



An Estimate of the Burden of Valley Fever in Kings County

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Coccidioidomycosis is the disease more commonly known as Valley Fever (VF). The disease most commonly occurs when “spores” of a soil growing fungus are inhaled. Rarely infection occurs when the “spores” enter the body through a break in the skin. Valley Fever is not transmitted from person to person. The range of the soil fungus is limited to a few areas of the United States, Mexico and South America. In the United States VF is recognized as a major public health issue only in Arizona and parts of California. In California most of the cases are reported from the southern San Joaquin Valley, the “valley” in Valley Fever. The restricted distribution of this disease in the United States has consequences for the people of Kings County.

Valley Fever is an orphan disease, that is, one of marginal importance. From a national perspective few people are at risk for Valley Fever. The numbers are too small to make it an attractive disease for private sector pharmaceutical research and development. In the public sector Valley Fever must compete with many other causes of disease, disability and death. There is very little funded research on Valley Fever. There are many things we don't know about Valley Fever. The treatments we have available are suboptimal and some people do poorly despite receiving the best treatment available. There are no practical preventive interventions that are known to be effective for the people who live in VF areas.

KINGS COUNTY

Kings is a small county located in the southern San Joaquin Valley. The 2010 Census data puts the population at 152,982. The population is more than 50% ethnically Hispanic/Latino. Multiple years of drought depressed the agricultural-based economy before the onset of the current Great Recession. Before the drought the county had a high poverty rate.

The population of the county is concentrated in the eastern half of the county. The western half has a very low population density and has only two communities, Avenal and Kettleman City, both of which are located close to the western edge of the county. Avenal is roughly ten times larger than Kettleman City. The inmates of Avenal State Prison constitute about 45% of the population of Avenal. The two communities are more than three quarters Hispanic/Latino. Avenal State Prison inmates are disproportionately African-American compared with Kings County. An unknown, but presumably large, number of people transit through western Kings County every day. Interstate Highway 5, one of three major north/south highways in California, passes through the far western part of Kings County.

COUNTING, DESCRIBING CASES IN THE COUNTY

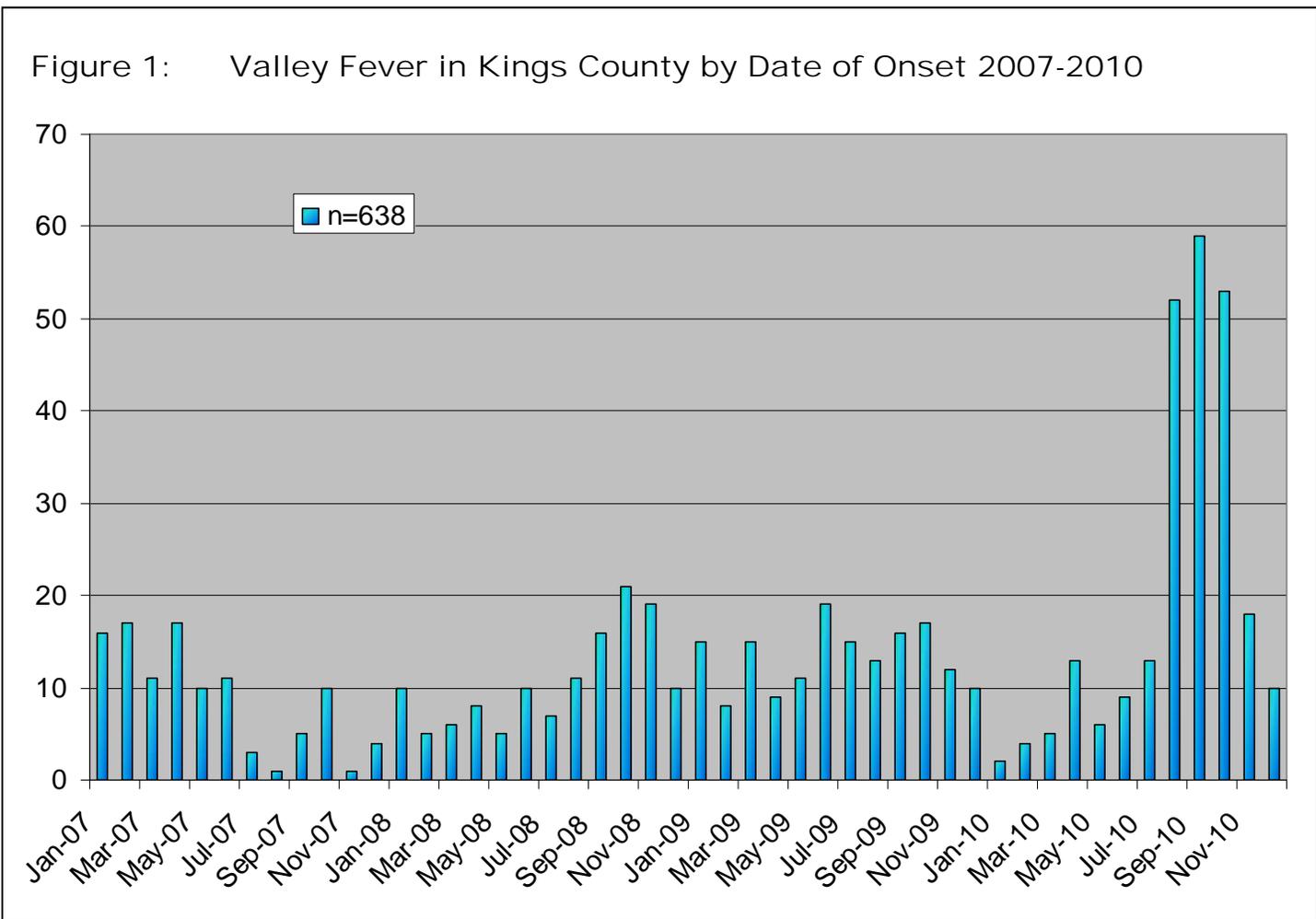
Valley Fever is known to occur in Kings County. Beginning in 2007 the Kings County Department of Public Health (KCDPH) devoted additional resources to defining the effect of Valley Fever on the people of our county. We did this without grants or other outside resources. This wouldn't have happened without the dedication and commitment of the department staff. The departmental people who've made this report possible are listed in the appendix. Through their efforts, the department has made some progress in identifying the people most affected and when they became infected.

