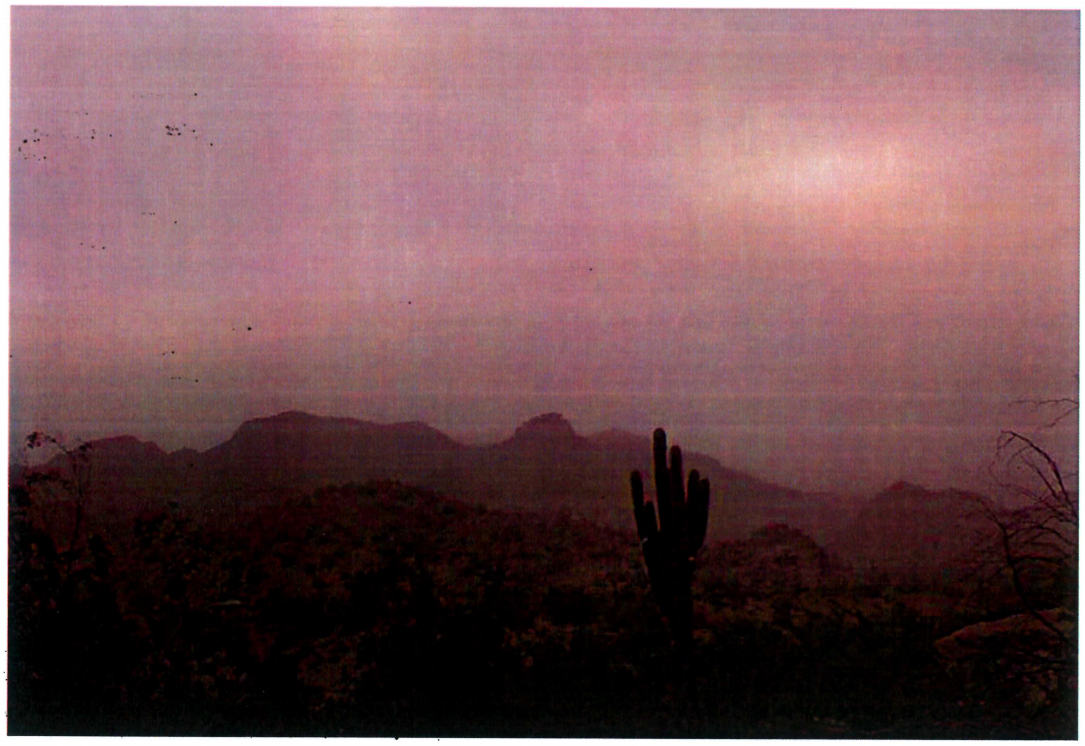
Valley Fever Annual Report 2007



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October 2008

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Executive Summary

Valley fever is caused by a fungus that is prevalent in the soil throughout the southwestern United States, Mexico, Central and South America. Although valley fever is often thought of as a mild and self-limited respiratory disease, it can cause severe, prolonged disease in those afflicted. In some cases, the disease may affect the brain and spinal cord, skin, bones, and other organs, resulting in serious, debilitating disease, or even death. Fortunately, the disease is not spread person–to-person, but there is no cure or vaccine for Valley Fever. Treatment has many side effects and must be continued for many months or even life-long.

Arizona serves as a model for other endemic U.S. states and is the primary driver for recent changes in the national valley fever surveillance definition. The Arizona Department of Health Services receives reports of patients with valley fever from laboratories and health care providers statewide. Analysis of these reports shows that:

- Arizona accounts for 60% of all reported cases in the country
- 95% of Arizona cases reside in Maricopa, Pima and Pinal counties
- Valley fever is the fourth most frequently reported infectious disease in Arizona
- Cases reported in Arizona have almost tripled, from 1,781 cases in 1999 to 4,832 cases in 2007 (75 per 100,000 population)
- The highest age-adjusted rates of valley fever occur in Sun City and Sun City West
- The increase in cases is evidence of an epidemic of valley fever in Arizona

In 2008, to help address this epidemic of valley fever, ADHS received funds for valley fever prevention and control from a legislative appropriation and from the Centers for Disease Control and Prevention (CDC). These funds enabled ADHS, for the first time, to hire staff in an effort to better understand the impact and local risk factors of valley fever, and improve knowledge, prevention and control of this disease.

ADHS conducted an enhanced surveillance study, by interviewing 10% of all Arizonans diagnosed with valley fever in 2007. The interviews reveal the significant impact of the disease among Arizonans.

- People missed an average of 1 month of work, for a total of 4,918 days
- People with valley fever could not perform daily activities for an average of 3 months or a total of 92 years
- People with valley fever waited an average of 44 days before seeking healthcare
- Patients saw their doctors three times before they were tested for valley fever
- On average, patients suffered symptoms of valley fever for half a year; although many were sick longer
- There were $86 million in hospital charges for valley fever cases in 2007

A telephone survey of a representative sample of the population statewide was conducted to evaluate Arizonans' awareness of valley fever and its risk factors. These results were compared with the enhanced surveillance findings.

- One in five Arizonans had never heard of valley fever

- Only 6% of patients heard about valley fever from their doctors, whereas 11% Arizonans heard of it from their doctors
- Arizonans were more likely to hear about valley fever from the media, while patients heard about it from their social circles

ADHS also performed a study of Arizona physicians.

- One out of three physicians has major gaps in their knowledge about valley fever, how to diagnose and how to treat the disease
- One third of health care providers are unaware that valley fever is reportable
- Only one in four patients with community acquired pneumonia (CAP) were tested for valley fever despite ADHS recommendations to test these patients

In response to these findings, ADHS launched a proactive educational campaign including brochures, posters, a documentary video, a website, and Governor's proclamations targeting the public, physicians, pharmacies, hospital emergency departments to:

- Raise awareness and provide information on the impact of valley fever in Arizona
- Remind physicians to test patients with CAP for valley fever
- Prompt patients to ask their physicians to test them for valley fever
- Tell the stories of real patients with valley fever

ADHS has launched a major initiative to investigate the high rates of valley fever in northwest Phoenix.

- A preliminary analysis comparing mining and non-mining areas revealed no association between mining and valley fever
- A CDC investigation team will arrive in November 2008 to determine risk factors for valley fever in northwest Phoenix.

Collaboration with partners is essential to develop better diagnostic tests, curative treatments and a vaccine for valley fever. Toward that end, ADHS is working with:

- CDC as part of a national public health valley fever task force to coordinate public health strategies for this disease
- Valley Fever Center for Excellence (VFCE) on a promising new drug Nikkomycin Z and to educate the community and physicians in Arizona
- Translational Genomics (TGen) on rapid molecular-based diagnostic tests and strain typing
- University of Arizona to examine influences of climate and other environmental factors affecting the incidence of valley fever
- University of Arizona School of Medicine to develop a vaccine to prevent valley fever

Arizonans are demanding action to investigate and prevent valley fever. ADHS receives hundreds of inquiries from the public and from concerned community groups. These factors highlight the important impact that valley fever has on Arizona and underscores the need to further investigate and control this epidemic.

Introduction

Valley fever has affected inhabitants in the Southwestern desert region for thousands of years[1]; the first case in Arizona was reported in 1938.[2] Coccidioidomycosis, often referred to as valley fever or cocci, is a re-emerging fungal disease endemic to the southwestern United States, parts of Mexico, Central and South America. Valley fever is caused by the fungus *Coccidioides*. Infection usually results in a mild respiratory disease, normally cleared without treatment. However, in some people, it can cause severe illness by affecting the lungs, central nervous system, skin, bones, and other organs, often resulting in pain, suffering, and sometimes death. There is no cure for valley fever and treatment has many side effects.

In 2008, the ADHS received a legislative appropriation as well as one-time funds from the Centers for Disease Control and Prevention (CDC) for valley fever prevention and control. These funds enabled ADHS, for the first time, to hire staff and further investigate valley fever to understand the impact and local risk factors of disease, in an effort to improve knowledge, prevention and control of this disease. Many of these activities are highlighted below.

Phoenix dust storm, September 11, 2008. Photo: Sonya Shannon, ADHS

[1] Harrison WR, Merbs CF, Leathers CR. Evidence of coccidioidomycosis in the skeleton of an ancient Arizona Indian. J Infect Dis 1991;164:436-7.
[2] Arizona State Department of Health. Arizona Public Health News: Coccidioidomycosis in Arizona. 1959; Vol 52 No 2.

Epidemiology

Every year, an estimated 150,000 people in the United States become infected with valley fever[3] and approximately 50,000 become ill. In the United States, Arizona has the highest number of reported cases, accounting for sixty percent of all US cases. Approximately 5,000 Arizonans are identified with valley fever each year by public health surveillance, which is significantly less than the 30,000 cases estimated to occur annually in Arizona. This highlights the fact that public health surveillance captures only a fraction of persons with valley fever. This is likely due to the fact that individuals may not seek care for their disease or may not receive diagnostic testing for valley fever if they do seek care.

Valley fever fungus is found in the soil of arid and semiarid regions. In the desert environment, the fungus grows in the top 2-8 inches of soil and produces spores that can be released into the air.[4] When the ground is disrupted, fungal spores can get picked up by the wind and travel for miles. Disturbance of the soil can occur due to strong winds, construction, farming, landscaping, gardening, driving on unpaved areas, and other activities.

Valley fever is acquired by inhaling spores from the environment, and is not spread from person to person. Once the spores are inhaled, they can cause infection in the lungs. Symptoms typically occur one to four weeks after exposure, and can include fever, cough, fatigue, shortness of breath, headaches, joint/muscle aches, and rash. Most people infected with valley fever (60%) have mild symptoms or have no symptoms at all. The remaining 40% can have symptoms lasting months or years. Most people with healthy immune systems can fight off the disease, often without treatment, providing lifelong immunity; however, in a small percentage of cases, symptoms may recur. In < 5% of those who are infected, valley fever can spread or "disseminate" to other parts of the body, such as the bones, skin, joints or brain. Persons who have compromised immune systems or are pregnant are at higher risk for disseminated disease. These individuals require lifelong treatment and their disease can be very serious, or even fatal. In 2007, there were 36 deaths due to valley fever, and the mortality rate was 0.6 deaths per 100,000 population.

