. – Arizona Administrative Code

ADHS – Arizona Department of Health Services

CDR – Communicable Disease Report

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 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 (A.A.C.) R9-6-202, 203, 204, and 205 describe the morbidities, test results, or prescriptions required to be reported by healthcare providers, administrators of healthcare 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 ADHS within five working days. Arizona requires reporting by both healthcare 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 secure electronic reporting systems, fax, mail, or telephone 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.[3] Additional information on communicable disease reporting as well as reporting can be found on the ADHS Office of Infectious Disease Services website.[4]

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 for Infectious Diseases Cooperative Agreement to continue some of these activities.

CDC – Centers for Disease Control and Prevention

ABRC – Arizona Biomedical Research Commission

Reportable diseases are required to be reported to Public Health by law.

Valley fever became laboratory reportable in 1997.

California reported more valley fever cases than Arizona for the first time.

Epidemiology in Arizona

The first reported case of valley fever in Arizona was described in 1938.[5] Between 1998 and 2015, Arizona accounted for roughly two-thirds of all valley fever cases reported nationwide[6] with thousands of cases reported to ADHS each year. However, public health surveillance only captures a fraction of 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.

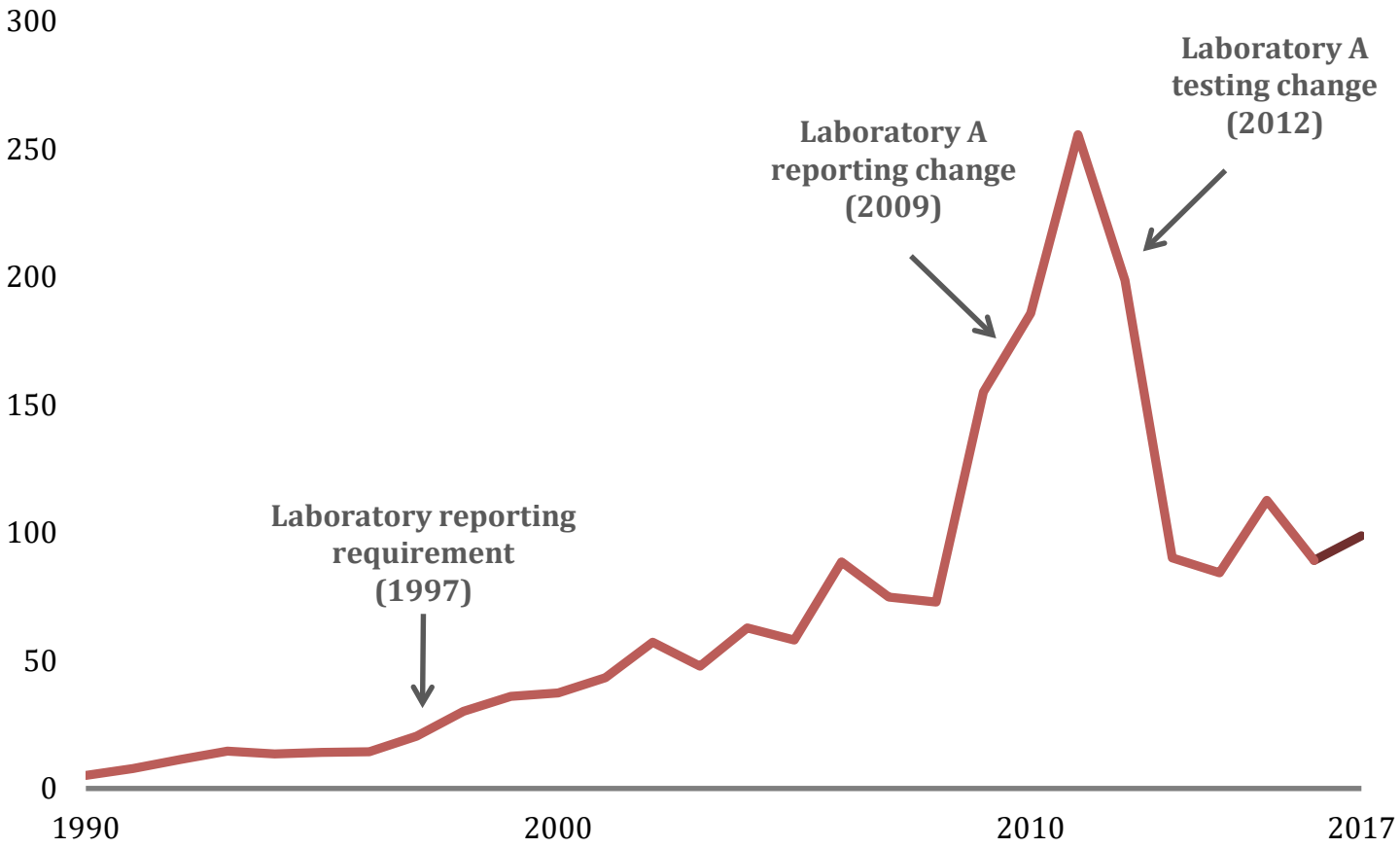
Cases of valley fever have been reported to ADHS for decades. Laboratory reporting of valley fever was mandated in 1997. Since then, reports of valley fever have increased dramatically. In 2009, a major commercial laboratory (Lab A) altered its reporting practices for valley fever, after consultation with ADHS, to include reporting of enzyme immunoassay (EIA) results, 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.
In 2017, 6,885 cases of valley fever were reported to ADHS. This is an increase of 784 cases (13%) compared to 2016; a small jump relative to California which reported 7,466 cases in 2017[7]— a 34% increase compared to 2016. 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 weather-related phenomena that may affect fungal growth, spore formation, and dispersal.
- Increased construction or desert soil disturbance in areas where the fungus is present.