Having no practical prevention recommendations for the general population, the Department decided to look closely at when people in Kings County contract Valley Fever, knowing that might suggest a preventive intervention. If weather patterns affect the growth of the fungus in the soil, as seems plausible, experience in Arizona, for example, likely wouldn't apply to Kings County. The VF literature gives two to four weeks as the time period between when someone becomes infected and when they begin to feel symptoms. We needed to determine the date they knew they were ill, which is often called the date of onset.

This date was usually missing or inaccurate on the illness reports we received before 2007. Beginning January 1, 2007, our department mandated additional requirements for VF disease reports submitted by doctors or other health care providers. . (The state requires that certain diseases be reported to the local health department.) Although in general the physicians and other providers were very cooperative, the workload of the department's staff increased as a result of this local mandate. They at times had to obtain clinic notes. Sometimes the nurses had to call the patients when the needed

information wasn't in the clinical record. Despite these efforts, 25% of the time we have been unable to determine the date of onset of the illness.

Figure 1: Valley Fever in Kings County by Date of Onset 2007-2010



We know that there often is a lag time between the onset of the illness and when it is diagnosed and reported. Our internal process also adds time. The data for 2010 is likely incomplete. As of February 25, 2011 we recorded 854 cases of VF in Kings County for the period 2007-2010. We identified a date of onset for 638 of the cases. The distribution of the 638 cases is shown in Figure 1.

Looking at four years of onset data, we couldn't find any patterns over time. We found no consistent differences by month or season. To date we have no explanation for the differences. We have found that rain fall and wind data in Kings County is somewhat limited.

For the period 2007-2010, our data show that the risk of VF in Kings County isn't evenly distributed by groups of people or by location in the county. Inmates of the state prisons represent approximately 14% of the county's population but accounted for 58% of the reported cases in the four-year period. The excess rate in state prisoners was previously noted and reported in 2005 to the California Department of Public Health. Within the inmate group, those in Avenal State Prison accounted for all the increased rate of illness. The inmates at Avenal State Prison represent approximately 5% of the county population but represent 50% of the reported cases. The two prisons in Corcoran account for 9% of the county population and 9% of the reported cases. In 2007 the state reported on the increased VF rate in state inmates in Pleasant Valley State Prison in Fresno County. The cause for the excess rate in state prisoners is unknown. Because previous exposure to VF provides partial immunity, state prisoners from areas without VF would be at higher risk for developing VF than would be people who've previously lived where VF is common. It is also possible that there is a diagnostic bias in the prisons. That is, because of increased awareness in the prisons; milder cases are more likely to be tested and diagnosed. Nothing has been published to date to support this explanation.