Rising Rates

Arizona physicians first started reporting cases of valley fever to the Arizona Department of Health Services (ADHS) in the 1930's. In 1997, laboratory reporting of positive valley fever test results was mandated, leading to a sharp increase in reported cases. However, the number of cases reported has continued to rise over the last decade (Figure 1). The highest number of coccidioidomycosis cases reported in Arizona was in 2006 with a total of 5,535 cases reported, and a rate of 89 cases per 100,000 population. In 2007, a total of 4,832 coccidioidomycosis cases were reported, with a rate of 75 cases per 100,000 population.

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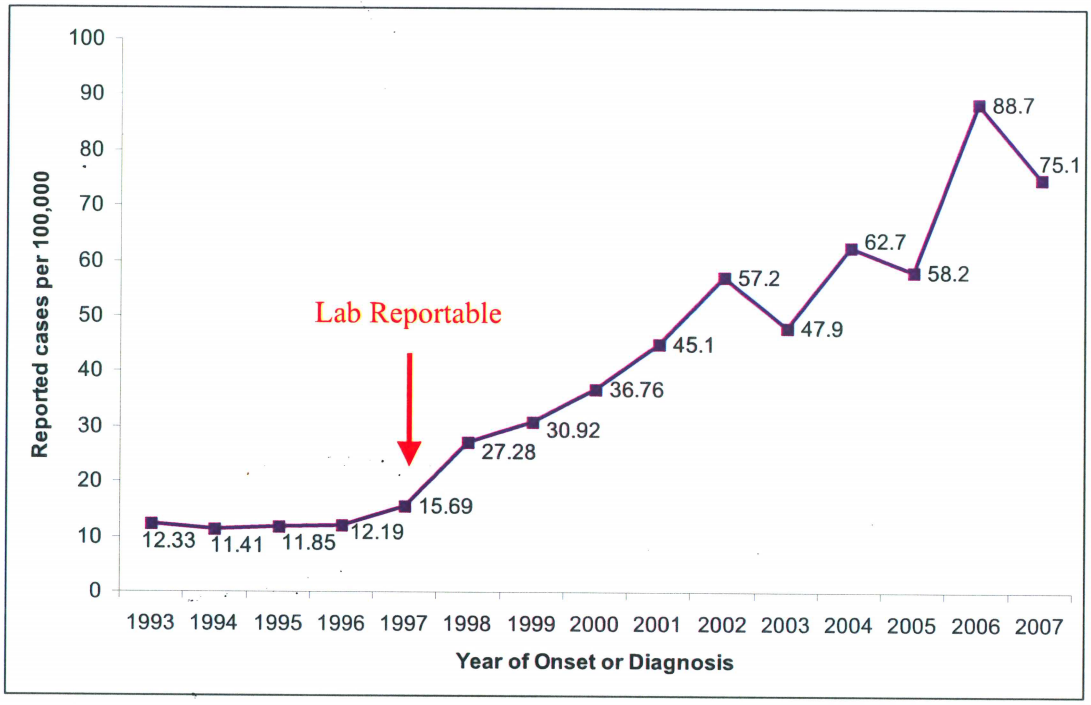
[3] Galgiani JN, Ampel NM, Blair JE, Catanzaro A, Johnson RH, Stevens DA, Williams PL. Coccidioidomycosis. Clin Infect Dis 2005;41:1217-23.

[4] Fisher FS, Bultman MW, Pappagianis D. Operational Guidelines for Geological Fieldwork in Areas Endemic for Coccidioidomycosis (Valley Fever). US Geological Survey Open-File Report v1 2000.

Figure 1. Rates of Reported Coccidioidomycosis Cases in Arizona from 1993-2007.



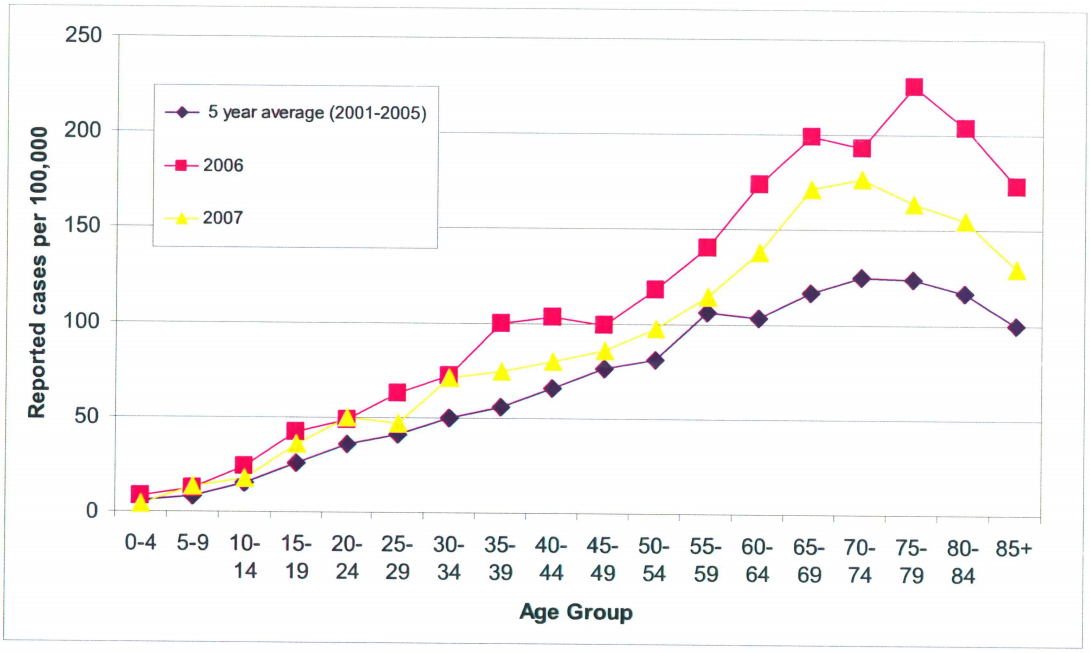
Several factors may account for the continued increase in coccidioidomycosis. First, increased awareness in the general public and healthcare community may lead to more requests for laboratory testing, and in turn, more diagnoses of valley fever. Secondly, large numbers of susceptible individuals, with no prior history of exposure, are moving into endemic areas, putting these people at increased risk for cocci infection. Many of these individuals are older than 65 years, which is the age group most affected in Arizona, based on our surveillance data. Older persons and those with weakened immune systems are more likely to experience severe valley fever disease, which may increase the likelihood that they seek care for their symptoms. Other factors, such as climate change and construction, might also contribute to the increased number of cocci cases; however the evidence for this is not definitive. Construction disrupts the top layer of soil, and, theoretically, could release valley fever spores into the air, while changes in climate patterns may result in increased fungal growth and distribution of the spores. Likely, a combination of many factors has contributed to the increased rates of valley fever seen in recent years.

Demographics

In 2007, several differences were noted among age and ethnic groups. The age of coccidioidomycosis cases ranged from 38 days to 99 years old, with an average age of 51 years. The highest rates of valley fever occurred among the 65-84 year age groups; rates among Arizonans age 65 and older are more than twice those in the general population (163 cases per

100,000 vs. 75 per 100,000, respectively) (Figure 2). Fifty-four percent of the reported coccidioidomycosis cases were male, with a rate of 81 per 100,000 population, while 46% of the cases were female, with a rate of 68 per 100,000. Higher rates in males are consistent with data from previous years in Arizona. When examining cocci data by race or ethnicity, the highest rates of valley fever were seen in African Americans at 53 per 100,000 population (Appendix A). However, only 36% of the coccidioidomycosis cases reported to the Arizona Department of Health Services contained information about race.

Figure 2. Valley Fever Rates by Age Group, Arizona 2007.



Seasonality

In general, valley fever infections tend to peak after the rainy and windy monsoon season. [5] The rainfall allows the fungus to grow in the soil and as the soil dries, fungal spores break off and become airborne. Reports of coccidioidomycosis in Arizona typically peak between October and January with a smaller peak from June to August (Figure 3). The seasonality of valley fever in Arizona differs from that of southern California, where infection rates tend to be higher in the later summer and early fall period.[6]

