

Death from Fungus in the Soil

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Reginald Tucker] Hi, I'm Reginald Tucker and today I'm talking with Dr. Shira Shafir, Assistant Professor of Epidemiology at the UCLA Fielding School of Public Health. Our conversation is based on her study about coccidioidomycosis found in soil, which appears in CDC's journal, *Emerging Infectious Diseases*. Welcome, Dr. Shafir.

[Shira Shafir] Hello, nice to be here.

[Reginald Tucker] Dr. Shafir, what is coccidioidomycosis?

[Shira Shafir] Coccidioidomycosis, also known as cocci or valley fever, is a disease primarily in the lungs caused by the fungus, *coccidioides*. It's found in the soil of dry, low rainfall areas. It's endemic in many parts of the Southwestern United States, Mexico, and Central and South America. Many of the people who live in these areas get exposed to the fungus at some point in their lives. For most people who get infected, the infection will go away on its own. However, for certain groups of people, they may develop severe or disseminated infections, meaning as more widely spread, or chronic pneumonia, and these people will require medical treatment.

[Reginald Tucker] Who is most likely to get coccidioidomycosis?

[Shira Shafir] Anyone who lives in or visits or travels through the areas where the fungus is endemic is at risk for infection with *Coccidioides*. We also know that the risk of infection increases when the amount of dust in the air increases, such as after earthquakes, dust storms, droughts, or other natural disasters. People whose occupations involve being outdoors or disturbing the soil are also at increased risk. These groups include archeologists, military personnel, construction workers, and farmers. The risk for disseminated disease is significantly higher among men, people with compromised or suppressed immune systems, like those who have HIV, those receiving corticosteroids, and pregnant women, particularly those in their third trimester. Risk for disseminated disease also seems to be higher for African Americans and Filipino Americans.

[Reginald Tucker] Do we know why men and people from these particular populations are more susceptible to the disease?

[Shira Shafir] We know that people with compromised or suppressed immune systems are more likely to get severe disease because their immune systems are not able to control the infection and this allows the fungus to spread from the lungs to other organs. Otherwise, we aren't really sure why the other groups are more susceptible to serious disease.

[Reginald Tucker] Is coccidioidomycosis considered a major cause of death in the US?

[Shira Shafir] While coccidioidomycosis has the potential to be severe and fatal, we believe that the number of deaths in the US associated with this disease are limited. Over an 18-year period, about 3,100 deaths related to this disease occurred.

[Reginald Tucker] So, who's most likely to die from the disease?

[Shira Shafir] Native Americans and Hispanics are most likely to die from this disease, as well as anyone over the age of 65. Additionally, individuals who have a compromised immune system are also

more likely to die from cocci. These conditions include HIV, tuberculosis, diabetes mellitus, autoimmune diseases, organ transplant, and cancers of lymphatic cells.

[Reginald Tucker] Do we know why this is?

[Shira Shafir] When we see more people die in some groups as compared to others, we think it's either because certain groups are at an increased risk of exposure, they might have an increased risk of severe disease, or a combination of these two factors. We see that people in Arizona and California are more likely to die of this disease, but we suspect that it's simply because they're more likely to get the disease in the first place. Additionally, Arizona and California are popular places for people to retire, so this increased risk may also reflect an older population seen in these states. People over the age of 65 may be at increased risk for death because their immune systems do not function as well and also because they are more likely to have other medical conditions. In some populations, we suspect that possibility of death increases because poor access to health care services might delay diagnosis, resulting in more severe disease.

[Reginald Tucker] How does a person get the disease?

[Shira Shafir] The fungal spores become airborne when the soil is disturbed by winds, construction, farming, and other activities. Then, infection occurs when a spore is inhaled. Within the lung, the spore changes into a larger, multi-cellular structure called a spherule. That spherule in the lung will grow and eventually burst, releasing endospores, which develop into more spherules. Valley fever symptoms generally occur within three weeks of exposure. And valley fever isn't a contagious disease, meaning it's not passed from person to person.

[Reginald Tucker] Where are the spores most likely to be found?

[Shira Shafir] *Coccidioides* species are found in lower elevation areas that receive less than 20 inches of rain per year and have warm, sandy soil. They're usually found 4 to 12 inches below the surface and they're able to grow better if there are animal droppings present in the soil.

[Reginald Tucker] How do they get there?