Stay out of blowing dust.

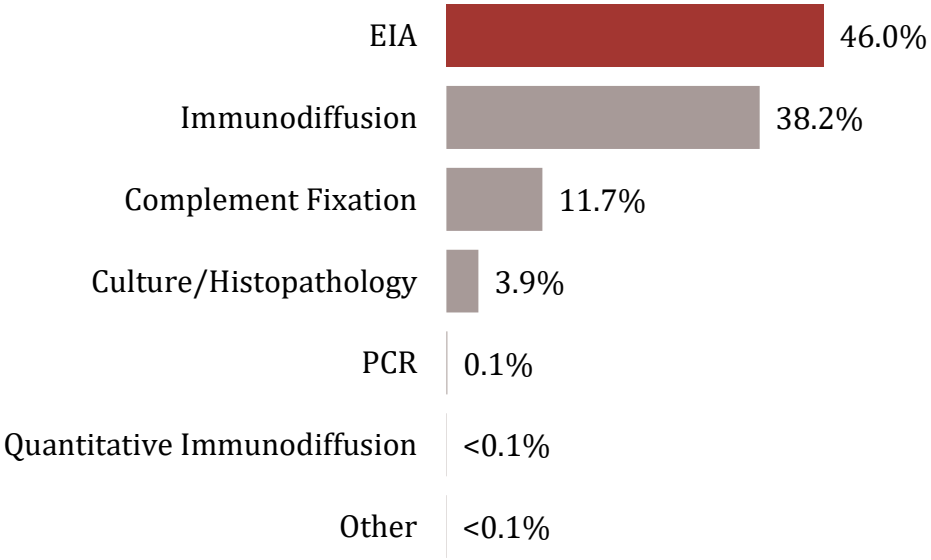
The rate* increased from 89.3 in 2016 to 98.8 in 2017. There were 6,885 reported cases in 2017.



*Reported cases per 100,000 population

Laboratory Data

Of the 27,391 positive valley fever tests in 2017, almost half were performed using an **Enzyme Immunoassay (EIA)**.

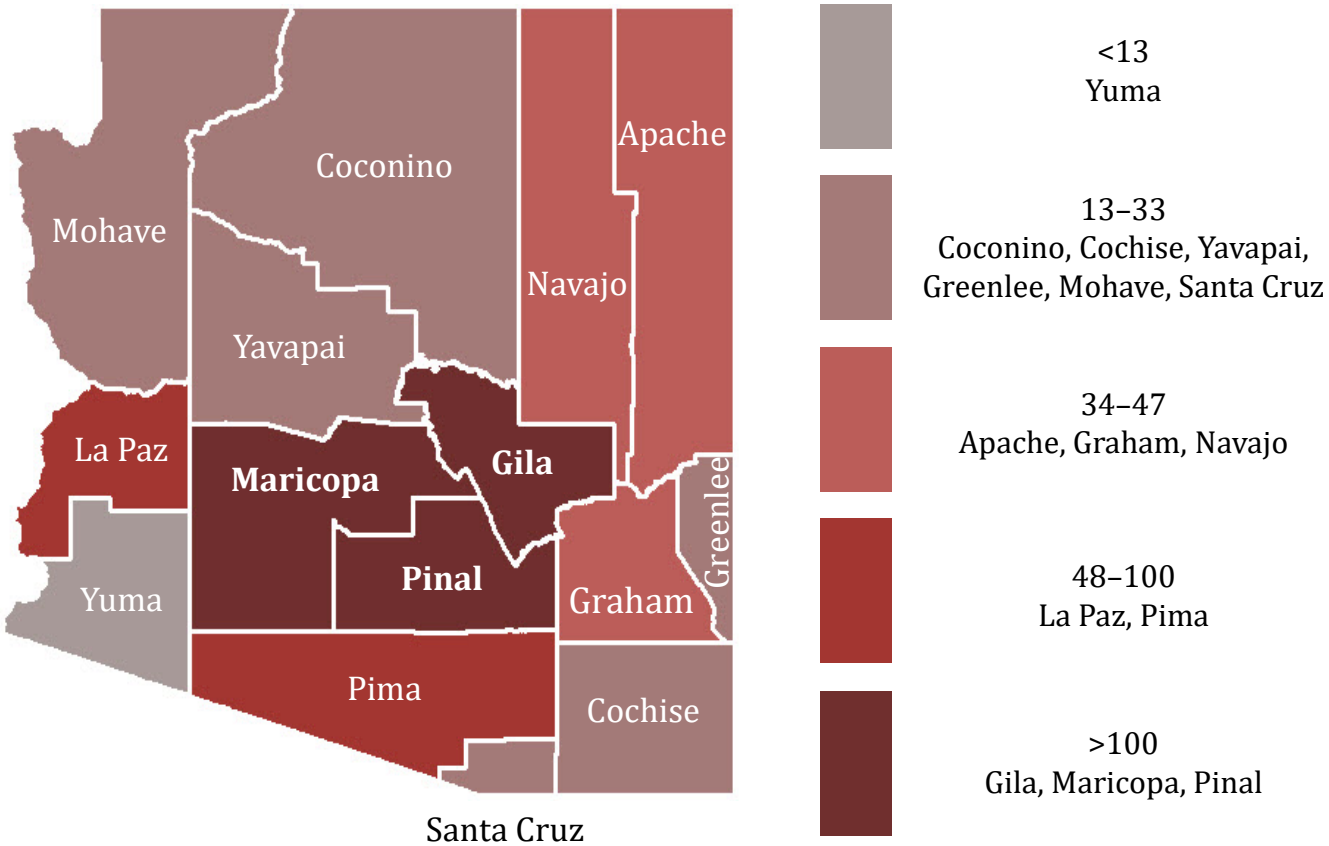


See Table 2 and Reporting Sources and Changes in Laboratory Reporting Practices in the Appendix for more information.

