

Epidemiologic Profile of Coccidioidomycosis

in

San Luis Obispo County, CA

1996-2012



San Luis Obispo County Public Health Department

May, 2014

Table of Contents

List of Figures 3

Introduction 4

Data Sources and Limitations 4

San Luis Obispo County Overview 5

Valley Fever Background..... 6

Coccidioidomycosis in San Luis Obispo County Correctional Facilities 7

Coccidioidomycosis in the San Luis Obispo County Community 11

Coccidioidomycosis in San Luis Obispo County 14

Regional Rates by zip code 18

Conclusion 19

References 20

List of Figures

Figure 1. Valley Fever-Endemic Regions in the United States 6

Figure 2.1. Percentage “Cocci” Cases Community vs. Institutionalized in SLO County from 1996-2012..... 7

Figure 2.2. Institutionalized Race Demographics for Coccidioidomycosis in SLO County from 1996-2012..... 8

Figure 2.3. Institutionalized Age Demographics for Coccidioidomycosis in SLO County from 1996-2012..... 9

Figure 3.1. San Luis Obispo County Community Coccidioidomycosis Cases by Race10

Figure 3.2: Rate of Coccidioidomycosis in SLO County Community by Age.....11

Figure 3.3. Valley Fever rates by gender in SLO County, 1996-2012.....12

Figure 3.4. Coccidioidomycosis Cases by Gender per Year in SLO County Community12

Figure 3.5. SLO County Community Coccidioidomycosis Cases Reported by Year13

Figure 4.1: Coccidioidomycosis Cases in SLO County Community vs. Correctional Facilities 1996-2012.....14

Figure 4.2. Coccidioidomycosis by Race per year in SLO County, Community and Correctional15

Figure 4.3. Year of Valley Fever Onset, SLO County vs. California, 2001-2012.....15

Figure 4.4. Date of Onset vs. Rainfall SLO County, 1996-2012.....16

Figure 4.5. Date of Diagnosis Statistics for “Cocci” in SLO County, Community and Correctional17

Map of Case Rate per 100,000 persons by Zip Code18

Introduction

This report is an Epidemiologic Profile of Coccidioidomycosis (Valley Fever, or “cocci”), in San Luis Obispo County (SLO County), California. Coccidioidomycosis is endemic in San Luis Obispo County, and since 2005, an average of 128 cases have been reported each year to County residents. It is estimated that between 30-60% of all residents in an endemic area are exposed to the Coccidioidomycosis fungus, thus potentially exposing between 81,000 and 162,000 residents of San Luis Obispo County to the disease. Although 60% of those infected show little or no symptoms, of those who are diagnosed from symptoms, more than 40% need to be hospitalized. With the average cost of a Cocci hospital stay averaging almost \$50,000, the importance of diagnosing and treating the disease early cannot be overstated.

This report covers reported Coccidioidomycosis cases in SLO County during the period 1996 to 2012. The report attempts to describe “cocci” in terms of its occurrence, transmission and impact. The goal in providing this information is to help community-based organizations, planners, and policy-makers in evaluating programs and policies involving Coccidioidomycosis for the county and to increase the community’s general awareness of the impact of Coccidioidomycosis in San Luis Obispo County.

Data Sources and Limitations

When viewing this report, please keep in mind the following:

1. The data represents those Coccidioidomycosis cases reported to the San Luis Obispo County Public Health Department by private physicians, laboratories, and State Institutions. It is not considered reflective of the total number of cases of Coccidioidomycosis, as there are undetected and unreported cases in the county. The data only reflects current reporting practices.
2. Due to confidentiality issues, when a category of persons being reported would result in a small number of cases, categories were collapsed to protect confidentiality. For example, some racial categories were collapsed to “Other” in figures. This condensation of data is done to protect confidentiality only, and is not meant to show any greater or lesser significance placed on any demographic or geographic group.
3. The data corresponds to cases reported between the years 1996-2012. However, the majority of cases were reported between the years 2002-2012. In 2010, labs were mandated by the state to report positive “cocci” cases to county public health departments. Before the mandate, Coccidioidomycosis cases were reported by clinical providers alone. Thus, increases in Coccidioidomycosis rates subsequent to the changes

made in 2010 did not necessarily reflect an increase in transmission of the fungus, but are more likely related to changes in reporting.

4. When geocoding cases to determine rates by zip code tract and census tract, results varied. Some cases geocoded by zip code were unable to be placed due to use of PO boxes. When PO boxes were in rural communities with large zip code areas, they were assigned to the enclosing community zip code. For example, for a case with a Shandon PO box, the case would be able to be assigned to the encompassing zip code surrounding Shandon. For large cities with multiple possibilities, they were excluded from the analysis. In geocoding to census tracts, some addresses were unavailable. In rural communities, where a zip code was available, and entirely contained within a census tract, the location was randomly placed in the census tract. Thus, rural rates have a lower error rate. Urban cases had a higher exclusion rate, which could have impacted urban rates per 100,000. However, with higher population rates in urban areas, this may not have had a significant impact.

San Luis Obispo County Overview

Located 200 miles north of Los Angeles and approximately 230 miles south of San Francisco, San Luis Obispo County is on the Central Coast of California. SLO County covers 3,316 square miles and, according to the California Department of Finance 2010 Census estimates¹, had a population of 269,637 in 2010, with 81% living in an urban area and 19% residing in a rural area. The population from 2000 to 2010 rose 9.3%.

The land area, according to the 2010 Census, is 3,299 square miles². SLO County is primarily an agricultural area, devoting 61.6% of the land to farming. The population density according to the 2012 census is an average of 82 people per square mile.

According to the 2010 Census, the San Luis Obispo population is comprised of a variety of races. The majority (82.6%) of the San Luis Obispo residents identify as White. Additionally, 2.1% identify as Black or African American, 3.2% as Asian, 3.8% as two or more races, 7.3% other races, 0.1% Native Hawaiian and other Pacific Islander and 0.9% American Indian and Alaska Native. The median age of residents is 39 years old. Persons over 65 years of age make up 15.2% of the population, 61.4% of individuals are between 20 and 64 years old, and 4.9% are under 5 years old¹.

The 2010 Census reports a nearly equal gender distribution in SLO County, with 51% of the population male and 49% female¹. More than three-fourths of the San Luis Obispo population identify as White¹.

There are currently two local correctional facilities in SLO County: the California Men's Colony near San Luis Obispo and the Atascadero State Hospital in Atascadero. Prior to 2008, a third facility, the El Paso de Robles Youth Correctional Facility in Paso Robles, operated in the North County, but has since been closed. These correctional facilities were and remain strictly male-only.

Valley Fever Background

Valley Fever (Coccidioidomycosis or “cocci”) is an infection caused by a fungus, *Coccidioides*. The fungus inhabits soil and dirt in arid climates—areas with sparse rainfall and high temperatures—typical to the southwestern United States and northwestern Mexico. “Cocci” is especially prevalent in Arizona and California. *Coccidioides* predominantly affects the lungs, producing flu-like symptoms. In most cases, symptoms resolve themselves; however, severe forms of the illness can be fatal. The map below shows the endemic regions of the United States, which includes San Luis Obispo County. There have been an estimated 150,000 infections in the endemic areas each year⁴.