[Shira Shafir] The soil is the natural reservoir for these spores. That means this is where they normally live.

[Reginald Tucker] Are there any trends in the spread of these spores related to temperature or seasons?

[Shira Shafir] Although blowing dust may carry the infectious spores of cocci anytime throughout the year, there are times we do see an increase in risk during certain times, which appears to be linked to the amount of rainfall. In Arizona, the peak seasons occur from June through August and from October through November. In California, the summer months of June through August have the most cases reported.

[Reginald Tucker] Why did you do this study?

[Shira Shafir] We did this study because we were interested in figuring out if there were any reasons or risk factors that made it more likely that someone would die from coccidioidomycosis.

[Reginald Tucker] How was your study conducted?

[Shira Shafir] We analyzed US death certificates from 1990 to 2008, basing our timeframe on publicly available data. These death certificates are issued for everyone who dies in the United States and contain demographic information, like age, sex, and race ethnicity, as well as geographic information, such as, state of residence and place of death. In addition to designating underlying causes, the physician or coroner can list conditions that are believed to have contributed to the death. By examining and comparing the death certificate data to the US Census data, we were able to calculate mortality rates. We also used a case-control study design and compared individuals who died of coccidioidomycosis to randomly chosen individuals who died of other causes to determine if there were any risk factors for death from the disease. By comparing the deaths in this way, we were able to see if people who died of cocci were more likely to be of a certain race, in a particular age group, in a particular state or region, or if they had any other diseases that may have increased their risk of dying from the infection.

[Reginald Tucker] Since valley fever is a public health threat, are there things the health community could be doing to improve outcomes for people who get the disease?

[Shira Shafir] The most important thing the health community can be doing is rapid diagnosis of individuals who are infected. Once they're diagnosed, they can be appropriately treated, but people can't be diagnosed if they don't go to the doctor. Hopefully, by making people aware of the seriousness of this disease, we can encourage people who have been living, visiting, and traveling in the areas where infection occurs to see their doctor if they're not feeling well, and then encourage doctors to test for the disease. Also, since we don't currently have a vaccine for the disease, continued research into a vaccine is extremely important, as well as more research into better treatments for the infection. And good reporting of the disease helps give us more information about where the disease is occurring and who is getting sick.

[Reginald Tucker] How would people know they should go to the doctor? What are the signs and symptoms? And is there a reliable test for the infection?

[Shira Shafir] There is a reliable test for the infection. Less than half of all people who are infected will experience any symptoms or they'll have very mild flu-like symptoms that go away on their own. However, when symptoms do occur, they can be serious and include fever, cough, headache, muscle aches, joint pain in the knees and ankles, and a rash on the upper trunk or extremities. People who are infected may have none, some, or all of these symptoms. These symptoms usually appear between one and three weeks after exposure to the fungus. If the disease advances, it can cause skin lesions, chronic pneumonia, meningitis, and bone and joint infection. If you're experiencing any of these symptoms and they last for more than a week, it's important to go to the doctor so you can be tested.

[Reginald Tucker] Is there anything individuals can do to protect themselves from this disease?

[Shira Shafir] It's very difficult to avoid exposure to coccidioides, but people who live in endemic regions should try to avoid dusty environments, if possible. People who are at risk for severe disease can take the following measures to avoid exposure. Wear an N95 mask if you must be in or near a dusty environment, such as a construction zone; as much as possible, avoid activities that involve close contact to dust, including yard work, gardening, and digging; use air quality improvement measures indoors, such as HEPA filters; if your doctor feels like it's necessary, you can take prophylactic anti-fungal medication; and finally, you should clean skin injuries well with soap and water, especially if they've been exposed to soil or dust, since it is possible for the fungus to enter the body through breaks in the skin.

[Reginald Tucker] Thanks, Dr. Shafir. I've been talking with Dr. Shira Shafir about her study, *Coccidioidomycosis-associated Deaths, United States, 1990-2008*, which appears in the November 2012 issue of the CDC's journal, *Emerging Infectious Diseases*. You can see the entire article online at www.cdc.gov/eid.

If you'd like to comment on this podcast, send an email to eideditor@cdc.gov. That's e-i-d-editor at c-d-c-dot-gov. I'm Reginald Tucker, for *Emerging Infectious Diseases*.

[Announcer] For the most accurate health information, visit www.cdc.gov or call 1-800-CDC-INFO.