In Kings County diagnostic bias would not explain the observed excess rate at the Avenal prison compared with the two Corcoran prisons. The prison in Avenal may be located in an area where the fungus is particularly abundant.

The department has previously reported on the increased rate of Valley Fever in the west side of the county. This trend was again noted for the period 2007-2010. Although Kettleman City and Avenal, including Avenal State Prison, represent only 12% of the county population, for the four-year period they accounted for 67% of the reported cases. The two communities, excluding the inmates, represent 7% of the county population and 17% of the reported cases. Even with the exclusion of the state inmates, the observed rate of disease in the western county remains elevated. An increased risk has also been reported in the non-prisoner population in the western part of neighboring Fresno County.

Males were disproportionately affected in Kings County. Eighty-three percent of the 2007-2010 cases occurred in males. Researchers have previously noted that males are disproportionately affected. For example, the California Department of Public Health reported that 65% of the 2000-2006 cases in California were male. The population of Kings County is disproportionately male. While California is close to 50% male, Kings County is 57.7% male. This predominance of males in Kings County likely is due primarily to the 14% of the population that are male state prisoners. The Naval Air Station in Lemoore may also contribute. Assuming that males experience an excess rate of VF in Kings and elsewhere, there is no agreement about the cause.

The age distribution of the cases is shown in Figure 2. The relatively low rate in children is not surprising. Other researchers have noted that children are less likely to develop disease than are adults. Old research has demonstrated a high rate of infection in children. The available evidence suggests that children tolerate infection better than adults. If true, this observation remains unexplained. The observed age distribution, as was noted with gender distribution, likely is highly influenced by the age distribution of the inmates at Avenal State Prison.

Figure 2: Age Distribution of Valley Fever Cases 2007-2011

Age Range	% (number) Cases	% Kings Population 2005-2009
<5 years	1 % (n=8)	8.4%
5-19 years	9 % (n=70)	22.4%
20-34 years	27 % (n=224)	27.3%
35-54 years	47 % (n=394)	27.3%
>55 years	19 % (n=158)	14.6%

Cases: n= 854 02/25/2011

The race and ethnicity of the cases is shown in Figure 3. The relatively high rate of unknown race/ethnicity makes interpretation problematic. We have found that race/ethnicity data often are not noted in clinic records. The apparent increase in cases in African-Americans is unexplained. African-Americans are known to be at much higher risk for complicated VF. Reports out of Kern County have suggested that African-Americans are at higher risk for any VF disease.

Figure 3: Valley Fever Cases Race / Ethnicity, Kings County 2007-2010

Race / Ethnicity	% (number) Cases	Kings County*	Avenal*
Hispanic	42% (n=362)	50.9%	71.9%
African-Amer/ Black	18% (n=151)	6.7%	9.9%
White / Non-Hispanic	21% (n=182)	35.2%	15.2%
Native American	<1% (n=3)	0.8%	0.5%
Asian	—	3.5%	0.7%
Unknown	18% (n=156)		

Cases: n=854 02/25/2011
*From 2010 Census

The disproportionate occurrence of VF in the west county and especially in the inmate population of Avenal State Prison affects the race, age and gender distribution of cases in Kings County. It is also apparent that a broad range of Kings County residents throughout the county were affected by Valley Fever in the four-year reporting period.

In addition to better counting of cases, the mandated increased reporting requirement has also allowed us to better characterize the nature of the illness at the time the disease is reported. This data is not included in this report.

ADVENTIST HEALTH STUDY

Knowing the number of cases provides only one measure of estimating the burden of VF on our communities. Diabetes, cancer and even motor vehicle accidents may cause more burden than VF in Kings County. The data we obtain from disease reporting generally doesn't provide an adequate measure of the seriousness of the disease. In the case of VF some initially mild cases can later become complicated. If you will, how important is VF for our community?