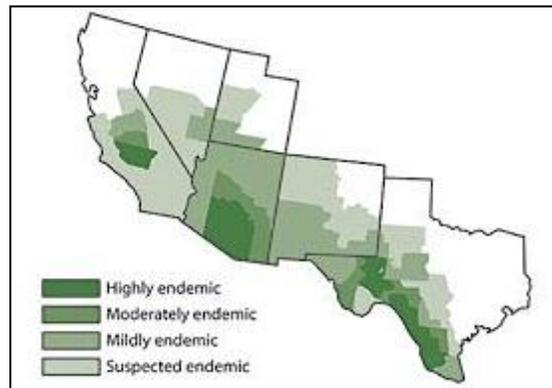


Figure 1. Valley Fever-Endemic Regions in the United States³.

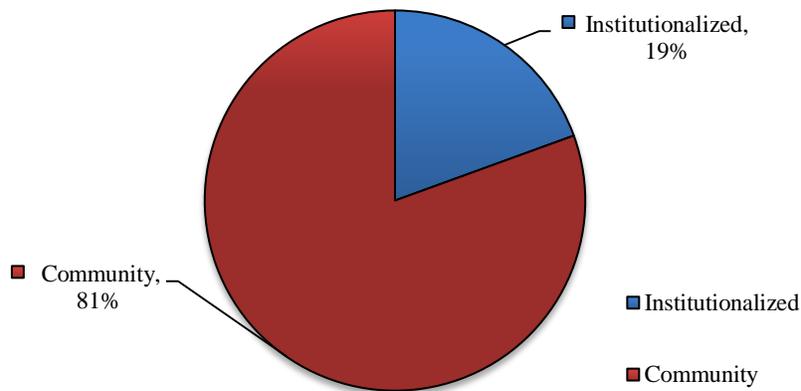
Valley Fever is contracted by breathing in dust containing a form of the *Coccidioides* fungus, called spores, which are too small to see. When soil housing *Coccidioides*, is disturbed, the fungal spores, called arthrospores, become airborne and can be inhaled by people or animals. Anyone who lives, works or travels in an area with Valley Fever is susceptible to infection. When a spore is inhaled, it transforms into a larger, multi-cellular structure, called a spherule, which continues to grow until it bursts, releasing more spores, called endospores, that grow into more spherules. Although the soil form of fungal spore can infect people and animals, the spherule form of the fungus cannot, and thus Valley Fever is not contagious between people or animals infected with the disease.

Almost two thirds of infected individuals exhibit no symptoms, experience only mild symptoms, and/or do not receive treatment. The remaining 40% of people show symptoms that closely resemble that of the flu or pneumonia, including fatigue, cough, chest pain, fever, rash, headache, and joint aches. In 1-2 percent of cases, the disease spreads, or disseminates, to other parts of the body, usually the skin. The disseminated infection can affect meninges, soft tissues, joints and bones. Although Valley Fever is generally a self-resolving infection, a small percentage of cases, less than 1%, are fatal. Due to lack of funding, a vaccine has not yet been developed for Valley Fever, but typically, Coccidioidomycosis is treatable with antifungal medications.

Coccidioidomycosis in San Luis Obispo County Correctional Facilities

There are currently two local correctional facilities operating in San Luis Obispo County: the California Men’s Colony near San Luis Obispo, and the Atascadero State Hospital in Atascadero. Prior to 2008, a third facility, the El Paso de Robles Youth Correctional Facility in Paso Robles operated in the North County, but was closed. Valley Fever cases that occur in institutions are generally not reflective of community cases. To help highlight the differences, case occurring in institutions and cases occurring in the community are broken out separately.

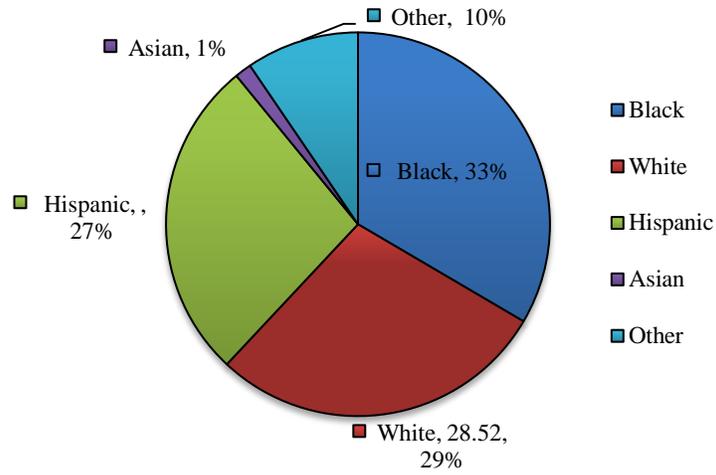
Figure 2.1. Percentage Coccidioides Reported in Community vs. Correctional Facility Cases in SLO County, 1996-2012.



Race and Ethnicity in institutionalized cases

The San Luis Obispo correctional facilities house inmates of diverse racial backgrounds. One third of SLO County correctional facility Coccidioidomycosis cases reported are from African American inmates, while nearly another third is attributed to Hispanic inmates. White cases account for twenty-nine percent of “cocci” cases. Ten percent of SLO County institutional cases fall under “other,” which corresponds to races including: Native American, Native Hawaiian or other Pacific Islander, mixed race, unreported or other.

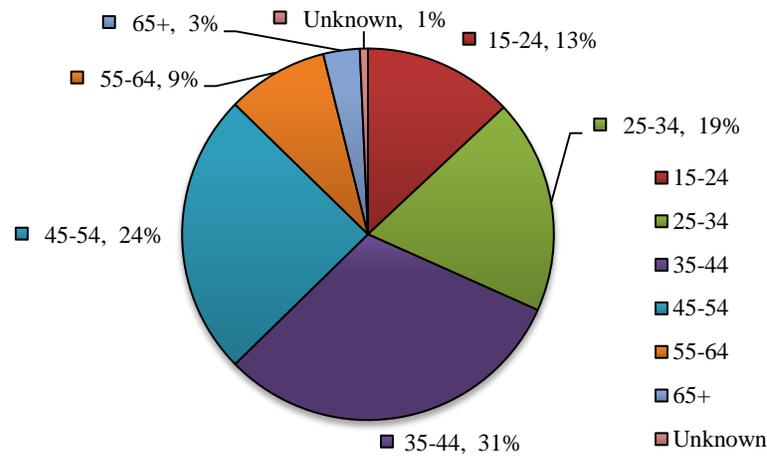
Figure 2.2. Institutionalized Race Demographics for Coccidioidomycosis in SLO County from 1996-2012.



Age in institutionalized cases

The State correctional facilities in San Luis Obispo house inmates of a variety of age groups. Nearly three-quarters of Coccidioidomycosis cases reported between 1996-2012 were within the ages of 25-54. The percentage of correctional “cocci” cases attributed to inmates 65 years or older was minimal. There were no “cocci” cases in correctional facilities for persons ages 0-14.

Figure 2.3. Institutionalized Age Demographics for Coccidioidomycosis in SLO County from 1996-2012.