Geographic Distribution

Cases were reported from every county in Arizona in 2017. Rates of reported valley fever were highest in Gila, Maricopa, and Pinal Counties. This is the first year that Gila County had a higher rate than Pima County. *See Table 3 in the Appendix for more information*.

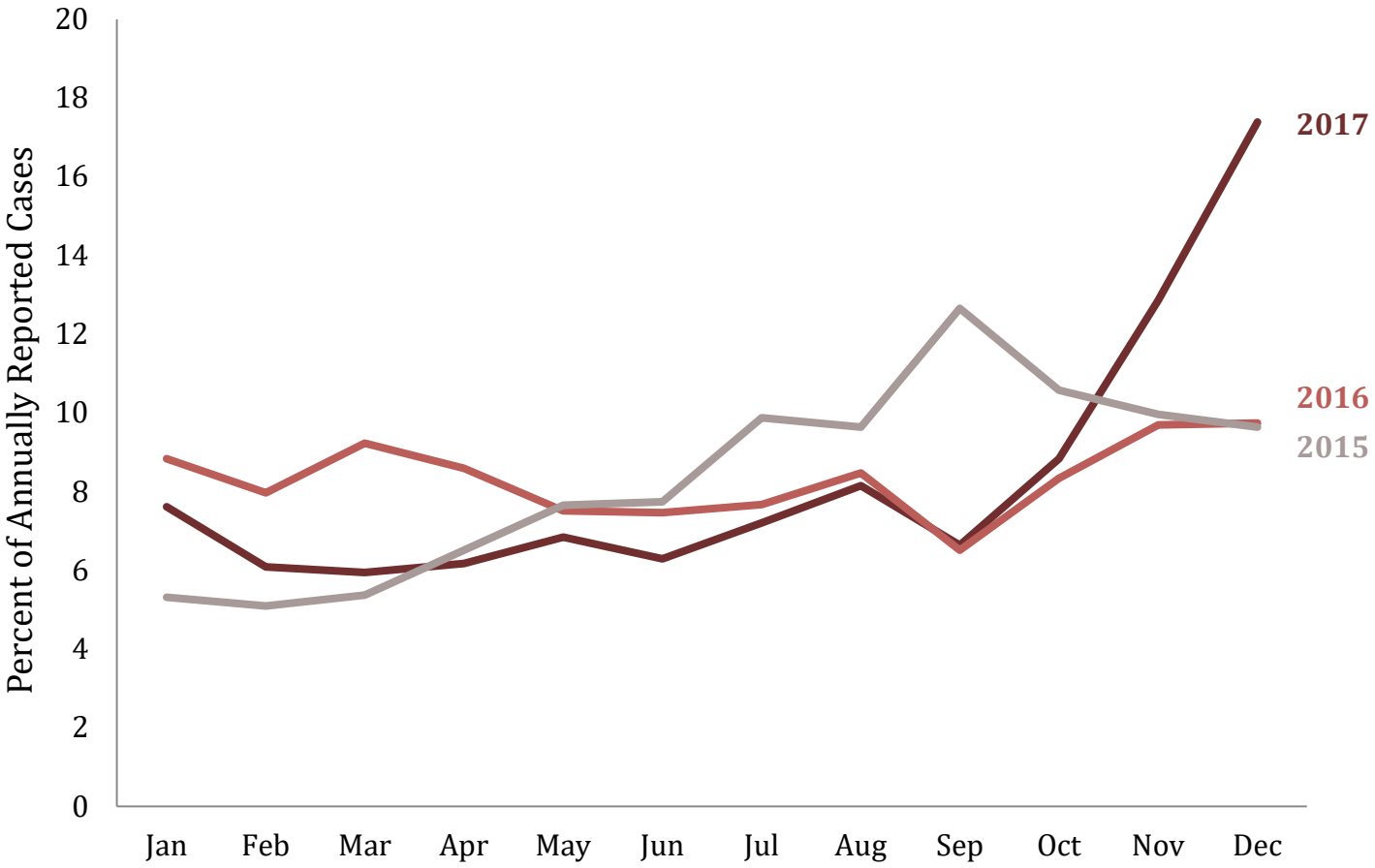
Pinal County had the highest rate* in 2017.



*Reported cases per 100,000 population

Seasonality

The proportion of cases reported each month in 2017 did not diverge significantly from previous years until the increase beginning in the fall.