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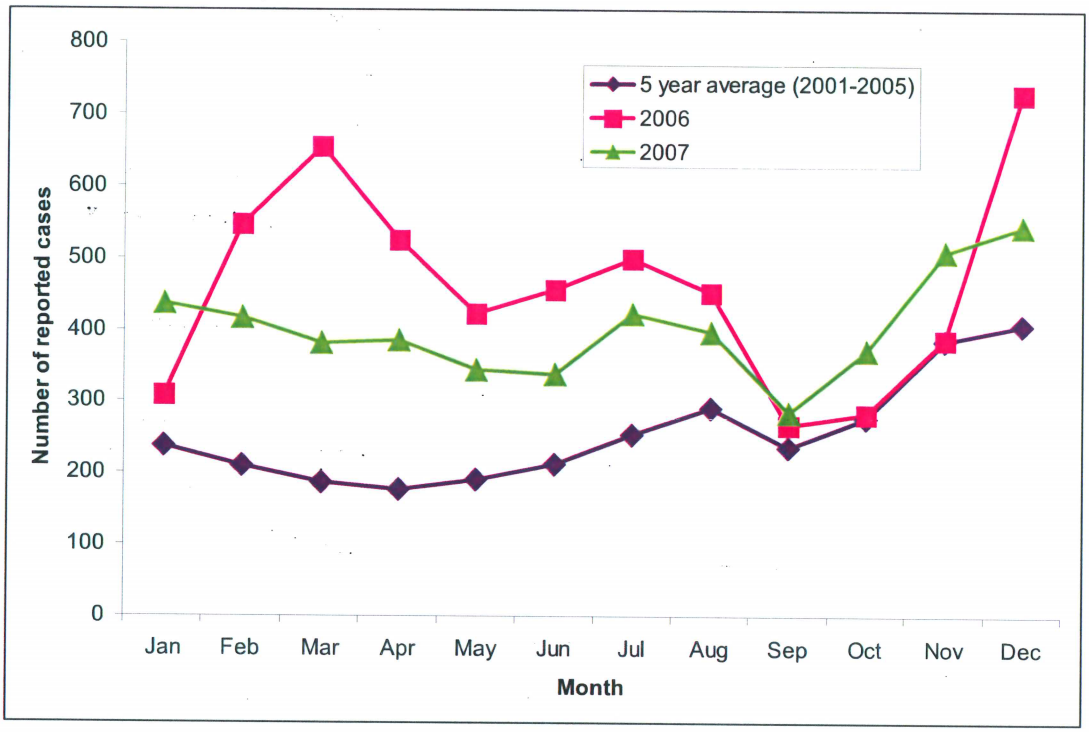
[5] Heymann DL. Control of Communicable Diseases Manual, 18th edition. APHA, 2004.
[6] Smith CE, Beard RR, Whiting EG, Rosenberg HG. Effect of Season and Dust Control on Coccidioidomycosis. JAMA 1946;132:833-8.

Figure 3. Reported Coccidioidomycosis Cases by Month, Arizona 2001-2007.



Statewide Distribution

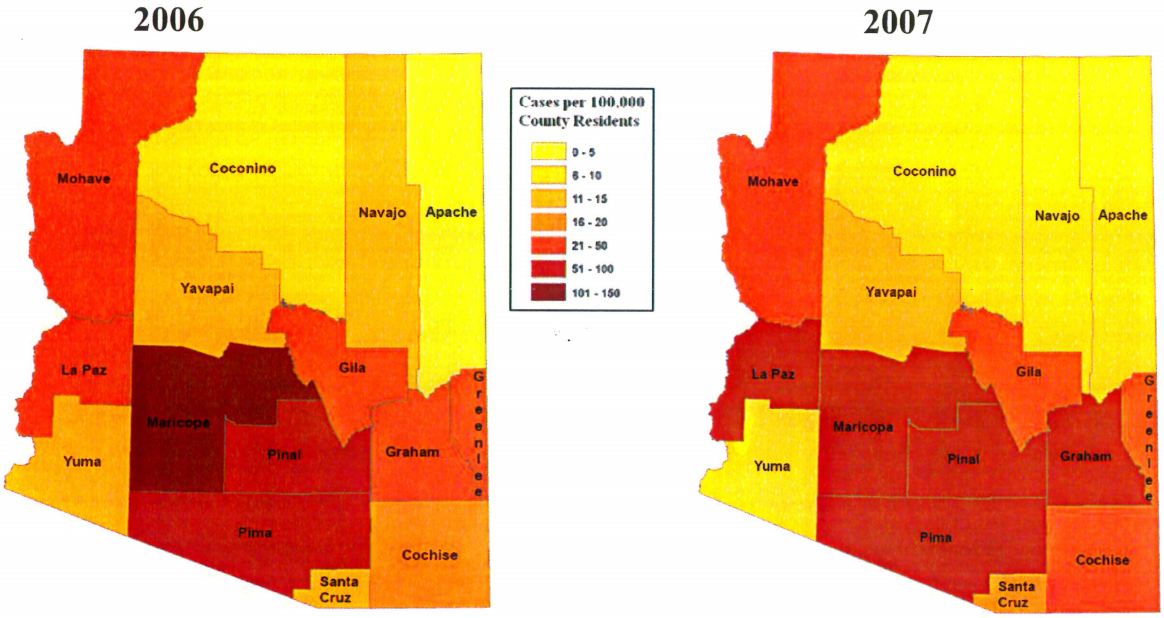
Valley fever is considered endemic to all of Arizona; however, the highest rates occur in Maricopa, Pinal, and Pima (Figure 4 and Appendix B) Counties. In 2007, the highest rates occurred in Pima County (90 per 100,000 population) followed by Maricopa County (89 per 100,000 population) and Pinal County (87 per 100,000 population).

When reported valley fever cases were examined by community, some of the highest rates of valley fever in Arizona were identified in the northwest Phoenix metropolitan area, including the communities of Sun City, Sun City West, Wickenburg, and Surprise. The demographics of Sun City and Sun City West were dramatically different in comparison to other areas of Maricopa County. More than 80% of the population in Sun City and Sun City West were over the age of 65 years, as compared to only 11% of the Maricopa County population.

Because valley fever was more frequently reported in individuals over 65 years of age, rates of valley fever were adjusted by age for each Arizona community during 2006 and 2007 (Appendix C, D). Age-adjusting is a statistical method used to compare communities that are significantly older or younger than other communities and provides an opportunity to determine if valley fever rates would be similar if the populations were of similar age. After age-adjusting, the rates for Sun City and Sun City West were still among the highest in the state. These data suggest that age alone does not explain the increased rates of valley fever in Sun City and Sun City West. The

ADHS, Maricopa County Department of Public Health and CDC plan to conduct further studies to examine why the rates are highest in these communities.

Figure 4. Valley Fever Activity by County, Arizona, 2006 and 2007.



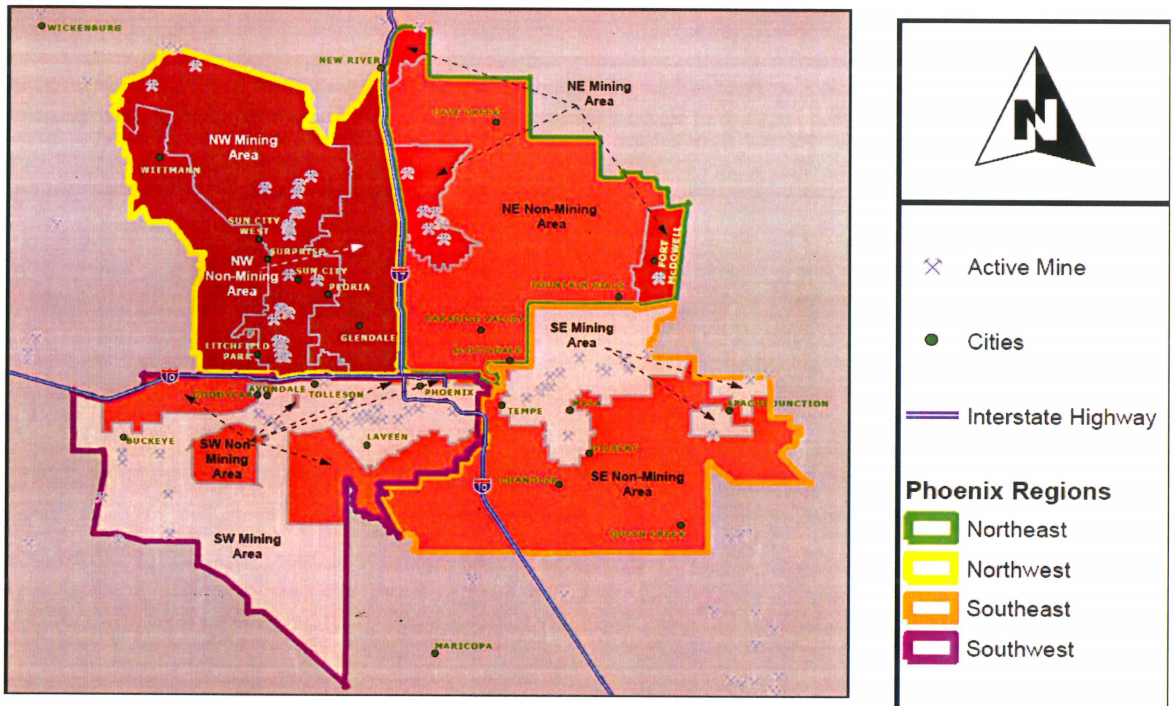
Phoenix Mining Analysis

Multiple sand and gravel mining operations are located throughout Arizona, and some of these mining areas are located in counties with the highest rates of valley fever. While these mining operations can produce large amounts of dust, it is unknown if this actually increases the risk for valley fever. It is known however, that the *Coccidioides* fungus grows only in the top layers of soil - typically 2-8 inches below the surface. Sand and gravel mining operations work mainly at depths greater than two feet. Therefore, in theory, mining facilities should pose little risk for increased valley fever infection to those in the surrounding areas.