Summary for Correctional Cases

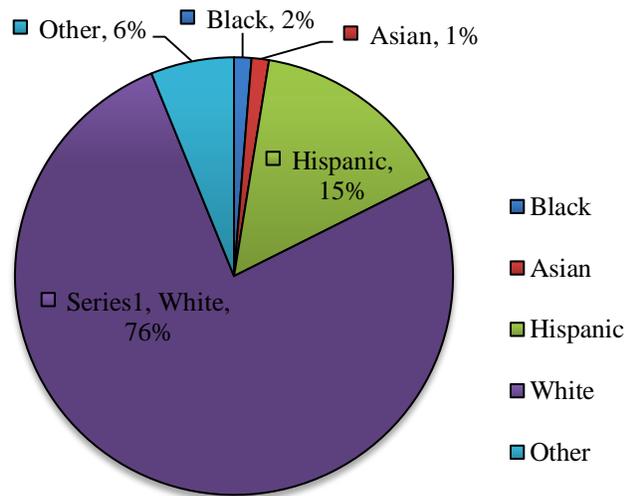
The San Luis Obispo State correctional facilities house a diverse population of inmates. Between the years 1996-2012, a total of 1,460 Coccidioidomycosis cases were reported to the San Luis Obispo County Public Health Department, of which 284 came from institutions. No San Luis Obispo County correctional facility cases were reported in the year 1998. It is not believed that there were no occurrences of “cocci” at correctional facilities in 1998; there is a possibility that the SLO County facilities did not have the time to report cases that year. Nearly twenty percent of all Coccidioidomycosis cases reported in the County of San Luis Obispo were accounted for by local correctional facilities. Additionally, one third of SLO County correctional facility Coccidioidomycosis cases reported were attributed to African American inmates and nearly another third were attributed to Hispanic inmates. The age range that had the highest number of reported Coccidioidomycosis cases were inmates between 35-44 years old. Valley Fever cases occur more frequently in two San Joaquin Valley prisons: Avenal and Pleasant Valley state prisons. About two-thirds of Valley Fever cases identified among California’s state prisoners from 2008 to 2012 occurred in Pleasant Valley and Avenal state prisons⁵. These prisons, which hold a combined 8,100 inmates are approximately 10 miles apart and 75 miles northeast of San Luis Obispo and 175 miles southeast of San Francisco. Inmates that are deemed more susceptible to Coccidioidomycosis, including those with a higher risk of disseminated “cocci” or have depressed immune systems such as those who are HIV-positive or undergoing chemotherapy are sometimes transferred to SLO correctional facilities. Therefore, case counts in San Luis Obispo County could be inflated. Inmates could have become infected at their previous correctional facility, and then diagnosed during their tenure in San Luis Obispo County facilities.

Coccidioidomycosis in the San Luis Obispo County Community

Race demographics in community cases of Valley Fever

The San Luis Obispo community population is comprised of a variety of races. According to the 2010 census, 82.6% of the San Luis Obispo residents identified as White. Additionally, 2.1% identified as Black or African American, 3.2% as Asian, 3.8% as two or more races, 7.3% other races, 0.1% Native Hawaiian and other Pacific Islander and 0.9% American Indian and Alaska Native¹. Between the years 1996-2012, nearly seventy-five percent of Coccidioidomycosis cases in the San Luis Obispo community were attributed to White persons, fifteen percent to Hispanic individuals, and the remaining nine percent to Black, Asian and “other.”

Figure 3.1. San Luis Obispo County Community Coccidioidomycosis Cases by Race.



Age demographics in community cases of Valley Fever

San Luis Obispo County is home to individuals of all ages. Between the years 1996-2012, Coccidioidomycosis case rates in the San Luis Obispo County community were highest among those aged 41-60. Incidence rates dropped significantly for persons ages 0-10 and above 80 years of age.

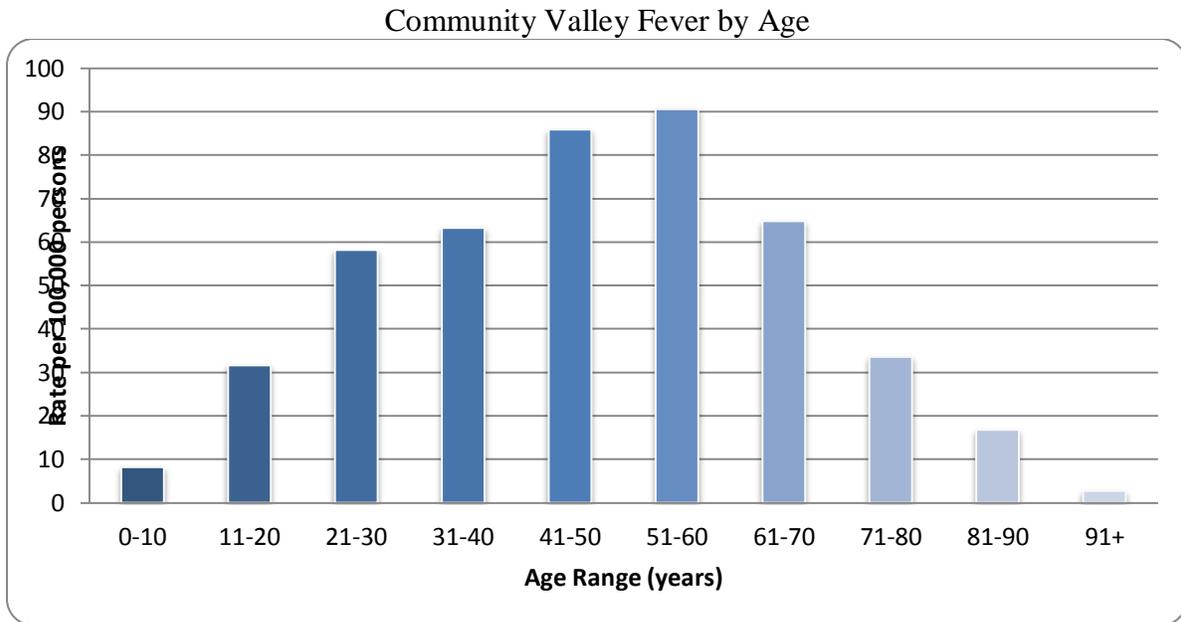


Figure 3.2. Rate of Coccidioidomycosis in SLO County Community by Age. Valley Fever cases per 100,000 by age.

Gender demographics in community cases of Valley Fever

Based on the 2010 Census, San Luis Obispo’s gender distribution showed a population that was 51.2% male and 48.8% female¹. Between 1996-2012, males showed a higher number of reported cases of Coccidioidomycosis than females in the community. Male Coccidioidomycosis cases made up 65% of community cases during that 17-year period. One possible explanation for this is that males typically are employed in outside job categories such as construction and agriculture more than females.

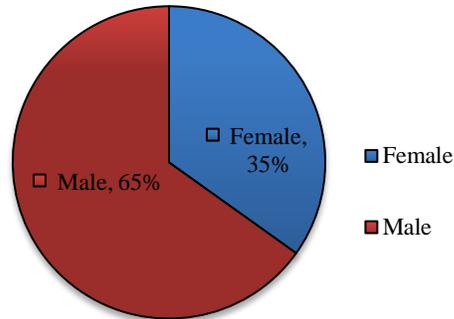


Figure 3.3. Valley Fever rates by gender in SLO County, 1996-2012

The number of Valley Fever cases by gender varied significantly between 1996-2012. There were consistently more male cases reported than female cases, approximately twice as many each year. There were increases in reported cases around 2004 and again in 2010, when labs were mandated to report “cocci” cases.