The range of illness associated with VF is very broad. The national estimate is that as many as 60% of persons infected with the fungus have no symptoms. Some of these may have a localized rash and may not seek medical attention. The rash is termed erythema nodosum. It is more common in younger people and in females. This rash is sometimes the only manifestation of the disease. Most people with symptoms have either a nonspecific influenza-like illness or a non-specific pneumonia. Rarely, the pneumonia improves but never resolves completely. Approximately 2% of people develop very serious, often prolonged disease. In these cases the fungus spreads from the lungs to involve bones, joints, lymph nodes, the linings of the brain or other organs. VF is uncommonly fatal, but can be, even with optimal available therapy. Some people are recognized as being at increased risk for complicated disease. For reasons unexplained African-Americans and Asians, especially Filipino-Americans, have been reported to be at increased risk for complicated VF. People with a compromised immune system, pregnant women and people with diabetes are known to be at increased risk. To further estimate the burden of Valley Fever in our community, we partnered with Adventist Health to look at cases that required inpatient care.

During the 2007 - 2009 study period, Adventist Health was the largest health care provider in Kings County and a significant provider in two adjacent counties. They operated two hospitals in Kings County and one in Fresno County. In addition to clinics in Fresno and Tulare Counties, Adventist Health has outpatient clinics throughout Kings County.

The Adventist Health Study has some acknowledged limitations. Not all these admissions involved Kings County residents. One of Adventist Health's three facilities is located outside the county. On the other hand, admission to Adventist Health facilities provides only a partial picture of inpatient care for Kings County residents. Patients admitted to Corcoran District Hospital or Lemoore Naval Station hospital weren't included. Patients admitted to facilities outside the county weren't included. Often Kings County residents are hospitalized outside the county, e.g., patients with Kaiser insurance coverage, patients admitted to Coalinga Regional Medical Center and Children's Hospital of Central California.

The Health Insurance Portability and Accountability Act (HIPAA) allows the Health Officer to have access to the records of all VF-related hospital admissions. Records were reviewed for the years 2007 to 2009. The reviewed cases had VF as either the primary or a secondary diagnosis. Adventist Health also provided data on the length of hospital stay and the charges. Because the Health Officer was able to access the medical records electronically, he was able to complete the record reviews as time permitted. It is unlikely that he would have been able to perform an on-site record review. In addition to the current report, the data will be used to produce a second, clinical report for community health providers. This report will follow in July 2011.

During this three-year period there were 147 admissions, and some persons had more than one admission. To avoid exaggerating the burden, only those admissions found to be primarily VF related were included in the analysis. Valley Fever may and likely did contribute to the remaining admissions, e.g., by prolonging the hospital stay. Lacking a means to estimate this contribution, these cases were excluded. Ninety five of the 147 admissions (65%) were included in the study. Seventy two persons were involved in the 95 admissions. Sixty four percent of these were residents of Kings County; 30.5% were Fresno County residents and 5.5% were Tulare County residents. None of the admissions involved a state correctional inmate. With the exception of one adolescent, no children were admitted during the study period. Pediatric admissions during this period likely would have been admitted elsewhere.

The average age of the 72 patients was 45.7 years with a range of 15-78 years. Sixty-nine percent of the 72 patients

were male. The race/ethnicity of the study group is noted in Figure 4. No race/ethnicity population distribution for the Adventist Health catchment area is available for comparison.

Figure 4: Adventist Health Valley Fever Admissions 2007-2009: Gender and Race/Ethnicity

Gender:	Male n=50 (69%)	Female n=22 (30.5%)
Race / Ethnicity		
White/Hispanic	68%	n=49
African-American	7%	n=5
Filipino	3%	n=2
White / Non-Hispanic	22%	n=16

Forty-six patients (64%) were admitted with community-acquired pneumonia (CAP). The other 26 (36%) admitted with other clinical manifestations of VF. The non-CAP cases were on the average more severely affected. They accounted for a disproportionate number of hospital days and charges. See Figure 5.

Figure 5: Adventist Health VF Admissions 2007-2009, LOS and Charges

	Length of Stay	Total Charges
CAP	338 days	\$2,035,911
Non-CAP	578 days	\$3,869,197
Totals	916 days	\$5,905,108

Selma Community Hospital in Fresno County accounted for only 6% of the hospital days and 5% of the hospital charges. Charges are not the actual amount paid by patients or insurers

The non-community-acquired pneumonia group (n=26) represented only 36% of the inpatients but accounted for 63% of the hospital days and 65.5% of the hospitalization charges.