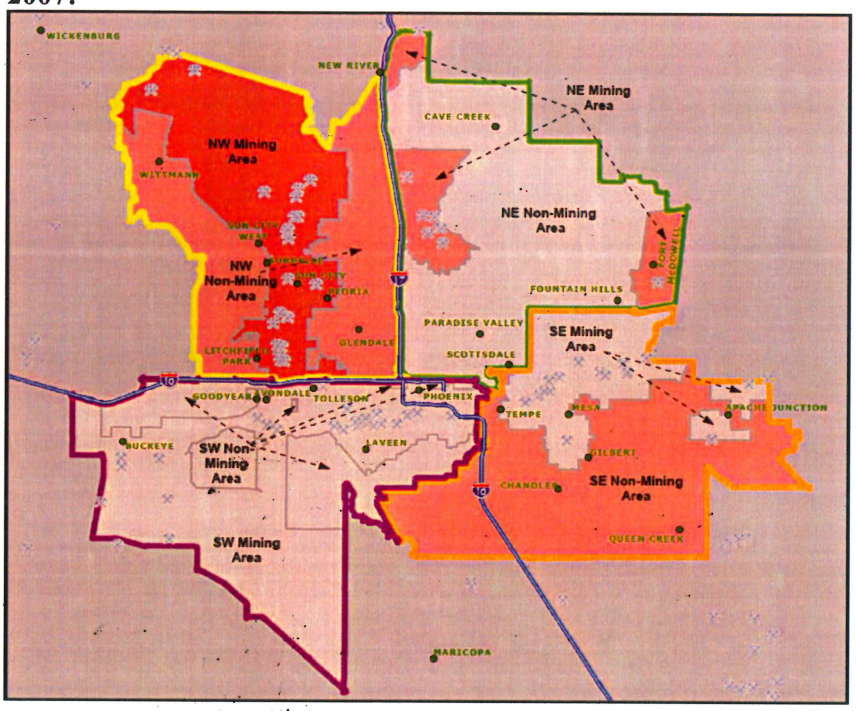
Due to rising community concern that mining may be the cause of increased valley fever rates in certain northwest Phoenix communities, an investigation of valley fever rates in mining areas of the Phoenix metropolitan area was conducted. To analyze the relationship between valley fever and mining operations, the Phoenix metropolitan area was divided into four regions – Northwest, Southwest, Northeast and Southeast (Figure 5, Appendix E, F, and G). Within these regions, communities located within three miles of a mine were designated as mining areas. Communities located greater than 3 miles from a mine were designated as non-mining areas. Age-adjusted rates of valley fever in mining areas were compared to those of non-mining areas in each region. The only region with a significant difference between mining areas and non-mining areas was the Southeast Region, where lower rates of valley fever were reported closer to the mines. These results suggest that mining is not a major contributor to valley fever infections.

Figure 5. Valley Fever Rates in Mining and Non-Mining Areas of the Phoenix Metropolitan Area, 2006 & 2007.

2006:



2007:



Enhanced Surveillance

ADHS monitors physician and laboratory reports and obtained basic demographic information about cases of coccidioidomycosis to follow trends and identify outbreaks. In 2007, ADHS initiated enhanced coccidioidomycosis surveillance to learn more about individuals diagnosed with valley fever and to better understand the impact of the disease on Arizonans. Arizona is the first and only state to initiate this type of in-depth coccidioidomycosis surveillance.

One out of every ten Arizona coccidioidomycosis cases reported from January 2007 to February 2008 was contacted and interviewed with a standardized questionnaire. Interviewees were asked about their signs and symptoms of valley fever, healthcare-seeking behavior, medical treatment information, and effects of the disease on their daily lives. A total of 493 people were interviewed during the enhanced surveillance investigation.

Case Definition

For a report of valley fever to be classified as a case by public health, it has to meet several criteria specified in a case definition. The coccidioidomycosis case definition utilized by the Council of State and Territorial Epidemiologists (CSTE) and the Centers for Disease Control and Prevention (CDC) requires both compatible clinical symptoms and laboratory confirmation[7]. Arizona has adopted a modified coccidioidomycosis case definition that includes only the laboratory criteria for several reasons. First, patient symptoms and clinical description are rarely reported to public health. ADHS attempts to capture every case of diagnosed valley fever, even if clinical information is unavailable. Our experience suggests that the majority of valley fever tests are performed on symptomatic patients. Lastly, since 60% of all US valley fever is reported in Arizona with approximately 5000 cases per year, ADHS does not have the resources to investigate the signs and symptoms of each case to determine if it meets the clinical description of the case definition. Thus, any positive valley fever test is classified as a case.

The data from the enhanced surveillance were used to validate Arizona's decision to change to a laboratory-based case definition. When valley fever cases identified only by a positive cocci laboratory test were interviewed, 95% of them had symptoms consistent with the CSTE case definition, indicating that almost all of Arizona cases meet the national case definition. Elimination of clinical criteria from the coccidioidomycosis case definition allows for easier surveillance methods and requires minimal resources, while still capturing the maximum possible number of true cases. The findings from the enhanced surveillance study will be used to propose changes to the national CSTE coccidioidomycosis case definition in other endemic areas of the US, to increase timeliness and accuracy of cocci reporting.

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[7] Centers for Disease Control. Case Definitions for Infectious Conditions Under Public Health Surveillance, Coccidioidomycosis (Valley Fever), 2008. http://www.cdc.gov/ncphi/disss/nndss/casedef/coccidioid2008.htm. Accessed October 3, 2008.

Symptoms

Enhanced surveillance provided ADHS with a better understanding of the symptoms that affect people with valley fever. Figure 6 shows that 55% of cases interviewed had seven or more symptoms associated with valley fever. The most common symptoms people experienced included fatigue, cough, shortness of breath and fever (Figure 7).

Figure 6. Total Number of Symptoms of Arizonans with Valley Fever (n=493).

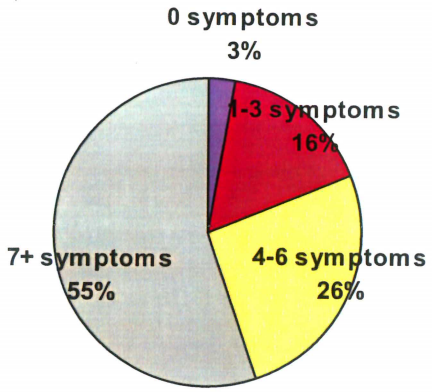
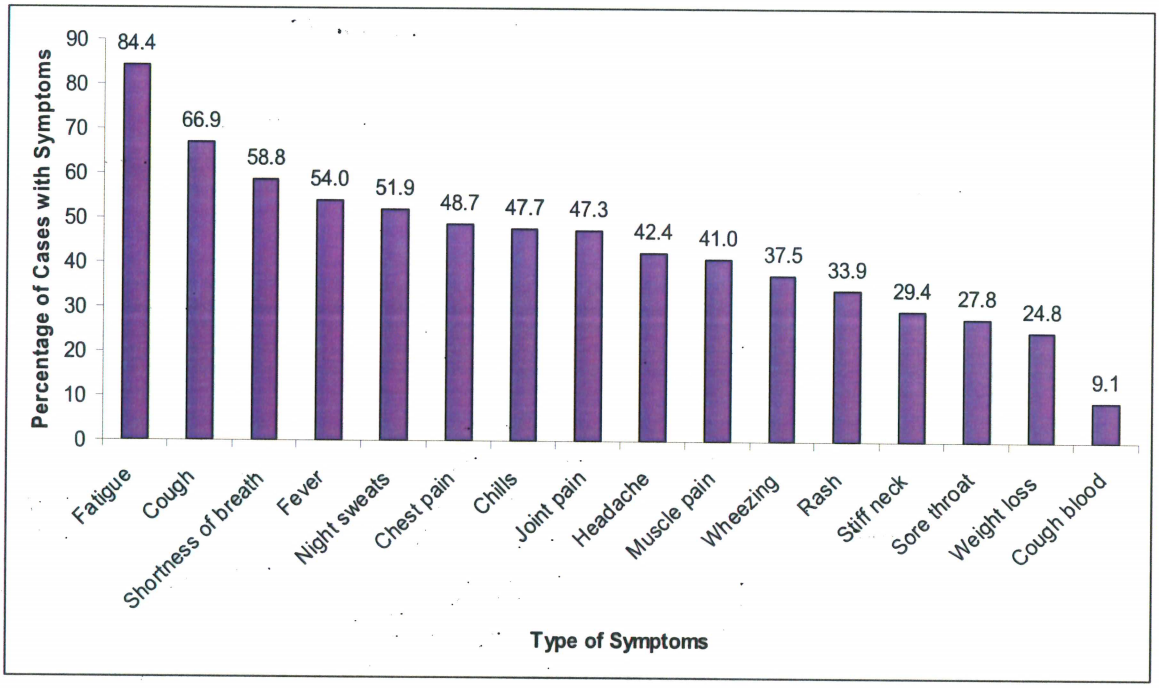


Figure 7. Most Commonly Reported Symptoms of Valley Fever Cases (n=493).



Impact on the Healthcare System

The enhanced surveillance data show the tremendous impact of valley fever on Arizona's healthcare system, in particular, emergency departments (Appendix H). Almost half of the people diagnosed with valley fever had at least one visit to the emergency room during the course of their illness, and a quarter of interviewed valley fever cases visited healthcare providers more than ten times (Figure 8). Over 40% of individuals were hospitalized overnight for their illness (Appendix I). Data from the Arizona Hospital Discharge Database show that in 2007, 1,735 valley fever-related hospital visits occurred, accounting for a total of $86 million in hospital charges. On average, it cost $50,000 per valley fever-related hospital visit. These data highlight the profound economic impact of valley fever on Arizonans.

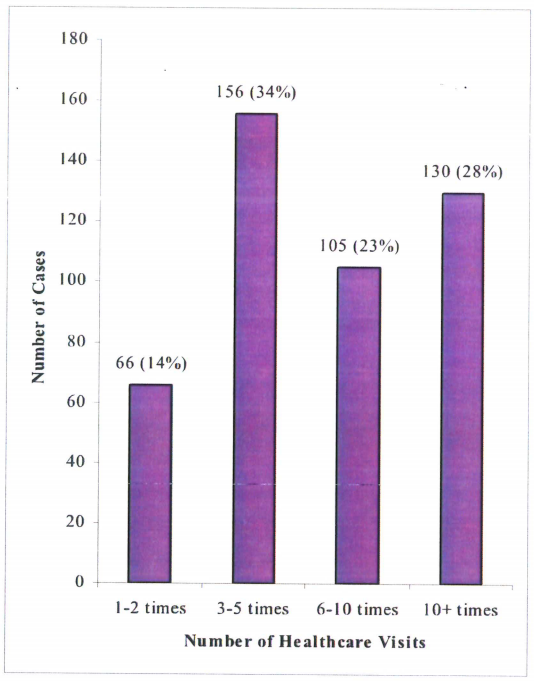


Figure 8. Number of Times Valley Fever Cases Visited a Healthcare Provider over the Course of Illness.