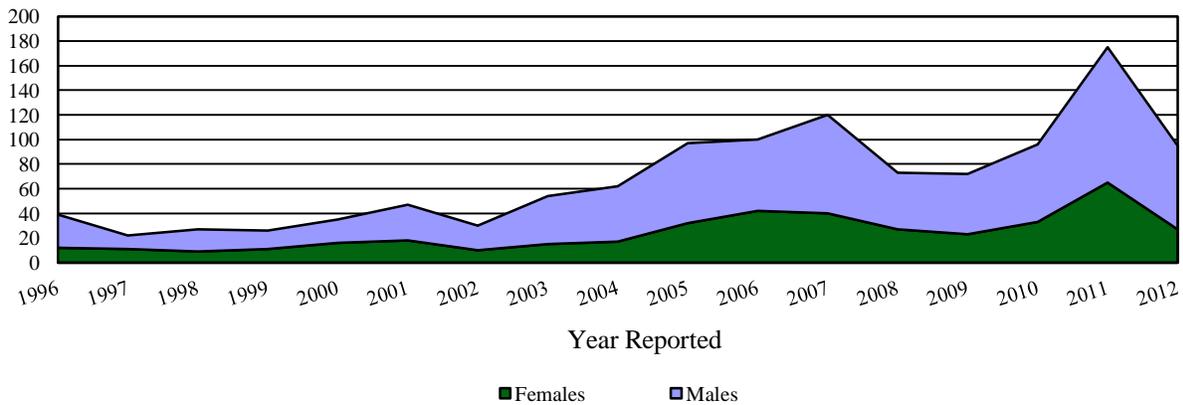


Figure 3.4. Coccidioidomycosis Cases by Gender per Year in SLO County Community.

Year of diagnosis in community cases of Valley Fever

Between the years 1996-2012, there was an increasing trend in the number of reported Valley Fever cases per year. In 2010, the number of cases of Valley Fever reported increased, corresponding to the implementation of the State mandate requiring labs to report Coccidioidomycosis cases. Additionally, between the years 2002 to 2007 there was a steady increase in reported “cocci” cases in the San Luis Obispo community. This trend was consistent with a Statewide increase in cases for that time period. Figure 3.5 shows the number of cases of Cocci reported by year.

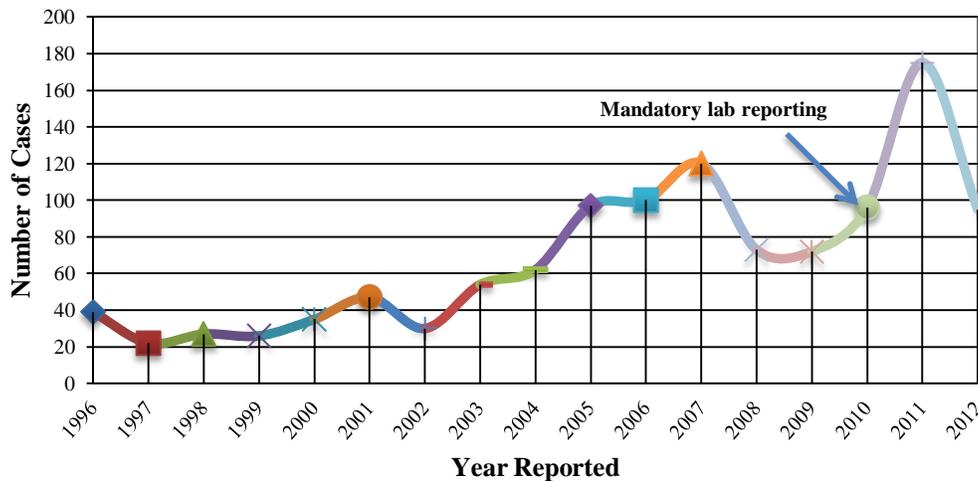


Figure 3.5. SLO County Community Coccidioidomycosis Cases Reported by Year.

Summary of Community Cases

From 1996-2012, San Luis Obispo reported 1176 Valley Fever cases among the community, 81% of all cases reported in the county. Coccidioidomycosis rates were highest in the community among persons between 41-60 years of age. Additionally, roughly three-quarters of “cocci” cases in the San Luis Obispo community were attributed to White individuals, fifteen percent of cases identified as Hispanic, and the remaining nine percent of cases specified the races: Black, Asian and “other.” Although roughly half of the San Luis Obispo population was male (51.2%), nearly two-thirds (65%) of Valley Fever community cases that were reported between 1996-2012 were attributed to males. Over the seventeen-year span, the number of Valley Fever cases in males was nearly twice that of female cases every year. The number of reported Coccidioidomycosis cases in the San Luis Obispo community increased over the years 1996-2012. In 2010, the state mandated that labs report positive “cocci” cases, which corresponds to the sharp increase of cases that year.

Coccidioidomycosis in San Luis Obispo County

Institutions vs. Community

With the presence of two current institutions housing inmates in the San Luis Obispo County, it is important to look at both community and institutional populations separately, as demographics differ between the two populations. The entire institutional population is male in San Luis Obispo and a higher percentage of inmates are African American and Hispanic compared to the community. Between the years 1996-2012, there were approximately 45 Valley Fever cases per 10,000 persons reported among the San Luis Obispo community, and 10 per 10,000 persons reported in correctional facilities.

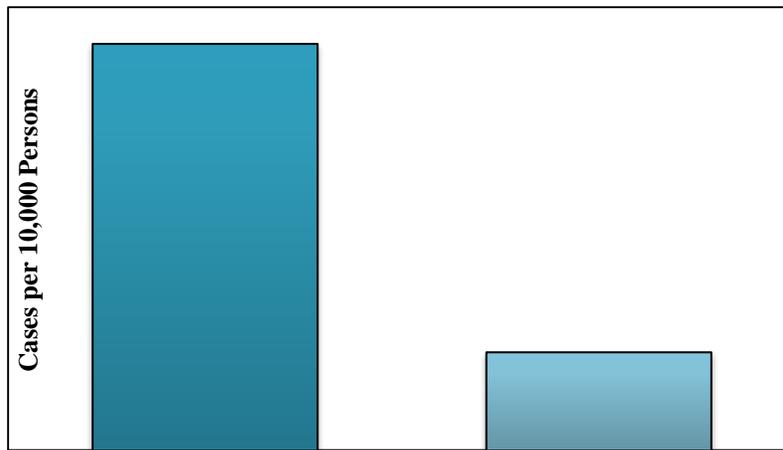
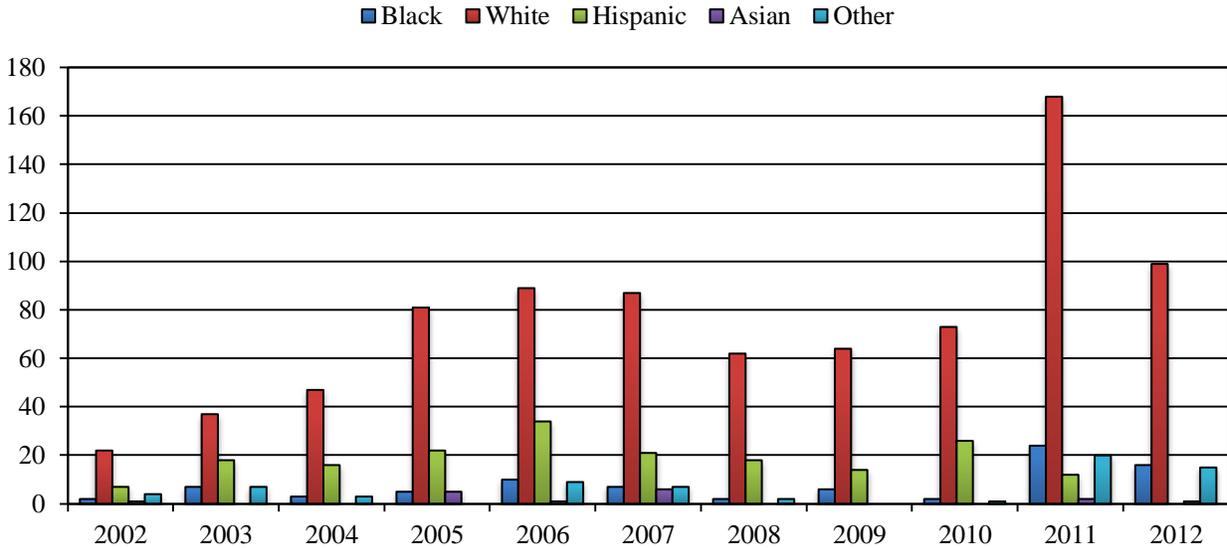