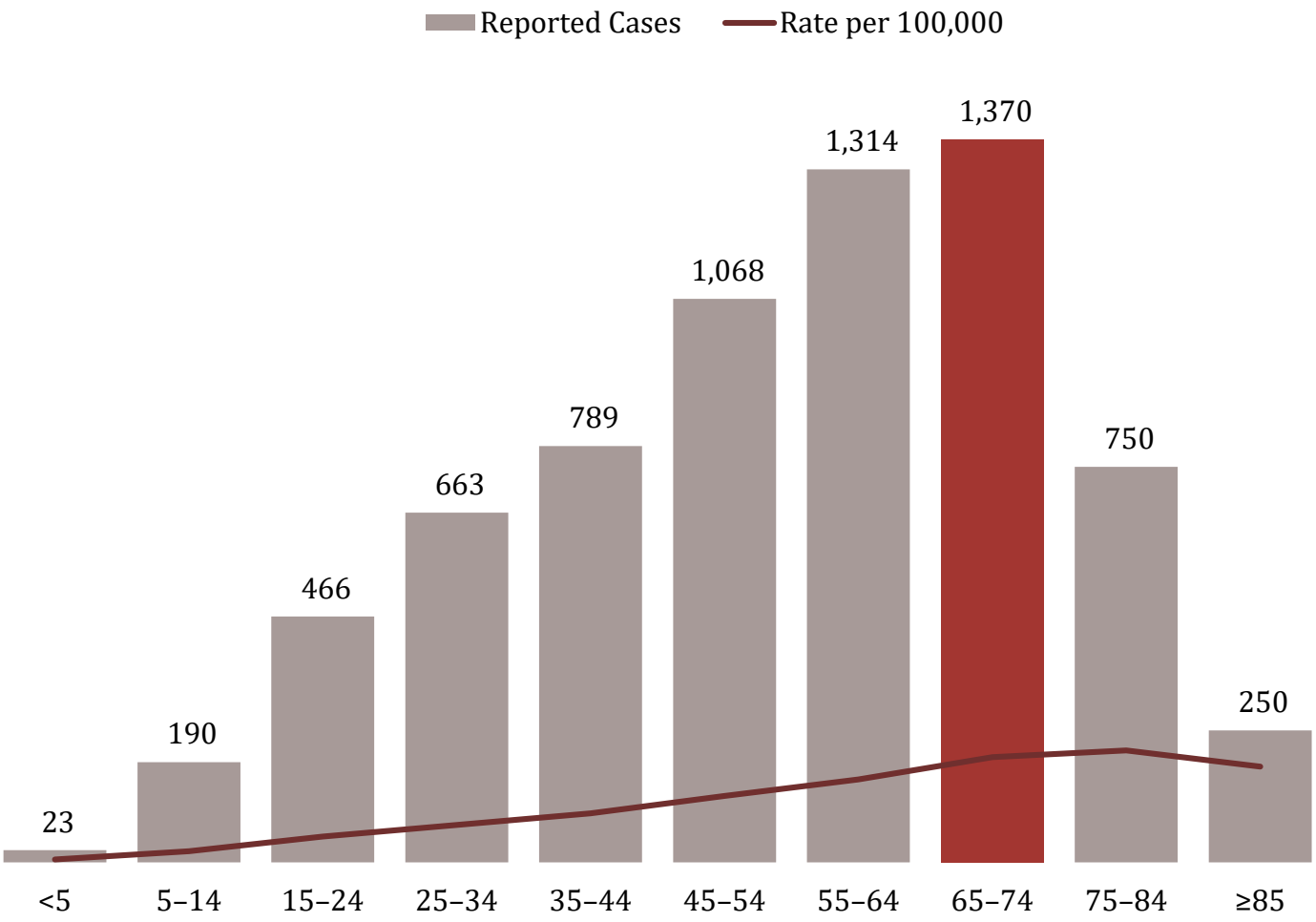
Seasonal variation in valley fever reports has been consistently noted in past years: numbers of reported cases usually increase in the spring and particularly in the winter. The past three years have seen an increase in August (2016 and 2017) or September (2015), and it is unclear why or if this trend will continue. These data do 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 healthcare 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 investigation found that the median time between symptom onset and diagnosis was 55 days.[8]

Demographics

Age

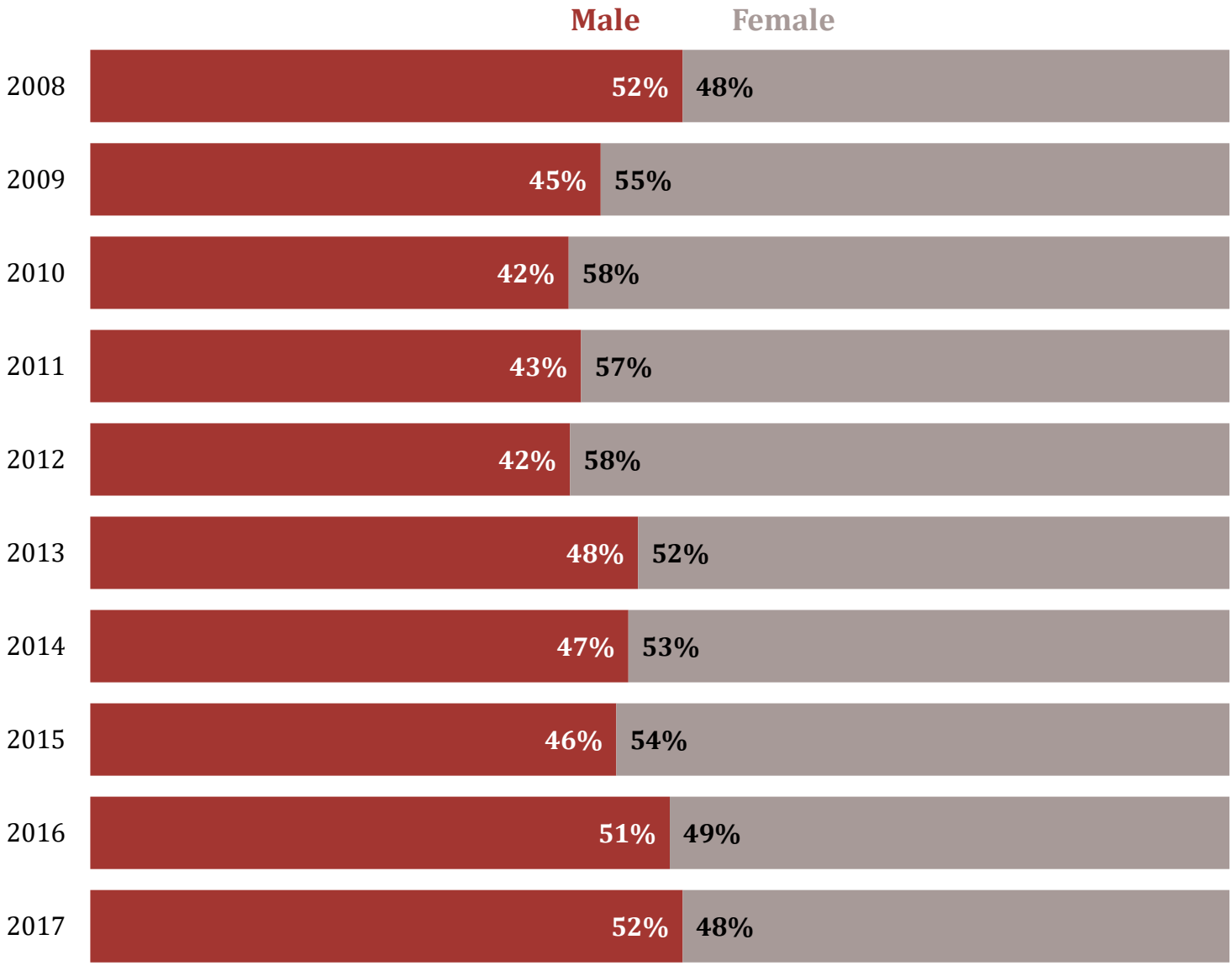
In 2017, the age of reported valley fever cases ranged from four months to 103 years old with a median age of 55 years. The highest rate of reported disease occurred among those 75–84 years old. Rates in this age group are more than twice those in the general population (211.9 vs. 98.8 reported cases per 100,000 population, respectively). Age could not be determined for six cases (approximately 0.1% of all cases). *See Table 4 in the Appendix for more information*.