Impact on People

Valley fever also significantly impacts the lives of those who become ill, as symptoms of valley fever can be prolonged and debilitating. On average, each person interviewed had symptoms lasting 6 months, much longer than the flu or mononucleosis (mono). Likewise, the prolonged symptoms of valley fever adversely impact an individual's ability to work and perform daily activities. Arizonans diagnosed with valley fever missed an average of 1 month of work and were unable to perform normal daily activities for more than 3 months. Infection with cocci for these 493 Arizonans alone resulted in a total of 222 years of symptoms and 33,716 days during which patients could not perform their daily activities (Appendix J).

Delays in Diagnosis

The symptoms of coccidioidomycosis are similar to other common respiratory illnesses including severe colds and pneumonia, which makes it difficult for the public and physicians to distinguish between valley fever and these other illnesses. This often leads to delays in seeking care, testing and diagnosis. On average, people with valley fever waited 44 days before seeking healthcare for their symptoms. Additionally, the average time between seeking healthcare and getting diagnosed with valley fever was about five months (Appendix J). If a patient knew about valley fever prior to seeking healthcare, he or she was more likely to be diagnosed and treated earlier than those who were not familiar with the disease [79 days vs. 282 days, respectively ($p=0.04$)]. Our data also show that those who had prior knowledge

Behavioral Risk Factor Surveillance System

The Behavioral Risk Factor Surveillance System (BRFSS) conducts an annual population survey about health behaviors and opinions and is designed to represent the entire population of Arizona. In 2008, the survey included questions to evaluate the general public's awareness of valley fever and its risk factors. Despite the high rates of cocci in Arizona, the BRFSS data indicate a wide range of cocci awareness: One in five Arizonans had never heard of valley fever and sixty percent of Arizonans believe that valley fever is a significant health problem. Over a third of the general public did not know how valley fever is transmitted (Figure 9).

Statewide BRFSS data were compared with the coccidioidomycosis enhanced surveillance data to identify differences in knowledge about valley fever between those infected and the general public. People with valley fever interviewed through enhanced surveillance were more likely to learn about valley fever from their social circles, while those contacted through BRFSS were more likely to hear about valley fever from the media (Appendix K). Only 6% of case-patients heard about valley fever from their doctors, whereas 11% of the general public heard about it from their doctors.

People who answered the BRFSS survey lived in Arizona for an average of 26 years while cases with valley fever lived in Arizona for an average of 16 years. More cases reported with valley fever had lived in Arizona less than 10 years when compared to the general public (25% vs. 40% respectively) (Figure 10). These data indicate that people who acquired valley fever were more likely to live in Arizona for a shorter period of time, however, most case patients lived in Arizona for more than a decade before being diagnosed.

Figure 9. How is Valley Fever Transmitted?

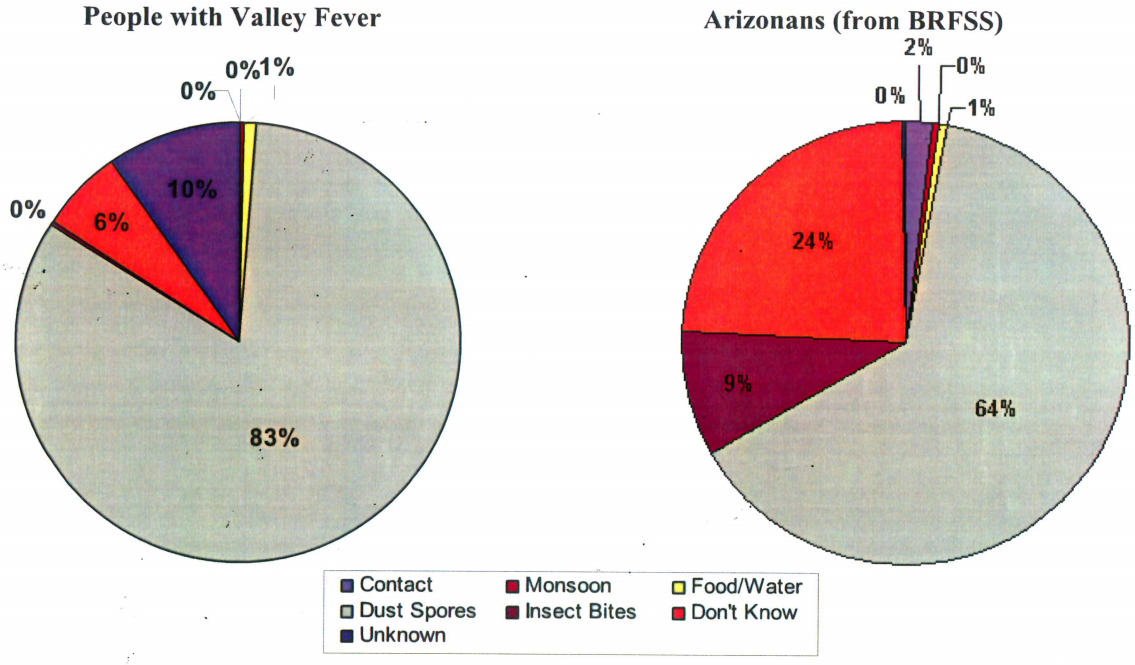
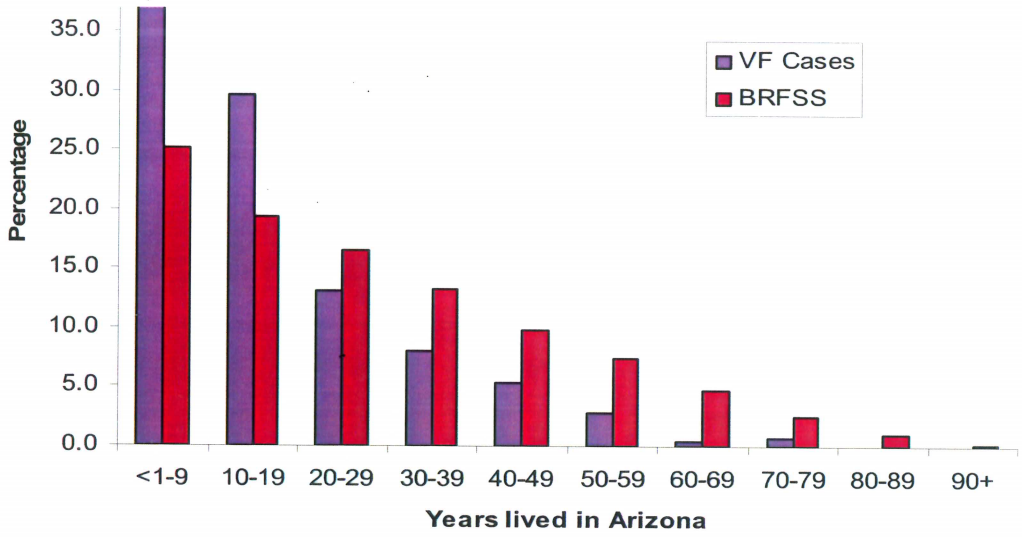
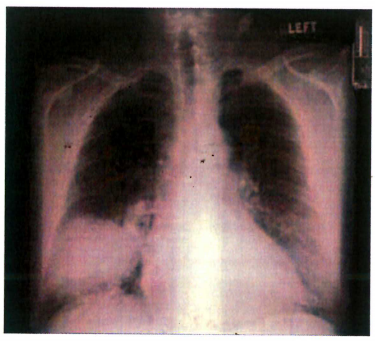


Figure 10. Length of Time Lived in Arizona: Valley Fever Cases Compared to Population (based on BRFSS).



Clinical Management / Physician Education

Both the enhanced surveillance data and the data attained from the BRFSS statewide survey show the importance of educating physicians and the public about valley fever. A study performed in Tucson, Arizona suggested nearly 30% of community-acquired pneumonia patients in areas endemic for cocci actually have valley fever.[8] In 2006, based on this study, ADHS recommended testing patients who presented with symptoms of community-acquired pneumonia for valley fever. This recommendation is important because misdiagnosis of valley fever can lead to unnecessary antibiotic treatment, delayed antifungal treatment, and to unrealistic expectations of symptom duration.



In 2007, Arizona physicians and nurse practitioners were surveyed in order to assess their knowledge, attitudes, and practices regarding diagnosis and treatment of valley fever. Questions were asked to evaluate recognition of symptoms, testing practices and treatment regimens. About one third of providers were not aware that valley fever is a reportable disease in Arizona and the same number of physicians were not sure if a valley fever vaccine is available. Less than half of providers scored at least 70% correct on valley fever treatment questions. Providers who scored ≥70% on valley fever knowledge and treatment questions were twice as likely to have received valley fever Continuing Medical Education in the prior twelve months.

The results of the healthcare provider survey highlighted the need for and value of accurate valley fever medical education for Arizona providers. Based on these results, ADHS developed and implemented several educational campaigns and activities for healthcare providers. Some of these activities included: presentations on valley fever by ADHS infectious disease physicians to physician groups across the state; grand round presentations to hospitals; and development of a brochure for healthcare providers with the recommendation to test patients with community-acquired pneumonia for valley fever. These brochures were sent to 8,000 primary care providers throughout the state of Arizona.

In 2007, data from the enhanced surveillance questionnaire indicated 23% of people with valley fever first sought care for their symptoms at an emergency department and approximately half of the patients required care from an emergency room (ER) physician at some point during their illness. To further evaluate the number of patients presenting with community-acquired pneumonia in Tucson emergency rooms, and whether they were tested for valley fever, ADHS conducted an investigation in collaboration with CDC. A second objective was to determine the unmeasured burden of valley fever among these patients diagnosed with community-acquired pneumonia. To achieve the objectives, medical records of patients diagnosed with community-acquired pneumonia in the ER were reviewed to

[8] Valdevia L, Nix D, Wright M, Lindberg E, Fagan T, Lieberman D, et al. Coccidioidomycosis as a common cause of community-acquired pneumonia. Emerg Infect Dis. 2006;12:958-62.