Figure 4.1: Coccidioidomycosis Rates per 10,000 in SLO County Community vs. Correctional Facilities 1996-2012.

In San Luis Obispo County between 2002-2012, the majority of Valley Fever cases were reported in 2011 and 2012, the years following the 2010 state mandate for labs to report “cocci” cases. Additionally, the race that had the highest incidence of “cocci” between that 17-year period in SLO County was the White population, followed by the Hispanic population.

Figure 4.2. Coccidioidomycosis by Race per year in SLO County, Community and Correctional. “Cocci” by race, year in SLO County.



San Luis Obispo vs. California

The California State Valley Fever statistics vary from the SLO County Data. The main distinction is the general upward trend in cases in California. In San Luis Obispo County, yearly change, while the general trend is increasing, some years show dramatic peaks. These differences are likely due to the small population size of SLO County compared to the state as a whole. Small changes in the SLO rate of incidence would show a large graphical change, whereas the same change in a larger population would hardly change the graph. The number of California state-reported cases has steadily risen since 1996 and an increasing trend in SLO County has been shown as well. Coccidioidomycosis became lab reportable in 2010, helping to explain some of the increase in Valley Fever cases after that year.

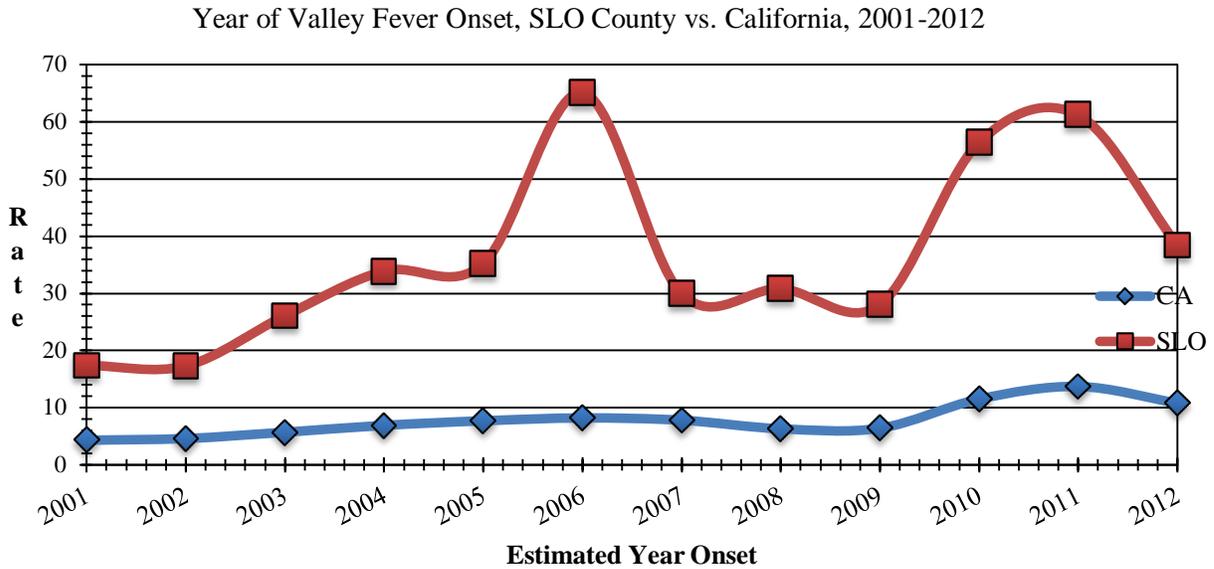


Figure 4.3. Year of Valley Fever Onset, SLO County vs. California, 2001-2012⁶.

Weather

Between 1996-2012, summer months in San Luis Obispo County consistently experienced less than one inch of rainfall. The combination of the lack of rain and warmer temperatures in the summer provided an ideal climate for the spread of *Coccidioides*. *Coccidioides* multiplies in the soil during the rainy season, but during the dry, windy season, can become airborne, thus increasing the chance a spore will be inhaled. In drought years, the fungus remains dormant, and does not multiply in the soil. When a period of drought is followed by rainfall, a spike in cases is generally seen. In SLO County, the majority of onset occurred in the later part of the year, after the summer months with the lowest amount of rainfall.

