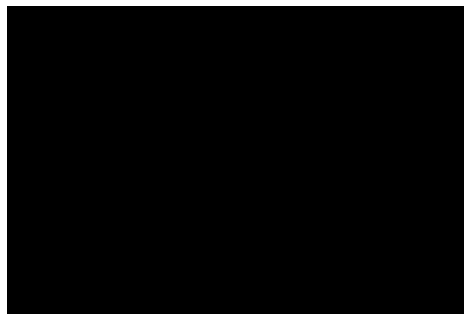


STANDARD DEVIATIONS: Dusty Trails, Dusty Trials

Greetings,

Is it possible for another intense dust storm, like the one that led to the deaths of eight people on Sunday, July 25, to happen again in Utah?

Not only possible, but likely. Our drought conditions are priming this kind of weather event; and the health hazards that can accompany dust in the West.



{Photographed in Ogden 7/28/21}

One condition endemic in our region, and exacerbated by dust, is **Valley Fever**. This is a fungus disease of mammals endemic to much of the Southwest region officially called [Coccidioidomycosis](#). Also known as California fever, desert rheumatism, or San Joaquin Valley Fever, the infection is a common cause of community-acquired pneumonia.

There are two fungus species endemic to our territory, *C. immitis* (California) and *C. posadasii* (AZ, UT, NV, NM, and Texas). In 2019, there were 18,407 cases of Valley fever reported to CDC, mostly in California and Arizona but the disease is almost surely underreported with tens of thousands of cases misdiagnosed. **This is a reportable disease in Utah** (within 3 days of identification). Testing includes ELISA for IgG & IgM as well as Immunodiffusion and Complement Fixation assays (antigen-challenge skin tests and chest X-ray are also used).

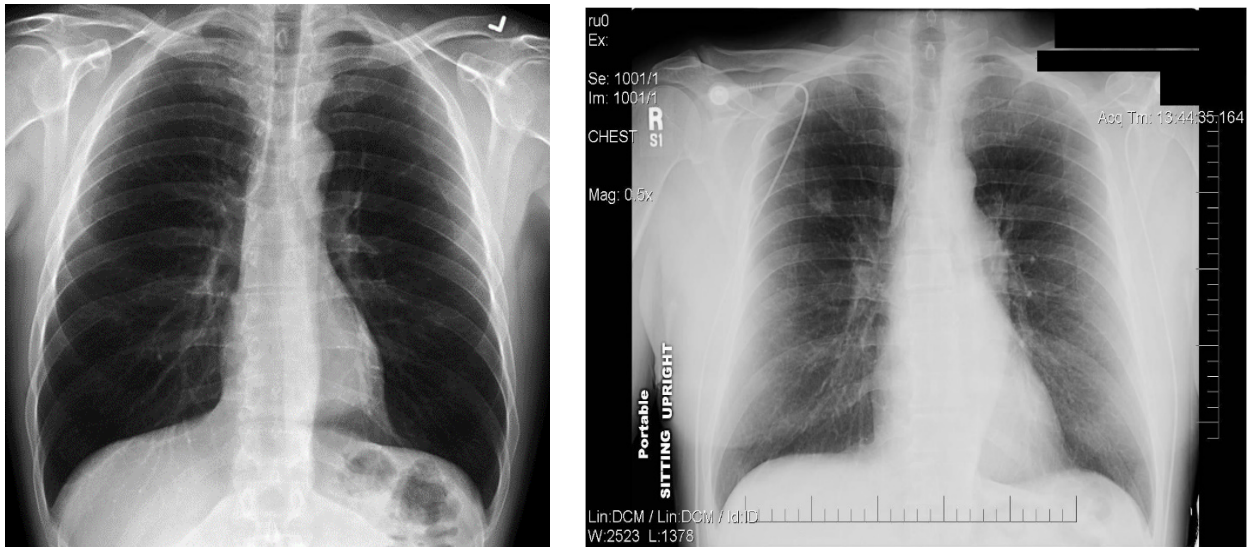
Although most cases of Valley fever are not associated with outbreaks, Valley fever outbreaks linked to a common source do occasionally occur, particularly after events that disturb large amounts of soil, like dust and dust storms.

And one huge factor in dust pollution is dry lake beds. Extensive research on the Great Salt Lake has found that about 750 square miles of dry lake bed have been exposed as the lake continues to shrink. The Sevier Desert (Millard County) is an arid vestige of Lake Bonneville that has long been a source of wind-blown dust; and drought is creating a drier, dustier landscape across the



entire state. Dust related problems will inevitably increase with continued climate change that impacts our water supply in the ground.