Fourteen of the 95 hospital admissions were transfers from other hospitals. Eight of the hospital discharges were transfers to other hospitals. With one exception these were to tertiary care hospitals (higher level care). One patient had several discharges and readmissions to and from higher level care hospitals. This patient had a combined, continuous hospital stay of 103 days. Of the 72 patients, one died during the hospital stay. Our study was limited to Adventist Health admissions. We did not capture the additional length of stay and hospital charges incurred by hospitalizations outside the Adventist Health system.

Eight of 26 (31%) of the non-CAP group had a diagnosis of VF prior to their 2007-2009 admission. Four of this group had a diagnosis of complicated VF at the time of their first 2007-2009 admission. Eight of 26 (31%) had a diagnosis of VF meningitis, a condition that will require lifelong treatment. Twelve of 26 (46%) had other serious medical conditions, and one was pregnant.

In the CAP group, 19 of 46 (41%) had another serious medical condition. Diabetes was the most common associated medical condition for both groups. Nineteen of 72 (26%) had a diagnosis of diabetes at the time of admission. None of the patients tested positive for HIV, but 65% of the patients had no record of HIV testing. Again, while other medical conditions were common 57% of the 72 patients were previously healthy before their hospitalization for VF.

As noted, the Adventist data, with one exception, didn't capture pediatric admissions. We know that there were five pediatric admissions to Children's Hospital of Central California in association with the observed outbreak in 2010. As of mid-March 2011, four had been discharged. The child still hospitalized had been hospitalized for 109 days by Mid-March. Of the four who had been discharged, the average length of stay in the hospital was 71 days.

The AH inpatient data demonstrates a considerable VF burden on our community with almost one thousand inpatient days and almost six million dollars in hospital charges. The inpatient data is limited by the absence of a reference population. We don't know the demographics of the population of people who use Adventist Health as their inpatient health care provider. Around one third of the cases are not residents of Kings County. The observed burden on our community may still be an underestimate. Although state inmates account for over half the VF cases observed in Kings county, there were no inmate admissions to the AH system in 2007-2009. There likely were many inmate admissions and the associated hospital days and charges weren't captured in the AH study. The selection process used may have excluded additional hospital admissions. We know that some of the patients in this study were discharged from or transferred to outside hospitals. It is likely that other non-inmate, Kings County residents were admitted to non-Adventist hospitals during the period 2007-2009. A more comprehensive study of inpatient burden would entail resources beyond those of the Kings County Department of Public Health. Without the full cooperation of the Adventist Health System, we couldn't have collected the data we have.

Valley Fever can be fatal. Including the VF-caused death noted previously, there have been five Kings County VF deaths since 2007.

WESTSIDE STUDY

Hospitalization analysis can provide only a partial picture of the burden of this disease in our community. We know that many people who eventually fully recover can have a prolonged disability associated with VF. Recognizing that the west side of the county has a higher risk for VF, beginning in 2010 the KCDPH implemented a survey in Avenal and Kettleman City. State prisoners were not included in this study. Every reported case was contacted and asked to participate in the survey. The survey was designed to assess the VF burden on these affected individuals. They are asked about the number of days missed from work or school, clinical care and duration of illness. Our methodology involves following them until they have fully recovered. We recognize that this is an additional imposition on these families and appreciate their cooperation with our study. The number of cases available is still limited and some of them remain open. Our preliminary results do add to the assessment of the burden of VF on the county.

Of 72 cases in 2010, ten either declined to participate or couldn't be located. Forty-nine of the 62 study cases (79%) reported missed school or work days. (This may be low because we didn't correct for people who were unemployed prior to their illness.) The average number of missed days was 43. Fifty-one of 62 (83%) reported days when they were unable to perform their normal activities. They didn't feel well enough to do what they normally do. The average number of days of decreased activities was 64 days. The study participants reported 372 outpatient visits (either Emergency Department or clinic) for an average of six visits per person. Seventeen of 62 (28%) were hospitalized for VF. These 17 people had 21 hospitalizations for a total of 459 days or an average of 27 days per person. Few of these hospitalizations (12%) occurred in Kings County. Our methodology doesn't allow us to collect the hospital charges for these hospitalizations.