Date of Onset vs. Rainfall SLO County, 1996-2012

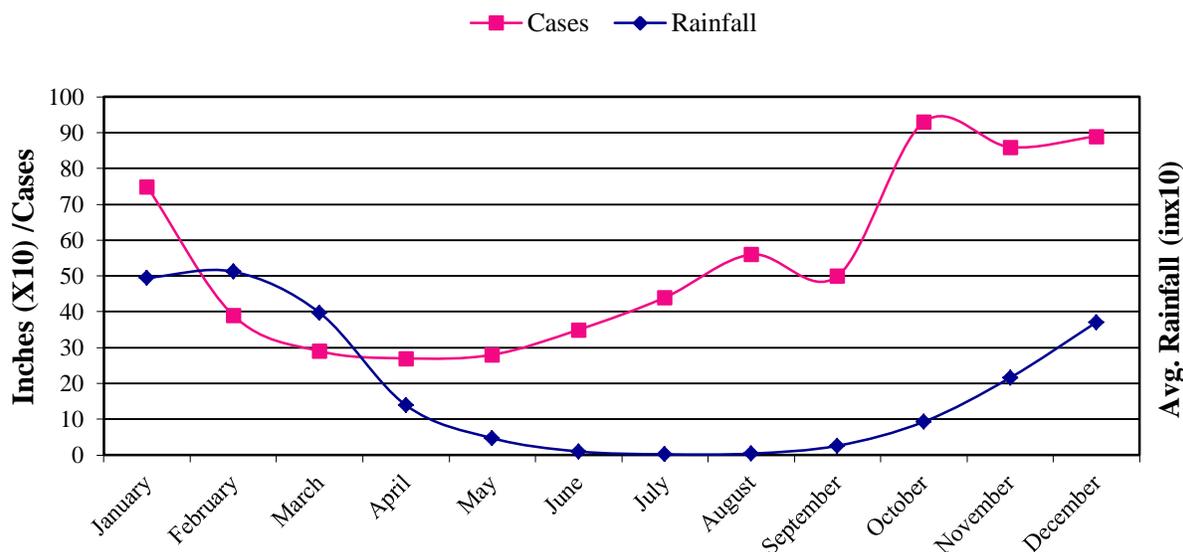
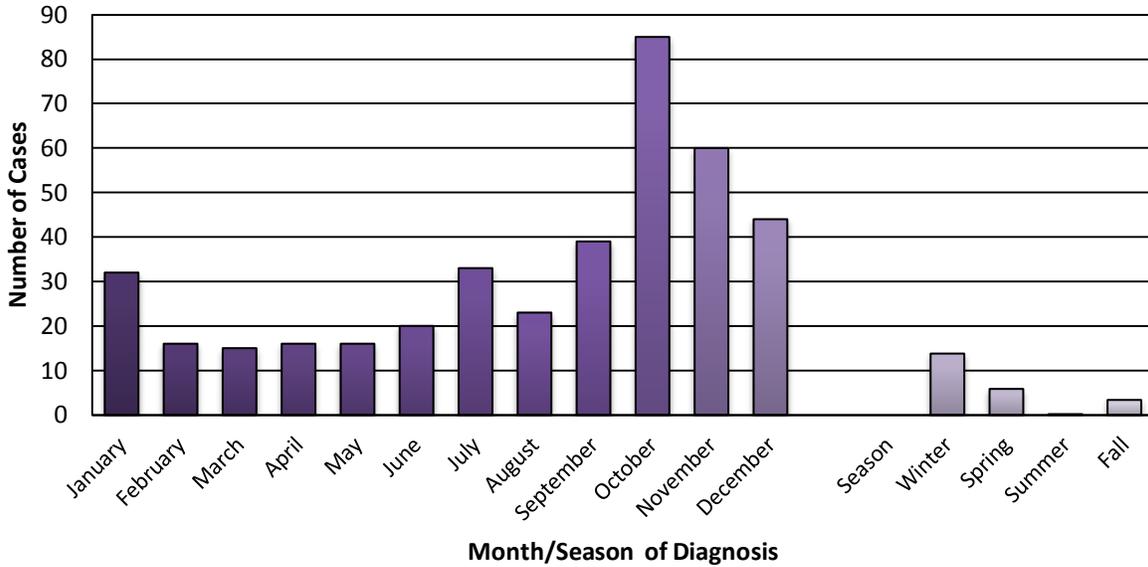


Figure 4.4. Date of Onset vs. Rainfall SLO County, 1996-2012. Average monthly rainfall vs. date of onset for “cocci” in SLO County. The average inches of rainfall per month in San Luis Obispo, CA was compared to the number of cases per month⁷.

Season/Month

For purposes of seasonal comparison, each season will be defined by a three month period of time. December, January, and February are winter; March, April, and May are spring; June, July, and August are summer; and September, October, and November are fall. The fall season shows the greatest number of cases. The number of cases begin rising in the fall, and peak in October, and then declines in the winter. Because there is often a delay in diagnosis of Valley fever, the increased reporting of cases in the fall can indicate that individuals diagnosed with Coccidioidomycosis contracted it in the previous summer months. Symptoms do not arise immediately, if at all, so the reported date of onset for the disease is generally weeks or months after infection. In addition to the slow onset of symptoms, there can be a delay in correctly diagnosing Valley Fever in a patient. Valley Fever is not widely recognized, leading doctors to sometimes falsely diagnose the disease and further delay accurate diagnosis.

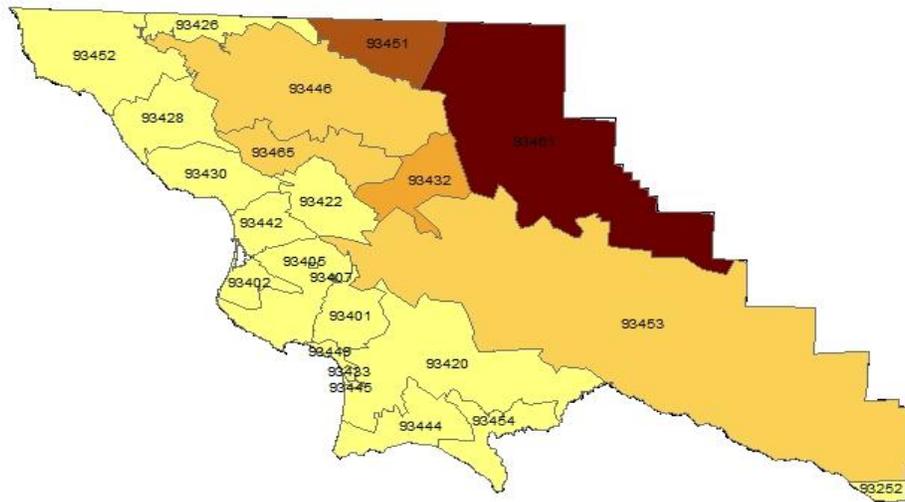
Figure 4.5. Date of Diagnosis Statistics for Coccidioidomycosis in SLO County for Community and Correctional.



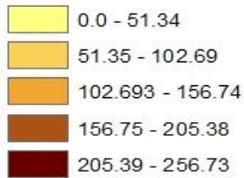
Regional rates of infection

Reported cases, and rates per 100,000 persons vary in San Luis Obispo County by region. On the following page, a map of San Luis Obispo County is shown, with crude case rates per 100,000 persons calculated for zip codes in the County. Age adjusted rates are unable to be calculated due to lack of age breakdown data for Zip Code Tract Areas (ZCTAs) from the Census. Population size for each zip code was obtained from the 2010 US Census ZCTAs. Of the 757 community cases identified between 2007 and 2012, only 7 had no address data that allowed for placement in a zip code. Rates in the northeast region of the County were highest, with the southeast also showing elevated rates. The coastal regions had lower rates overall.