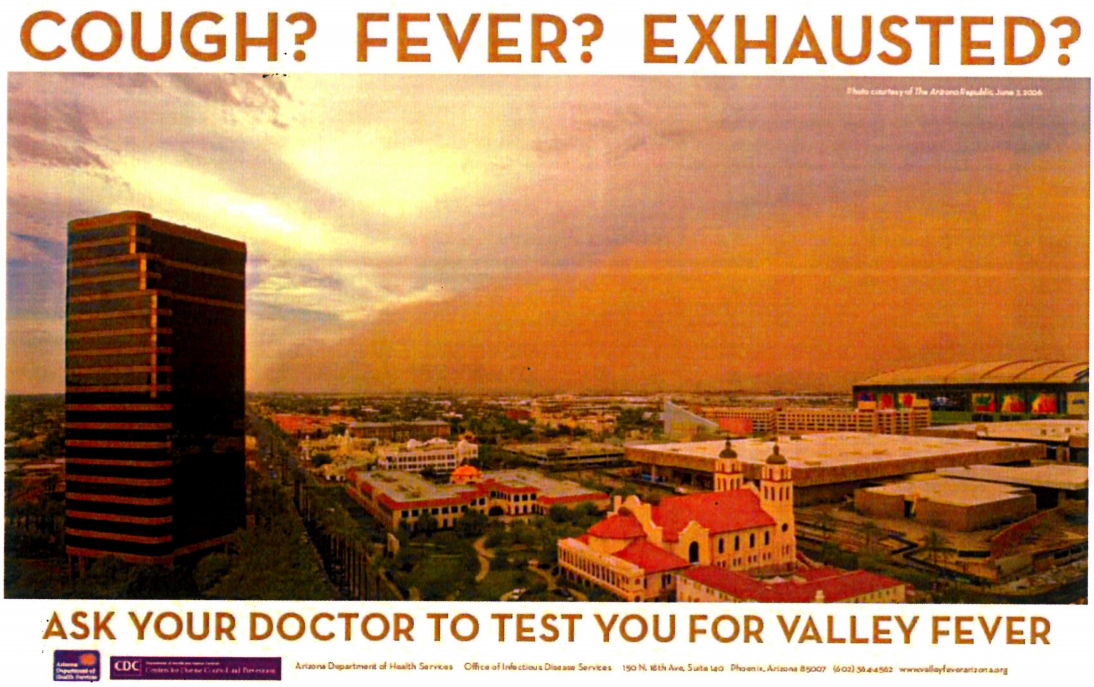
determine if testing for valley fever had been performed and whether the results were positive. The review indicated that only one fourth of pneumonia patients seen in the ER were tested, despite ADHS recommendations to test these patients for valley fever. An educational campaign directed towards emergency room physicians was initiated and a poster prompting testing of community-acquired pneumonia patients for valley fever was developed by ADHS and CDC and placed in Arizona emergency departments.

Public Education

Data from both the BRFSS and enhanced surveillance studies highlighted important gaps in the public's knowledge of valley fever and its transmission. These gaps are likely responsible for delays in patients seeking care for their symptoms. To fill in these knowledge gaps, ADHS, in conjunction with the Valley Fever Center for Excellence (VFCE), produced an educational brochure to increase knowledge of valley fever among Arizonans. This brochure contains accurate and easy-to-understand information about valley fever, its transmission and symptoms, and where to get further information about the disease. It is being distributed to the public by the Valley Fever Center for Excellence, healthcare providers, valley fever community advocates, and commercial pharmacies. ADHS also created a poster for hospitals, outpatient clinics and other healthcare facilities to encourage people with valley fever symptoms to request testing from their healthcare providers (Figure 11).

To reach a larger audience in Arizona, ADHS produced a valley fever documentary video to educate the public about the disease through stories of real people diagnosed with valley fever. The goal is to air the video on local public television stations, post it on the websites of ADHS and VFCE, and hopefully share it with public libraries and schools in the coming year.

Figure 11. ADHS Coccidioidomycosis Educational Poster.



Partnerships

ADHS works with various partners to advance knowledge of and research in coccidioidomycosis. In 2007, ADHS continued its annual partnership with the Valley Fever Center for Excellence to present public and physician educational conferences during Valley Fever Awareness Week. This annual week-long event is held to increase awareness of valley fever among Arizona physicians, public health officials, and interested general public. Topics included new valley fever treatment and vaccine research developments, the impact of valley fever on Arizona's citizens and animals and the importance of testing pneumonia patients for valley fever. ADHS is also currently working with the University of Arizona and the Valley Fever Center for Excellence to provide valley fever education through an online Continuing Medical Education course.

In order to provide educational opportunities to students and to learn more about public health aspects of valley fever, ADHS works with Arizona universities and medical schools to support student internships. For example, one medical student from the University of Arizona is conducting a study on valley fever laboratory reporting to validate the state's valley fever surveillance system and compare the predictive value of different tests.

ADHS is also an active member of a nationwide public health valley fever task force coordinated by CDC. This group involves epidemiologists from all states where valley fever is endemic in the US. Thus far, the task force has successfully changed the CSTE coccidioidomycosis case definition to more accurately reflect the science of the disease. As mentioned previously, the task force is awaiting presentation of Arizona's valley fever enhanced surveillance data, as well as surveillance data from endemic areas in California, to determine if the clinical criteria should be removed from the current CSTE case definition.

In addition to educational and public health activities, ADHS is partnering with organizations, such as Translational Genomics Research Institute (T-Gen), to improve diagnostic testing for coccidioidomycosis. ADHS is also working with T-Gen to develop environmental testing techniques to identify the *Coccidioides* fungus in the soil, which will ultimately assist public health in targeting valley fever interventions.

Future Directions

ADHS is partnering with Maricopa County Department of Public Health and CDC in order to determine why the Sun City and Sun City West areas in Maricopa County have extremely high valley fever rates, a team of CDC epidemiologists will visit Arizona in November 2008 to investigate potential risk factors of valley fever unique to these areas in the Northwest Valley. The information learned from the investigation will be used to target valley fever education and identify prevention strategies in these areas.

ADHS will continue to partner with the University of Arizona, VFCE, T-Gen, CDC and other states with endemic valley fever to learn more about this important disease and determine the best way to target public health interventions.

APPENDIX

Appendix A. Race and Ethnicity Distribution of Valley Fever Cases compared to Arizona Demographics*, 2007.

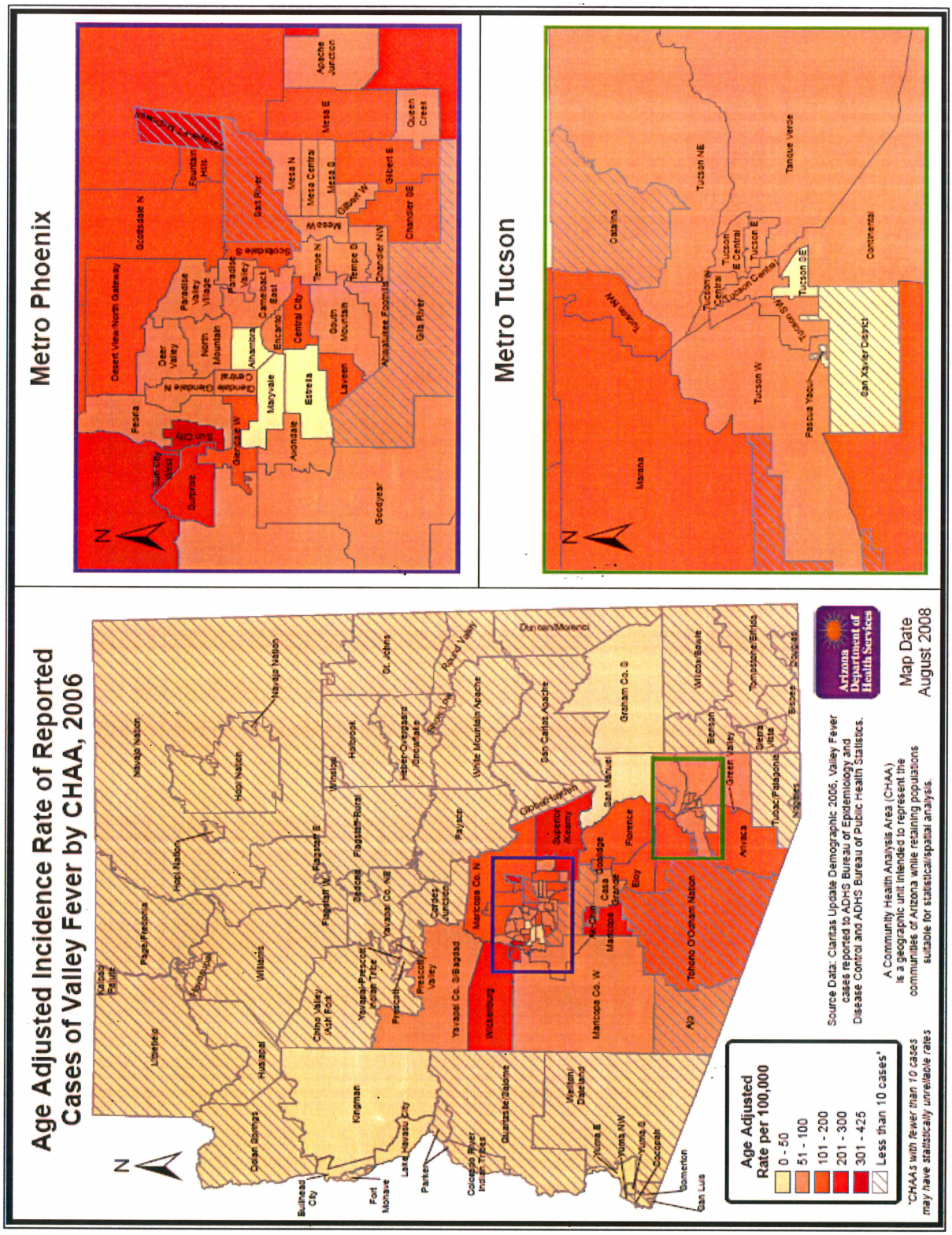
Race	2007 (n=1,726)	2007 Demographics (n=6,432,007)	Rate per 100,000
American Indian/Alaska Native	95 (5.5%)	337,764 (5.3%)	28
Asian/Hawaiian/Pacific Island	52 (3.0%)	169,780 (2.6%)	31
Black/African-American	136 (7.9%)	253,477 (3.9%)	53
White	1,443 (83.6%)	3,872,764 (60.2%)**	37
Ethnicity	**2007 (n=4,334)**	**2007 Demographics (n=6,432,007)**	**Rate per 100,000**
Hispanic	277 (6.4%)	1,798,222 (28.0%)	15
Not Hispanic	872 (20.1%)	4,633,785 (72.0%)	19
Unknown	3,185 (73.5%)	---	---