The largest proportion of cases was **65–74 years old**.



Sex

Males accounted for just over half of reported cases with known sex* in 2017.



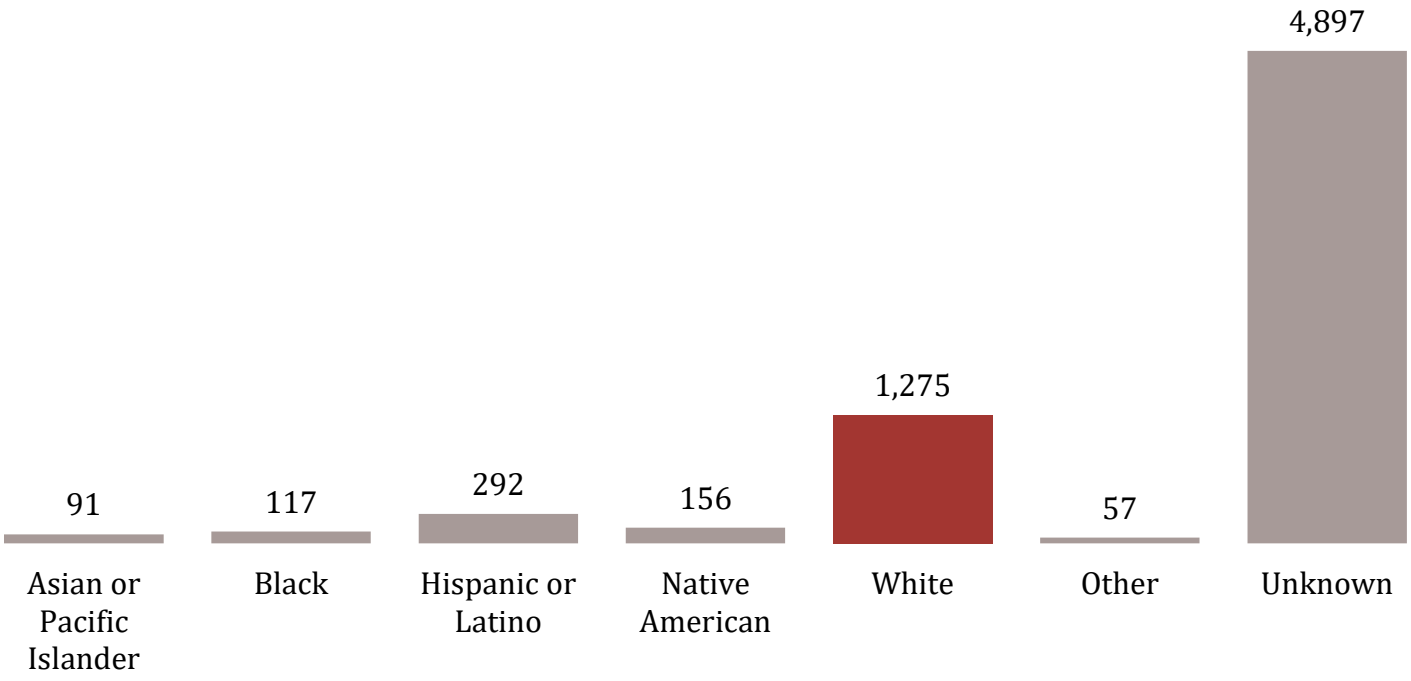
*Sex was not reported for 13 cases in 2017 (0.2% of all cases).

Prior to 2009, the majority of reported cases were male. 2016 was the first year since 2008 that males accounted for the majority of cases. It is not clear why, but reporting and testing changes may have caused this shift. *See Table 5 in the Appendix for more information.*

Race/Ethnicity

Of the 6,885 reported cases, 71.1% did not contain information about race or ethnicity. Thus, it was not possible to analyze incidence rates by race or ethnicity. *See Table 6 in the Appendix for more information.*

Whites accounted for 64.1% of reported cases with known race or ethnicity.