**San Luis Obispo County
Valley Fever rates per 100,000
2007-2012**

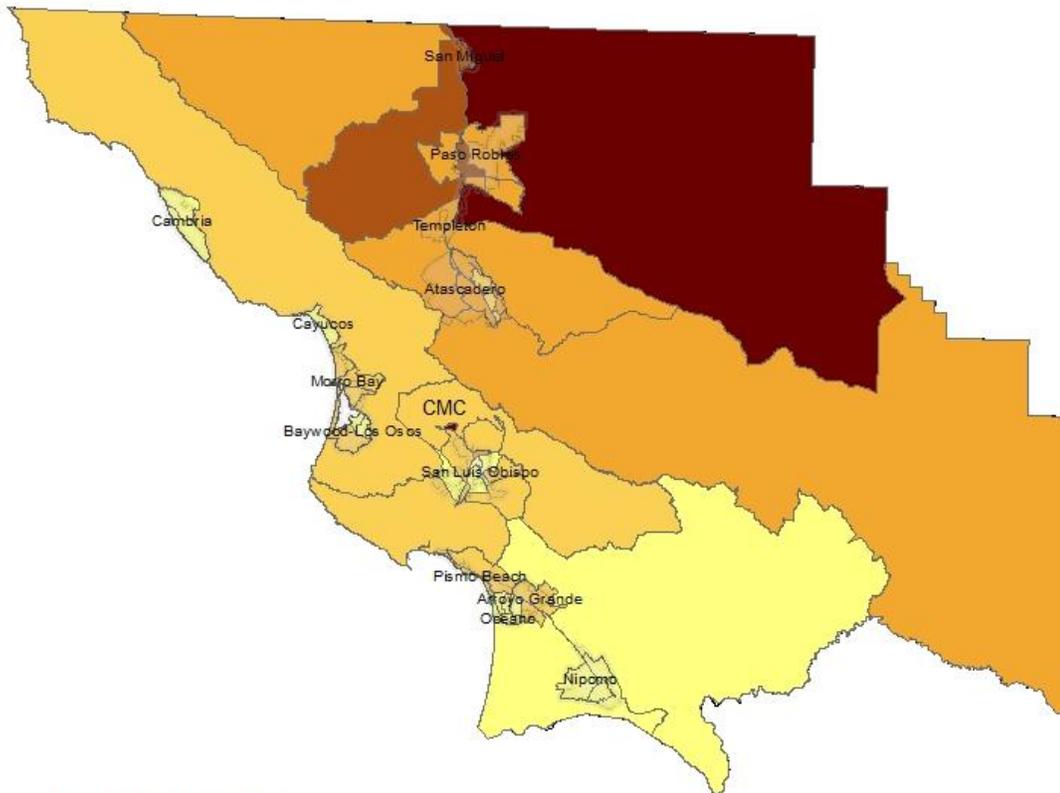


**Zip Code Rates
per 100K**



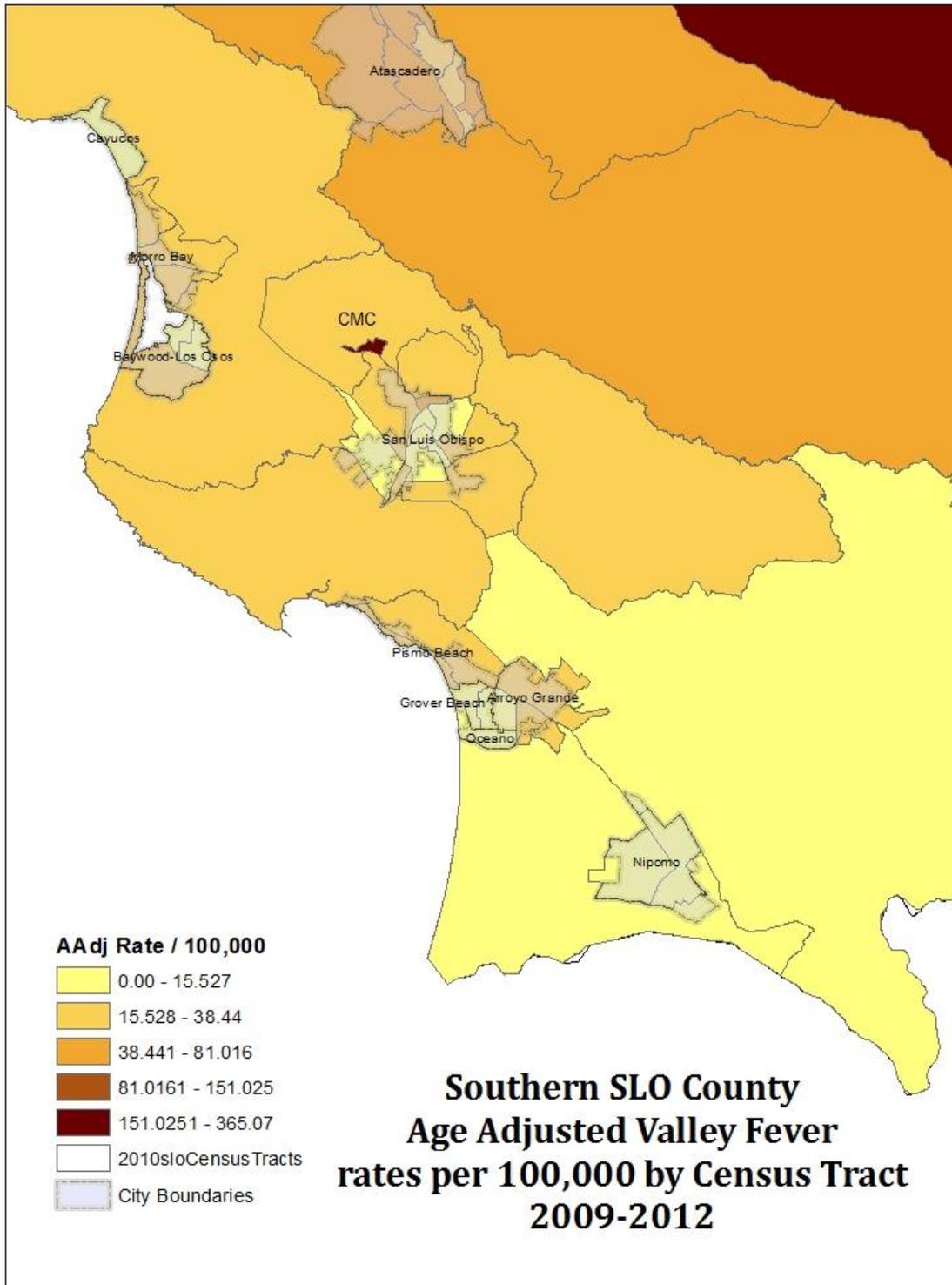
On the following pages, age-adjusted rates by census tract are shown for San Luis Obispo County for the years 2009-2012. Greater detail of North County and South County follow.

San Luis Obispo County Age Adjusted Valley Fever rates per 100,000 by Census Tract 2009-2012