Coccidioidomycosis occurs when fungal spores are inhaled. It is not contagious but may recur or become chronic and is seen when soil disruption happens. The initial infection begins with Valley fever, where most people (60%) have minimal or no symptoms. But the condition can progress to a chronic form and even to a disseminated coccidioidomycosis that can result in chronic pneumonia, skin ulcers, abscesses, bone lesions, cardiac inflammation, UTI, and meningitis.



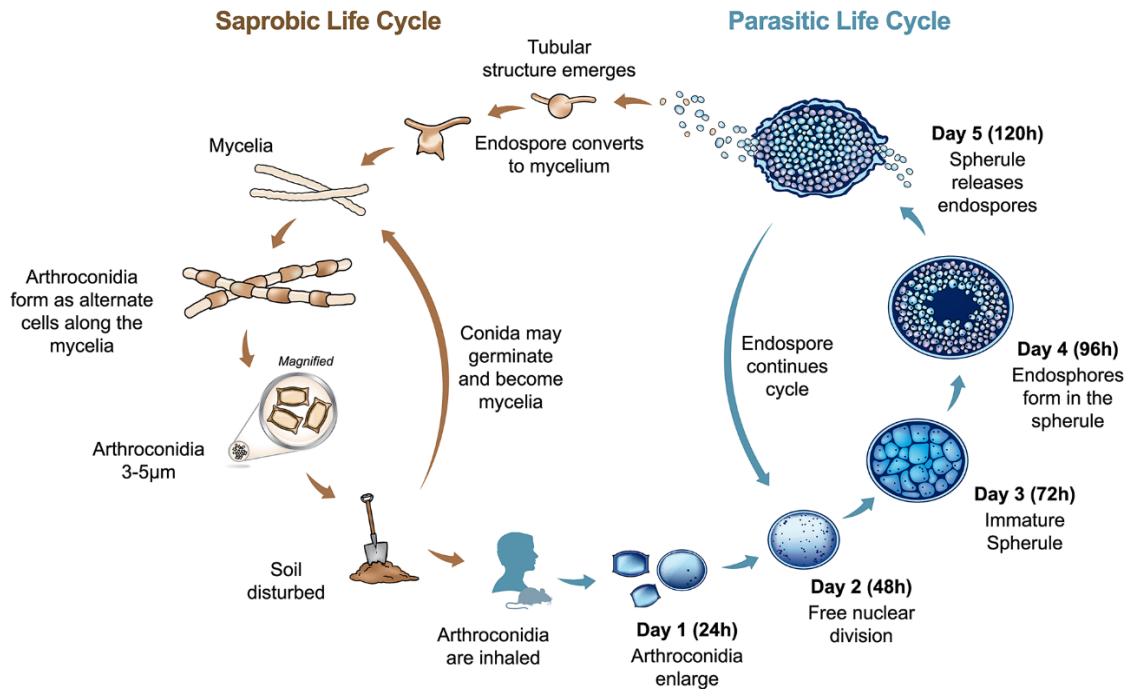
{Normal chest X-ray (L) and Pulmonary fibrosis (R) caused by coccidioidomycosis.}

The disease presents just like a flu or pneumonia, making a correct diagnosis not only difficult but imperative to successful treatment.

Mild asymptomatic cases often do not require any treatment. But severe and/or chronic infection involves antifungal therapy, which can require 3-6 months of treatment. Oral fluconazole and intravenous amphotericin B are used in progressive or disseminated disease. Fluconazole has a particular advantage in crossing the blood-brain barrier and is used for coccidioidal meningitis. There are some nephrotoxic side-effects with treatment.

The fungus a **dimorphic saprophytic**; it mainly lives and feeds off of dead organic matter in soil but also has a parasitic life cycle:





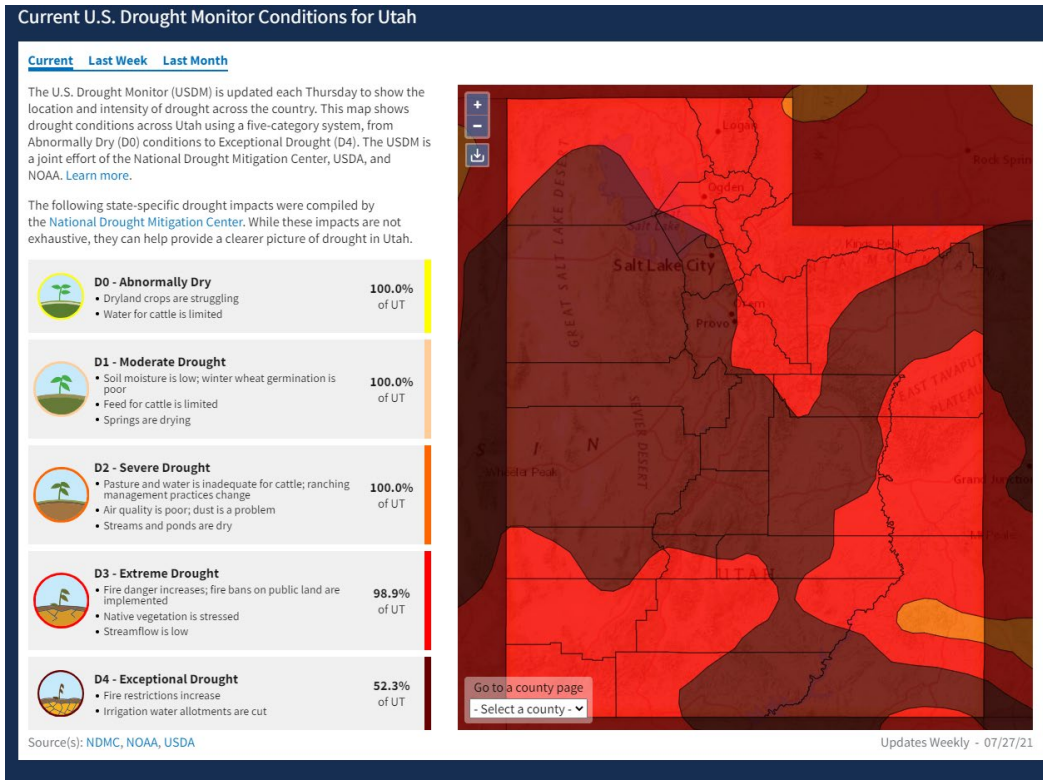
Life Cycle of *Coccidioides*

{Conditions *in vivo* are ideal for cell division.}

In soil (and agar), *Coccidioides* exist in filament form. It forms hyphae in both horizontal and vertical directions in wet/moist soil. Over a prolonged dry period, cells within hyphae degenerate to form alternating barrel-shaped cells (arthroconidia). Arthroconidia are lightweight and are effectively carried by air currents when dust is formed. This small aerosol collects in the alveoli, a nice little incubator. The parasitic life cycle is initiated when arthroconidia enlarge and transform into immature spherules. From 24 to 72 hours, spherules undergo free nuclear division and begin developing endospores. From 72 to 120 hours, the mature spherules rupture to release endospores, forming cavities in the bronchi that result in symptoms like characteristic chest pain, coughing up blood, and persistent cough. In individuals with a weakened immune system, the infection can spread through the blood.

Utah does not suffer from frequent, high-intensity dust storms (yet), but as the drought continues its hold on the state, the risk of having more of them amplifies. The Great Salt Lake is at its lowest recorded level and vast areas of lake bed are becoming dust. The dust-related crash last month occurred in a region that is experiencing some of the worst drought conditions in the country, which makes dust storms more likely. The entire state of Utah is in the two *most extreme* drought categories, according to the US Drought Monitor.





{Will Utahns be downwinders, for fungi?}

What does this have to do with labs and biosafety?

Well, for one, if this drought stirs up more dust, then we can expect a rise in fungal exposure and cases of Valley fever. We probably miss many already but the differential diagnosis may become more relevant and valuable. We'll see more presentations, and that translates to more testing, for Valley fever itself, *and* the accompanying sequelae.

Secondly, and this is my whole point, **risk can change**; and we need to recognize the ways that changes affect risk (e.g., a sudden squall of dust across a busy highway). When conditions make our environment (on and off the bench) more hazardous, then we need to think about mitigations that offer protection. Our desiccating desert becoming more dangerous with dust-borne disease is just one way risk is changing. *Maybe the delta variant of COVID-19 is another example of changing risk that we can easily observe, today?*

Utah does not record many cases of Valley fever, but the organism is here and we're likely misdiagnosing some pneumonias. Increasing dust will increase risk of exposure and disease. Just like the weather, risk can change in a flash. Awareness of risk dynamics helps us anticipate change.

Have a great week and be safe,

Bryan