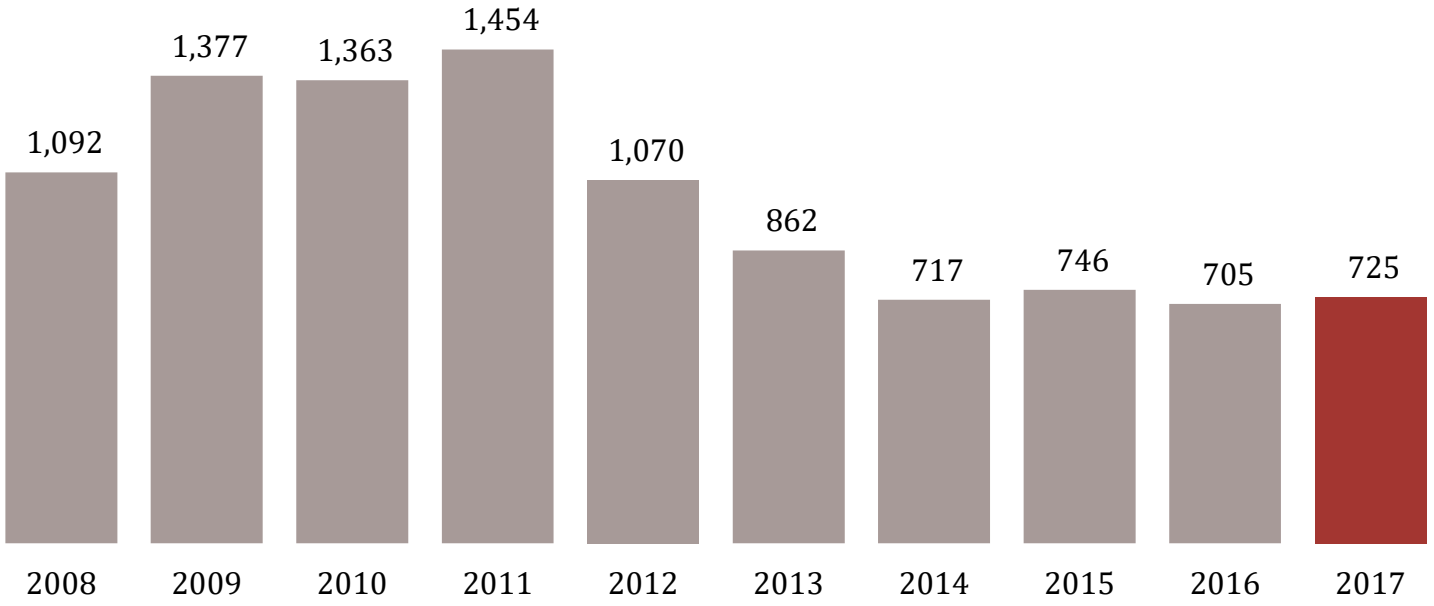
Hospitalizations

In 2017, there were 725 hospitalizations with a primary diagnosis of valley fever. The rate of hospitalizations with a primary diagnosis of valley fever increased from 16.7 hospitalizations per 100,000 population in 2008 to a high of 22.6 hospitalizations per 100,000 population in 2011, falling to 10.4 hospitalizations per 100,000 population in 2017. Pinal, La Paz, and Maricopa Counties had the highest rates of hospitalizations. The causes of this variability are unclear, but may reflect improved diagnosis and recognition by healthcare providers and changes in the incidence of disease. It should also be noted that the transition from ICD-9 to ICD-10 codes occurred in October 2015, but it is uncertain how this change affected the number of hospitalizations with a primary diagnosis of valley fever. *See Table 7 in the Appendix for more information*.

Pinal, La Paz, and Maricopa Counties had the highest rates

ICD – International Classification of Diseases

There were 725 hospitalizations with a primary diagnosis of valley fever in 2017 *.



*Year of hospitalization does not necessarily correspond to the year of initial diagnosis (e.g., someone hospitalized in 2017 could have been initially diagnosed with valley fever in 2016 or before)

$48,594
median charges per hospitalization

AHCCCS – Arizona Health Care Cost Containment System

AHCCCS was the most frequently listed expected source of payment.

Almost 40% of hospitalizations involved a stay in the ICU.