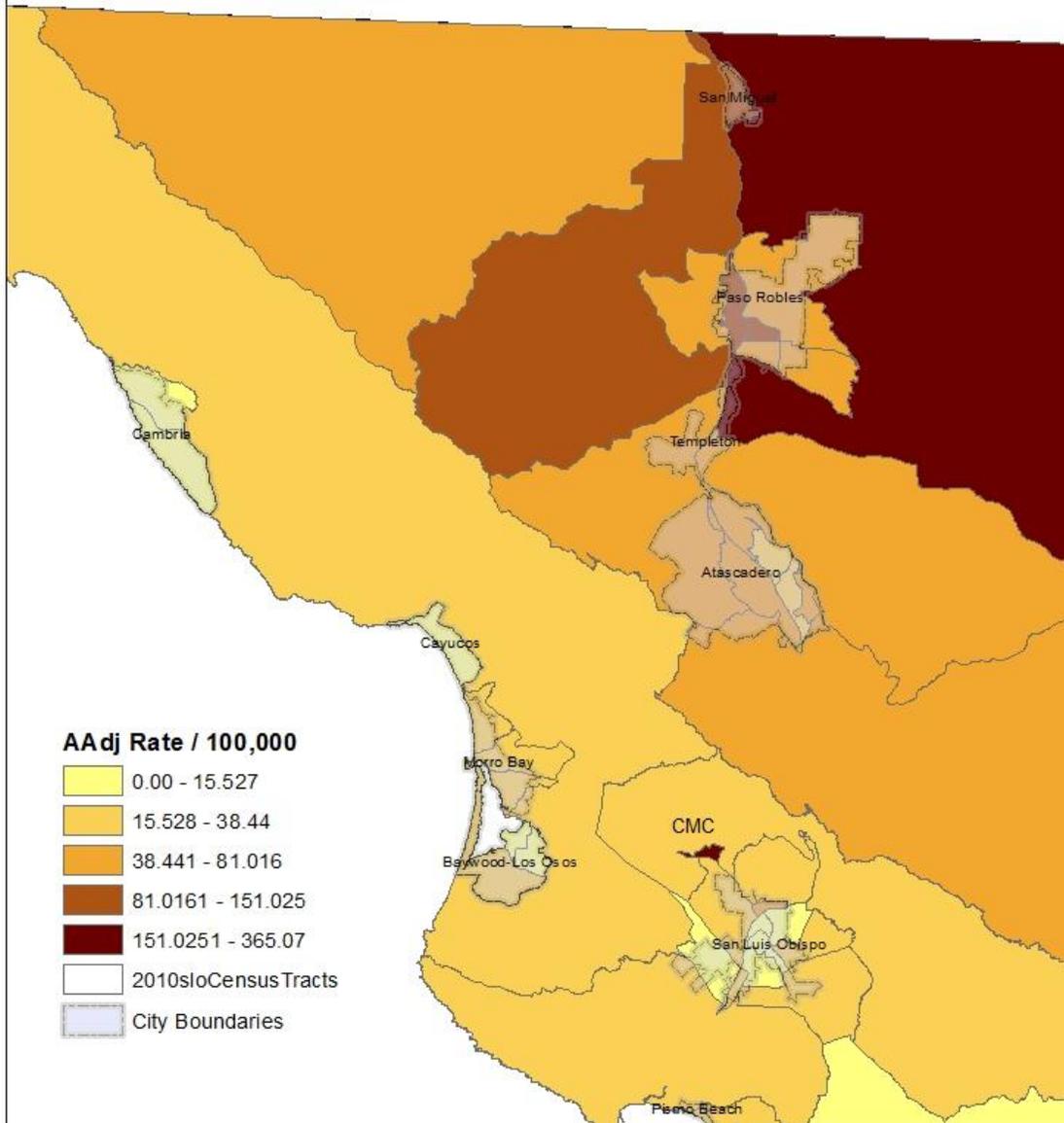
AAj Rate / 100,000

- 0.00 - 15.527
- 15.528 - 38.44
- 38.441 - 81.016
- 81.0161 - 151.025
- 151.0251 - 365.07



The map above shows greater detail of the SLO, coastal and South County regions. Here, CMC is the high rate census tract shown to the north of SLO. The City boundaries help illustrate how many census tracts can be in a city, but very few comprise the more rural portions of the County.

**Northern SLO County
Age Adjusted Valley Fever
rates per 100,000 by Census Tract
2009-2012**



The map above shows the greater detail of the North County and coastal regions. It also shows the eastern portion of Paso Robles with higher rates of Cocci than the western portion. The explanation for this is unknown.

Conclusion

Valley Fever has important medical, demographic, and financial implications for the state. According to the University of Arizona Valley Fever Center for Excellence, most cases of Valley Fever are so mild that over 60% of those infected with the fungus exhibit no symptoms or experience flu-like symptoms and do not seek medical attention. Common Valley Fever symptoms are not unique to the disease and so it can be easily misdiagnosed. Identifying Coccidioidomycosis as the cause of illness requires specific laboratory testing⁸.

Although no specific age, sex or gender is more at risk for developing Valley Fever, certain demographics have a higher risk of the infection spreading to other parts of the body (dissemination). Men have a higher rate of dissemination than do women. Additionally, studies have shown that the rate of dissemination in African Americans and Filipinos is higher than the rest of the U.S. population. Other persons that have an increased risk of disseminated Coccidioidomycosis are those with immune system deficiencies such as patients with diabetes, pregnancy, Hodgkin's disease or are positive for HIV⁹.

Caused by inhaling fungal spores, Coccidioidomycosis costs the state prison system about \$23 million annually in inmate health care. Additionally, a class action lawsuit has been opened on behalf of current and former inmates who contracted the disease while in prison¹⁰. On the map of age-adjusted rates by census tract, CMC is represented by its own census tract, and shows up as a high rate region within the lower rate region surrounding San Luis Obispo.

In 2013, an outbreak of Valley Fever resulted in over 50 cases of Coccidioidomycosis among workers at two solar power construction sites in San Luis Obispo County. Valley Fever illnesses occurred among workers building the solar farms in the eastern portion of the County known as California Valley¹¹. A similar construction-related outbreak at Camp Roberts in 2007 resulted in over 90% of the work crew becoming infected with Valley Fever. Workplace exposure may be more prevalent than thought, and have implications for workplace safety and prevention in outdoor industry.

There is currently no vaccine for Valley Fever, and the only prevention is to avoid inhaling dust or dirt. The risk of infection can be lessened by staying indoors on very windy days when dust or dirt are visible in the air. Anyone who lives in or visits an endemic area is at risk for contracting Valley Fever. There is no evidence that suggests any particular group of people is more or less at risk for disease.

References

- (1) U.S. Census, 2010: Profile of General Demographic Characteristics (DP-1). San Luis Obispo County. U.S. Census Bureau, 2010.
- (2) U.S. Census, 2010: Demographic Profile Data Release. Land Area, Population and Population Density: San Luis Obispo County. U.S. Census Bureau, 2010.
- (3) "Valley Fever: Awareness Is Key." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 27 June 2013. Web. 27 Feb. 2014.
- (4) "Valley Fever Center for Excellence." *Valley Fever Center*. University of Arizona, 2010. Web. 05 Feb. 2014.
- (5) Walsh, Denny. "Valley Fever." *Cdcrglasscell*, 3 July 2013. Web. 22 Mar. 2014.
- (6) Chapman, Ron. "Coccidioidomycosis Yearly Summary Report." *California Department of Public Health*. State of California, 10 September 2011. Web. 03 March 2014.
- (7) "Period of Record Monthly Climate Summary." *Western Regional Climate Center*. Desert Research Institute, 23 Apr. 2009. Web. 17 Feb. 2014.
- (8) "Valley Fever Center for Excellence." *Valley Fever Center*. University of Arizona, 2010. Web. 29 Mar. 2014.
- (9) "Valley Fever Center for Excellence." *Valley Fever Center*. University of Arizona, 2010. Web. 29 Mar. 2014.
- (10) Cook, Rachel. "Inmates Fearful as Some Are Sent into Valley Fever Prisons." *Reporting on Health*. University of Southern California, 25 Aug. 2013. Web. 27 Mar. 2014.
- (11) Almendrala, Anna. "Valley Fever Hits Central California, Sickens 28 Solar Plant Workers." *The Huffington Post*. TheHuffingtonPost.com, 01 May 2013. Web. 29 Mar. 2014.