*Arizona Vital Statistics uses five categories for race/ethnicity: American Indian/Alaska Native, Asian/Pacific Islander, Black/African-American, White non-Hispanic and Hispanic/Latino ethnicity.
**For 2007 demographics for the state of Arizona, white means white non-Hispanic.

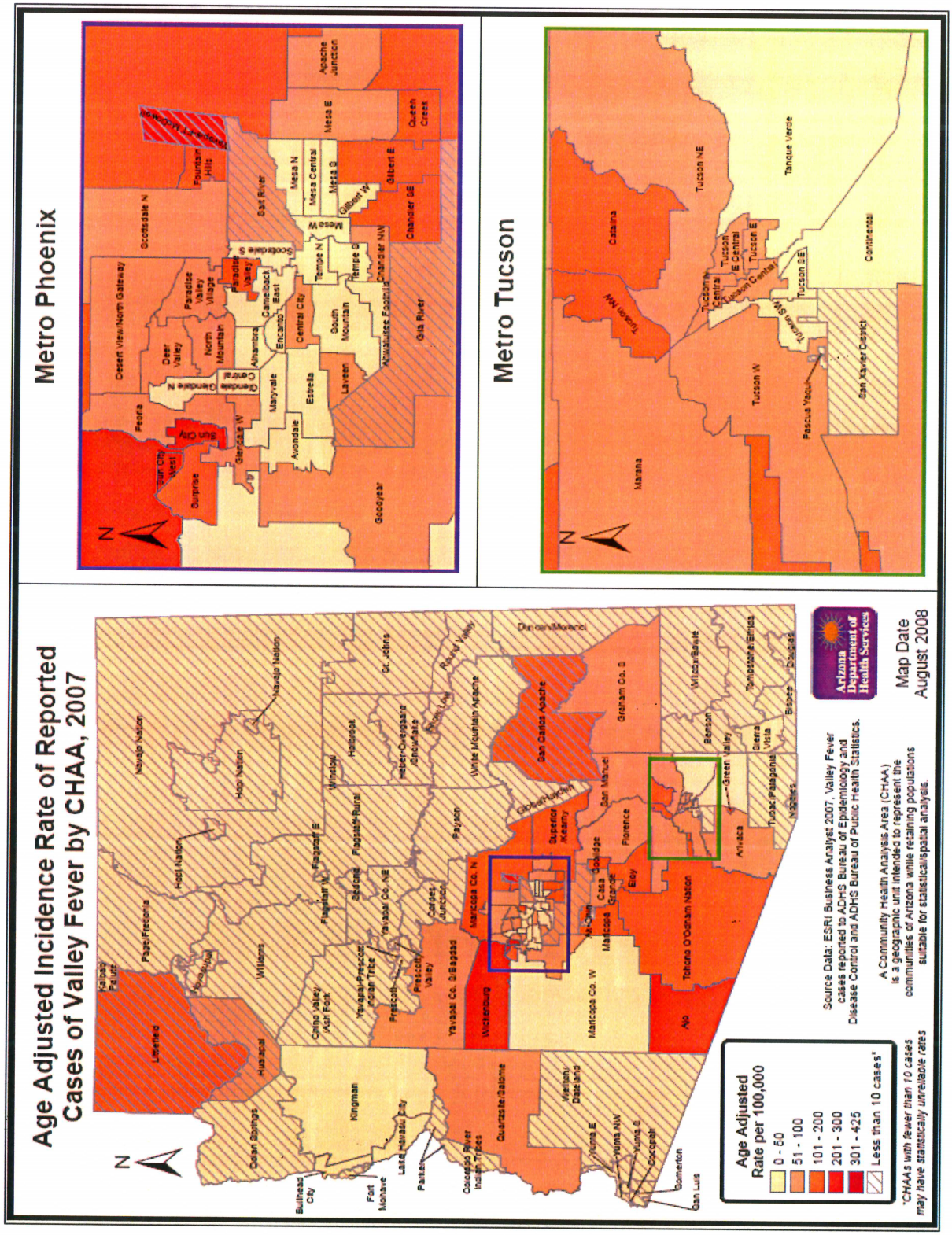
Appendix B. Valley Fever Cases by County, Arizona 2006 and 2007.

County	Year 2006		Year 2007	
	Cases per 100,000 Residents	Total cases	Cases per 100,000 Residents	Total cases
Maricopa	112	4,209	89	3,459
Pima	91	897	90	904
Pinal	83	225	87	256
La Paz	47	10	69	15
Graham	42	15	66	24
Gila	27	15	27	15
Mohave	25	49	25	50
Greenlee	24	2	24	2
Cochise	16	21	23	32
Yuma	14	27	6	13
Yavapai	14	29	12	26
Navajo	13	15	10	11
Santa Cruz	13	6	15	7
Coconino	8	11	10	13
Apache	5	4	7	5
Arizona	**89**	**5,535**	**75**	**4,832**

Appendix C. Age-Adjusted Rates of Reported Coccidioidomycosis in Arizona, 2006.



Appendix D. Age-Adjusted Rates of Reported Coccidioidomycosis in Arizona, 2007.



Appendix E. Analysis of Mining and Coccidioidomycosis in the Phoenix Metropolitan Area.

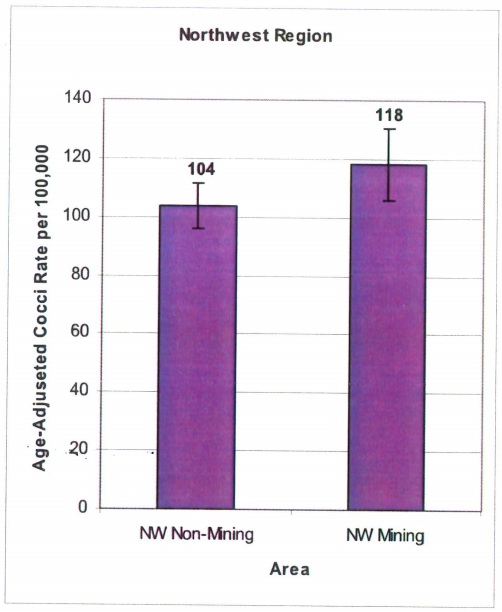
2006

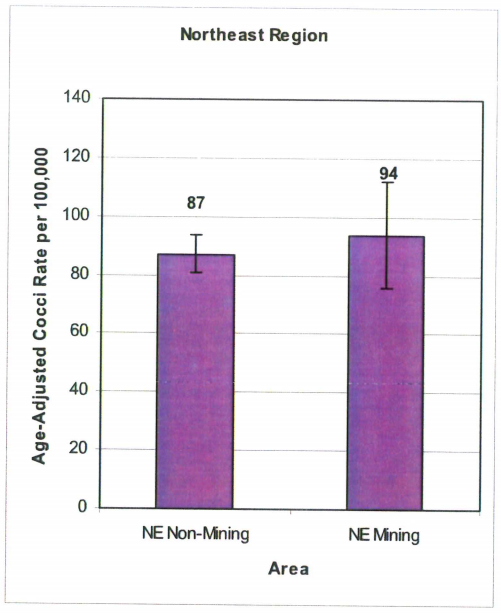
Metropolitan Phoenix Area	Number of Cases	Age-Adjusted Cocci Rate	95% Confidence Interval
NE Non-Mining	722	87	(81, 93)
NE Mining	107	94	(76, 112)
NW Non-Mining	722	104	(96, 112)
NW Mining	421	118	(106, 130)
SE Non-Mining	771	87	(81, 93)
SE Mining	224	63	(55, 72)
SW Non-Mining	94	85	(67, 103)
SW Mining	115	62	(50, 74)