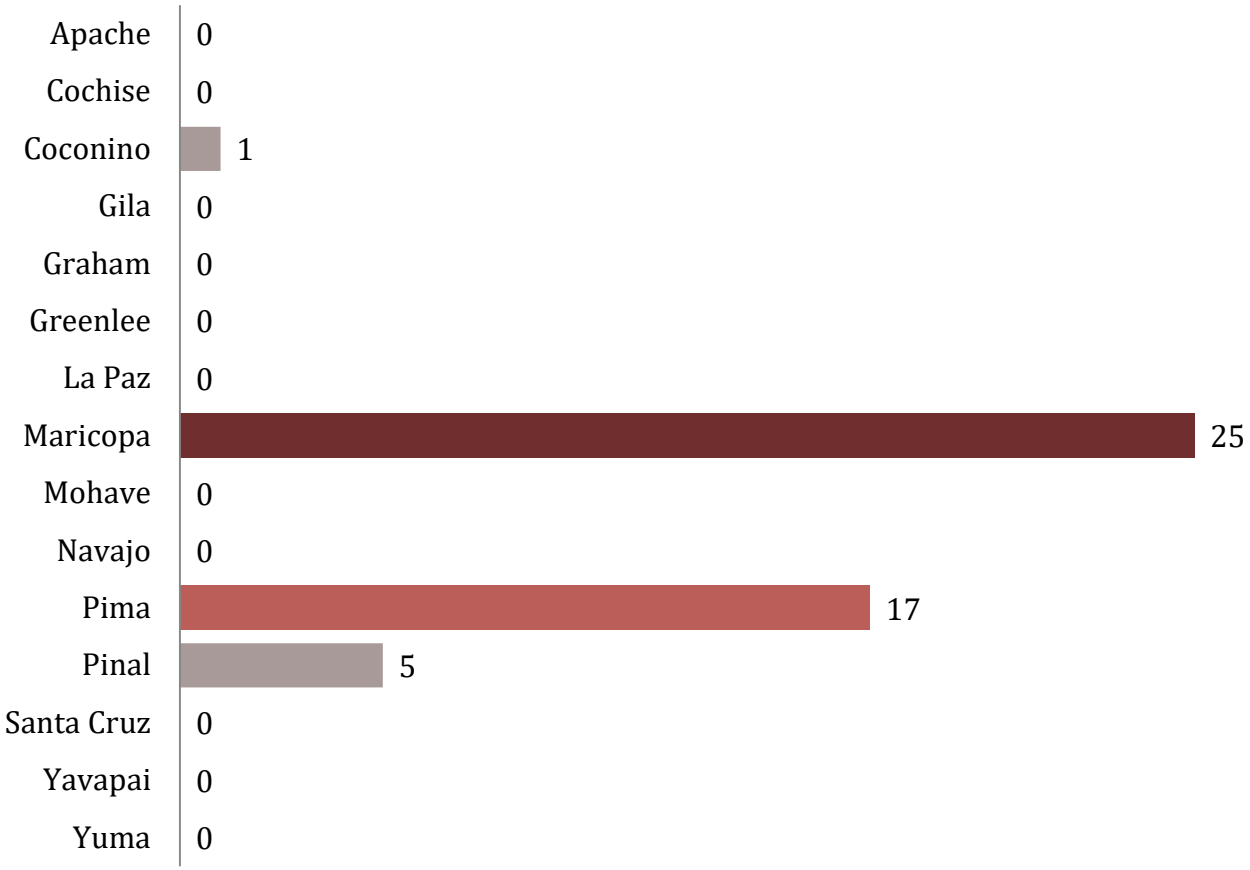
Valley fever continues to be a costly disease. A previous investigation noted that total charges, which do not reflect actual payments, for Arizona residents hospitalized with a primary or secondary diagnosis of valley fever at non-federal facilities in Arizona were $86 million in 2007.[8] In 2017, hospitalization charges for Arizona residents with a primary diagnosis totaled $50.6 million with a median of $48,594 in total charges per hospitalization. The Arizona Health Care Cost Containment System (AHCCCS) (29.1%) was the most frequently listed expected source of payment, followed by Medicare (25.9%), Health Maintenance Organizations (HMO) (17.7%), Preferred Provider Organizations (PPO) (10.0%), Medicare Risk (8.6%), Indemnity (4.0%), and self-pay (3.1%). Total charges associated with hospitalizations for which AHCCCS and Medicare were listed as sources of payment were $17 million and $13.3 million, respectively. The total healthcare costs attributable to valley fever are greater due to the exclusion of the cost of outpatient care and other forms of inpatient care in these figures.

Males accounted for 52% of reported cases in 2017; however, a slightly higher proportion (55.7%) of hospitalizations involved a male patient. The age distribution of hospitalized patients was as follows: 8.3% <25 years old, 25.5% 25–44 years old, 36.7% 45–64 years old, 26.6% 65–84 years old, and 2.9% 85 years or older. The median age was 53 years. Approximately 36.8% of hospitalizations involved an intensive care unit (ICU) admission. The median length of stay was 4 days. Fifteen percent of patients were readmitted to the hospital with a primary diagnosis of valley fever. Six patients died during a hospitalization.

Deaths

Valley fever is rarely lethal. However, infection in persons who are severely immunosuppressed, due to HIV/AIDS for example, may lead or contribute to death. Based on causes of death listed on death certificates from 2017, valley fever was a primary or contributing cause of death in 48 deaths in Arizona. A recent public health investigation found that death certificates might underreport valley fever as a cause of death. The estimated number of deaths attributable to valley fever derived from death certificates and hospital discharge data was seven-fold higher than the estimate calculated from death certificates alone.[8] Thus, these data are likely an underestimate of the true number of deaths attributable to valley fever.

Maricopa County accounted for more than half of the deaths attributable to valley fever among Arizonans in 2017 *.
Pima County nearly doubled its number of deaths compared to last year.



*Year of death does not necessarily correspond to the year of initial diagnosis (e.g., someone who died in 2017 could have been initially diagnosed with valley fever in 2016 or before)

Acknowledgments

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 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 CDC or the VFCE.

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(602) 364-3676
valleyfeverarizona.org