Statistically the 62 people in our Westside Study should eventually have a full recovery. Clearly the medical care and the temporary disability involved in VF are significant even when a full recovery is expected.

KCDPH

In addition to studying VF in Kings County, the KCDPH has taken action to lessen the burden of VF on our residents. Our public health nurses reported that some patients experienced problems getting Valley Fever medications. Some of these patients were found to be covered by the state's Medi-Cal program. We found that the needed medications required a treatment authorization. This resulted in delays and sometimes in denials. With the help of our California Department of Public Health colleagues, the Medi-Cal authorization requirement for Valley Fever treatment was removed. We've confirmed that there are no medication barriers for patients covered by the County Medical Services Program. We have posted on our website guidance for medical providers to use in getting free or very low cost medications for their indigent but uninsured patients.

In partnership with the Valley Fever Center for Excellence in Arizona we have identified VF educational resources for community health care providers. Physicians new to the area and to VF can now take a high-quality online training program on VF.

The KCDPH will continue to receive disease reports and will continue to track this disease in our community. We will continue to try to explain the observed variation in disease occurrence.

KCDPH will continue to raise VF awareness. For example, Valley Fever may cause more disease in California than is generally recognized. Travelers on Interstate 5 in Kings County probably are at risk for contracting VF. Infection and illness have been documented elsewhere after brief, transient exposure. Few of those affected would likely be properly diagnosed if they reside in an area free of VF. Physicians unfamiliar with Valley Fever are very unlikely to diagnose it and most patients would eventually recover without specific treatment.

COUNTY RESIDENTS

We have no preventive strategy for the general population of residents. The KCDPH Environmental Health Division is available to consult and provide information to employers and the public on risk reduction and prevention of occupational Valley Fever. The Division can provide assistance in identifying, evaluating and controlling the occupational routes of exposure. The Environmental Health Division can be reached by phone by calling (559) 584-1411.

Individuals with medical conditions and those taking medications that alter immune functions should consult with their health care provider about VF risk reduction. County residents may want to ask their clinical providers to test for VF when they have a compatible illness. Fever and cough are the most common symptoms with or without a rather profound fatigue. Most people don't have a rash. However, rash may accompany or precede the fever. A rash may be generalized and nonspecific. The rash, previously mentioned, erythema nodosum, is suggestive of VF. Usually on the legs, the rash is circular/oval, red, firm, under the skin surface and slightly tender to the touch. With the exception of the rash just mentioned, there is nothing specific about the symptoms and signs of VF. We don't know that treatment with the medications we have available reliably shortens the duration or intensity of the illness. Having the diagnosis may still be helpful in explaining your symptoms and in avoiding unnecessary diagnostic studies and treatment with antibiotics.

COMMUNITY

Valley Fever disproportionately affects some county residents. The following is an example of someone heavily burdened by Valley Fever.

A Kings County resident— who, at the time he became ill with Valley Fever was a 21 years old, African-American college student.. In addition to being a full-time student, he worked part-time. A successful high school athlete, he also kept himself fit and trim. He had disseminated disease as his first sign of illness. His disease had spread beyond the lungs when he first became ill. He was hospitalized four times in Kings County and had several admissions to referral hospitals. He was hospitalized for over 90 days in Kings County and his hospital charges for the Kings County admissions were over a half a million dollars. His weight dropped from a lean 165 to a skeletal 115 lbs. For quite a while he was unable to even get out of bed without assistance. Thankfully, he is now recovering. After missing one and a half years of school because of his illness, he's resumed his college education. He has daily pain that requires treatment. He must continue on daily VF treatment. He is now learning to live with the fact that his disease could return despite daily treatment. This young man is an excellent example of why we need to prevent Valley Fever or, failing that, have more effective treatment.

RECOMMENDATIONS

The orphan status of this disease means that we need to generate community support for the necessary research and development. In the past both the state and the federal governments have provided some support for VF research. We should encourage our state and federal representatives to continue to support VF research. Community civic organizations should consider adopting this orphan disease for their support. The Valley Fever Vaccine Project, housed at California State University, Bakersfield, is making progress on the development of a vaccine. The Valley Fever Center for Excellence at the University of Arizona is working on a promising new drug for the treatment of Valley Fever.

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APPENDIX

I would like to acknowledge the following Health Department staff for their dedication and commitment to all that went into making this report possible:

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