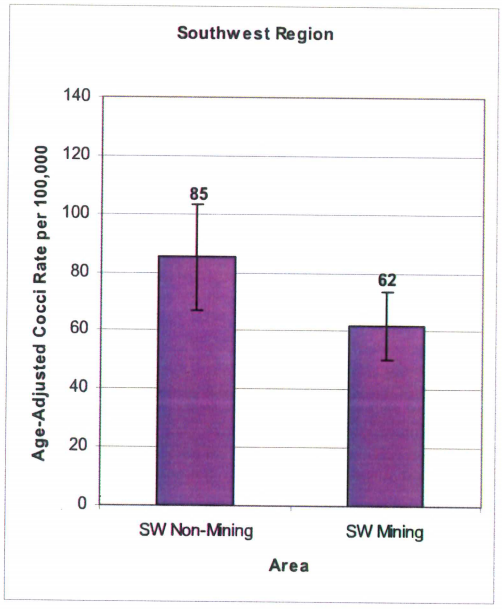
2007

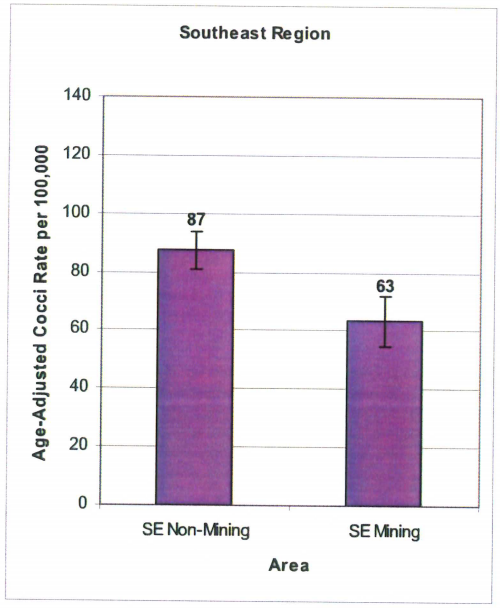
Metropolitan Phoenix Area	Number of Cases	Age-Adjusted Cocci Rate	95% Confidence Interval
NE Non-Mining	572	65	(60, 70)
NE Mining	89	71	(56, 86)
NW Non-Mining	565	71	(65, 77)
NW Mining	336	84	(75, 94)
SE Non-Mining	657	71	(65, 76)
SE Mining	191	53	(45, 60)
SW Non-Mining	56	39	(29, 50)
SW Mining	114	44	(36, 53)

Appendix F. Analysis of Mining and Coccidioidomycosis in the Phoenix Metropolitan Area, 2006.

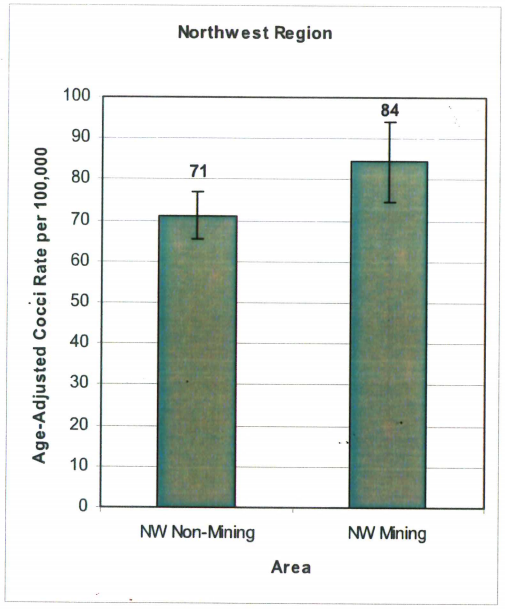


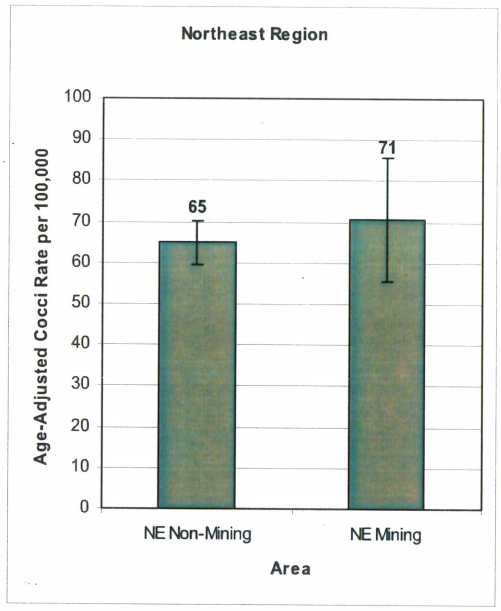


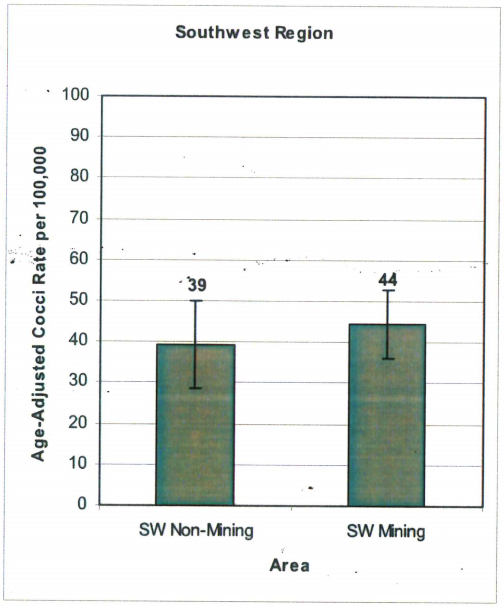


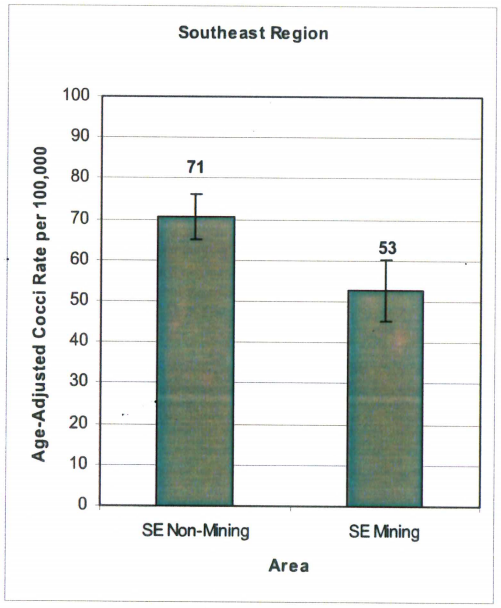


Appendix G. Analysis of Mining and Coccidioidomycosis in the Phoenix Metropolitan Area, 2007.









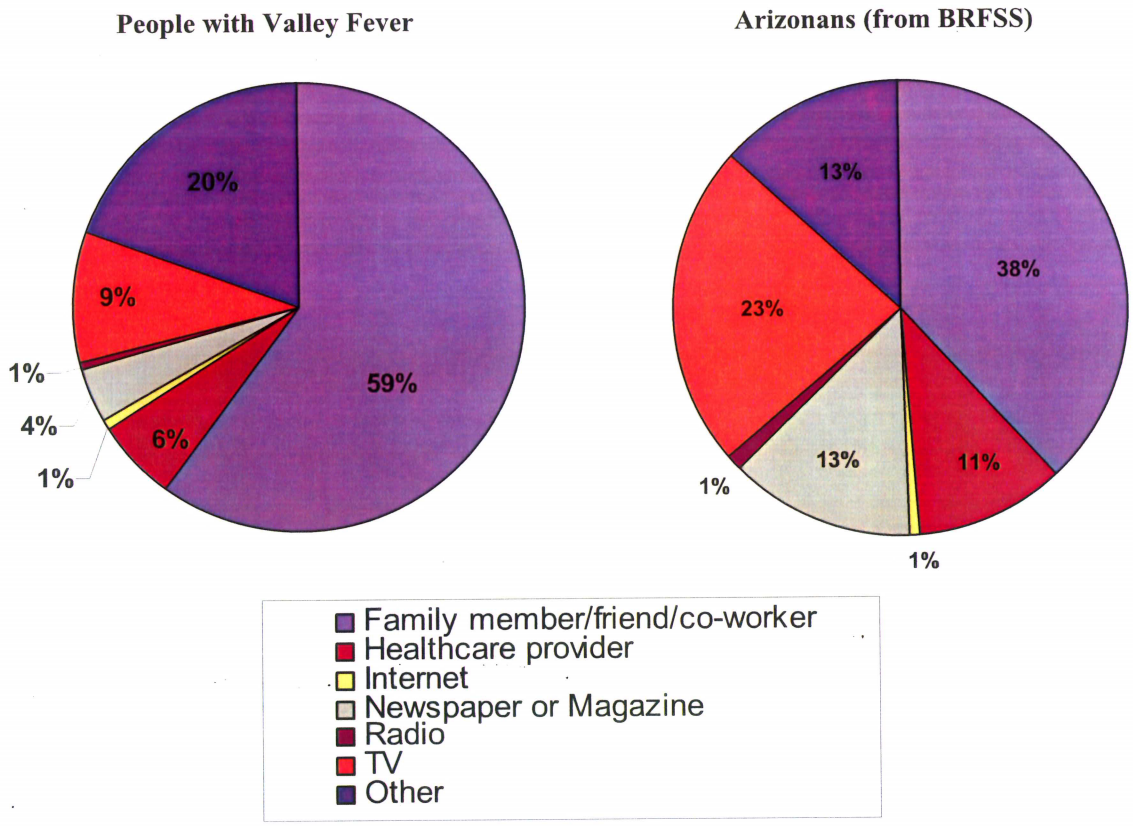
Appendix H. Location where Cases First Sought Treatment for Valley Fever.

Location	Count
Emergency room	111 (23.7%)
Primary care physician	274 (58.4%)
Urgent Care	56 (11.9%)
Other	28 (6.0%)

Appendix I. Emergency Room Visits and Hospitalizations.

Healthcare Visit (n=493)	Yes	No	Unknown
Visited the emergency room for illness	217 (46.1%)	251 (53.3%)	3 (0.6%)
Hospitalized overnight for illness	200 (41.8%)	276 (57.7%)	2 (0.4%)

Appendix J. Symptom Duration and Number of Days Lost for Valley Fever Cases.

Impact of Valley Fever	n	Mean	Median	Total (days)
Symptom duration (days)	420	193.2	108.5	81,144
Number of days missed from work	159	30.9	14.0	4,918
Number of days missed from school	35	16.6	9.0	582
Number of days missed from daily activities	352	95.8	47.0	33,716
Number of days before sought care for symptoms	411	43.6	11.0	17,938
Number of days between date sought care for symptoms and date of positive test result	422	156.1	23.0	65,864

Appendix K. Source of Where People First Heard About Valley Fever.