References

1. Harrison WR, Merbs CF, Leathers CR. Evidence of Coccidioidomycosis in the Skeleton of an Ancient Arizona Indian. J Infect Dis [Internet]. 1991 Aug 1 [cited 2018 Oct 10]; 164(2):436–7. Available from: https://academic.oup.com/jid/article-abstract/164/2/436/795936?redirectedFrom=fulltext
2. Marsden-Haug N, Goldoft M, Ralston C, Limaye AP, Chua J, Hill H, Jecha L, Thompson GR, Chiller T. Coccidioidomycosis Acquired in Washington State. Clin Infect Dis [Internet]. 2012 Dec 7 [cited 2018 Oct 10]; 56(6):847–50. Available from: https://academic.oup.com/cid/article-lookup/doi/10.1093/cid/cis1028
3. Arizona Secretary of State [Internet]. Arizona Administrative Code. 2013 Sep 30 [cited 2018 Oct 10]. Available from: https://azsos.gov/rules/arizona-administrative-code
4. Arizona Department of Health Services [Internet]. Communicable Disease Reporting. [cited 2018 Oct 10]. Available from: https://www.azdhs.gov/reporting
5. Farness OJ, Mills CW. A case of fungus Coccidioides infection primary in the lung with cavity formation and healing. Bull Am Acad Tuberc Phys. 1938; 2:39–44.
6. Centers for Disease Control and Prevention [Internet]. Valley Fever (Coccidioidomycosis) Statistics. 2018 Jun 1 [cited 2018 Oct 10]. Available from: http://www.cdc.gov/fungal/diseases/coccidioidomycosis/statistics.html
7. California Department of Public Health [Internet]. Epidemiologic Summary of Coccidioidomycosis in California, 2016. 2017 Jun [cited 2018 Oct 10]. Available from: https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/CocciEpiSummary2017.pdf
8. Jones JM, Koski L, Khan M, Brady S, Sunenshine R, Komatsu KK. Coccidioidomycosis: An underreported cause of death—Arizona, 2008–2013. Medical Mycology [Internet]. 2017 Jun 8 [cited 2018 Oct 10]; 0:1–8. Available from: https://academic.oup.com/mmy/article/56/2/172/3863088

Resources

- Arizona Department of Health Services: valleyfeverarizona.org
- Valley Fever Center for Excellence: vfce.arizona.edu
- Center for Disease Control and Prevention: www.cdc.gov/fungal/diseases/coccidioidomycosis
- Coccidioidomycosis Study Group: coccistudygroup.com

Appendix

Table 1. Reported cases and rates of valley fever, 1990–2017.

Year	Reported cases	Rates*
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
2014	5,624	84.4
2015	7,622	112.8
2016	6,101	89.3
2017	**6,885**	**98.8**

*Reported cases per 100,000 population

Back to Report: Epidemiology in Arizona

Table 2. Positive valley fever laboratory tests, 2017.

Test Type	Frequency	Percent
EIA	12,603	46.0%
Immunodiffusion	10,467	38.2%
Complement Fixation	3,215	11.7%
Culture/Histopathology	1,066	3.9%
PCR	27	0.1%
Quantitative Immunodiffusion	10	<0.1%
Other, not valley fever	3	<0.1%
Total	**27,391**	**100%**

Back to Report: Laboratory Data

Reporting Sources and Changes in Laboratory Reporting Practices

Ninety-nine percent of cases were reported by laboratories in 2017. The proportion of cases reported by a single major commercial laboratory (Lab A) increased from 2009–2012. In mid-2009, Lab A altered its reporting practices for valley fever after consultation with ADHS, to include reporting of enzyme immunoassay (EIA) results, greatly increasing the total number of reported cases. In late 2012, the same laboratory changed the testing platform used for EIAs, and in 2013 the number of cases reported statewide declined 55% compared to 2012.

Back to Report: Laboratory Data

Table 3. Reported cases and rates by county, 2017.

County	Cases	2017 Rates*	2012–2016 Avg. Rates*
Apache	30	41.3	22.7
Cochise	31	24.1	38.8
Coconino	32	22.2	24.8
Gila	62	112.8	75.9
Graham	18	47.0**	51.2
Greenlee	3	27.4**	27.5
La Paz	19	88.0**	76.9
Maricopa	4,932	116.8	140.0
Mohave	67	31.9	32.4
Navajo	46	41.3	36.8
Pima	1,022	99.6	110.5
Pinal	518	121.1	139.8
Santa Cruz	17	33.0**	30.7
Yavapai	60	26.6	23.5
Yuma	28	12.6	13.3
Arizona	**6,885**	**98.8**	**114.9**

*Reported cases per 100,000 population
**Rates are based on counts fewer than 20, which are unreliable

Back to Report: Geographic Distribution

Table 4. Reported cases and rates by age groups, 2017.

Age Group* (years)	Cases	Rates**
<5	23	5.2
5–14	190	20.7
15–24	466	48.7
25–34	663	70.8
35–44	789	93.0
45–54	1,068	125.6
55–64	1,314	157.3
65–74	1,370	199.3
75–84	750	211.9
>84	250	181.6

*Age could not be ascertained for 2 cases (approximately 0.03% of all cases).
**Reported cases per 100,000 population

Back to Report: Age

Table 5. Cases and rates by sex, 2017.

Sex	Cases	Percent of total	Rates*
Female	3,305	48.1%	94.3
Male	3,567	51.9%	103.1
Unknown	13	0.2%	---

*Reported cases per 100,000 population

Back to Report: Sex

Table 6. Race or ethnicity of reported cases, 2017.

Race or ethnicity	Cases	Percent of total	Percent of cases with known race or ethnicity
Asian or Pacific Islander	91	1.3%	4.6%
Black	117	1.7%	5.9%
Hispanic or Latino	292	4.2%	14.7%
Native American	156	2.3%	7.9%
White	1,275	18.5%	64.1%
Other	57	0.8%	2.9%
Unknown	4,897	71.1%	---

Back to Report: Race/Ethnicity

Table 7. County rates of hospitalization with a primary diagnosis of valley fever, 2017.

County	Hospitalization Rates*
Apache	4.1**
Cochise	0.8**
Coconino	0.0**
Gila	7.3**
Graham	2.6**
Greenlee	0.0**
La Paz	13.9**
Maricopa	12.7
Mohave	2.9**
Navajo	3.6**
Pima	9.2
Pinal	14.7
Santa Cruz	1.9**
Yavapai	3.1**
Yuma	1.4**
Arizona	**10.4**

*Reported cases per 100,000 population
**Rates are based on counts fewer than 20, which are unreliable

Back to Report: Hospitalizations