Health Impacts:
Can desert dust really make you sick?

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ADOT/NWS Dust Storm Workshop- Casa Grande, AZ- March 6, 2012
Image from TCEQ Chelsea Street Webcam, El Paso
NASA MODIS satellite images last Tuesday vs. Saturday
What are the health effects of this dust... other than from accidents? In particular, is there a respiratory health impact from dust storms?
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1. Coccidioidomycosis (valley fever)
Valley fever
San Joaquin Valley fever; Coccioidiomycosis

Last reviewed: August 29, 2011.

Valley fever is an infection that occurs when the spores of the fungus Coccioides immitis enter your body through the lungs.

Causes, incidence, and risk factors
Valley fever is a fungal infection most commonly seen in the desert regions of the southwestern United States, and in Central and South America. You get it by breathing in fungal particles from soil. The infection starts in the lungs.

Valley fever may also be called coccidiodomycosis.

Traveling to an area where the fungus is commonly seen raises your risk for this infection. You are also more likely to develop a serious infection if you have a weakened immune system due to:

- Anti-tumor necrosis factor (TNF) therapy
- Cancer
- Chemotherapy
- Diabetes
- Glucocorticoid medications (prednisone)
- Heart-lung conditions
- HIV
- Organ transplant
- Pregnancy (especially the first trimester)

People of Native American, African, or Philippine descent may also get more severe cases.

Symptoms
Most people with Valley fever never have symptoms. Others may have cold- or flu-like symptoms or symptoms of pneumonia. If symptoms occur, they typically start 5 to 21 days after exposure to the fungus.

Common symptoms include:

- Ankle, feet, and leg swelling
- Chest pain (can vary from mild to severe)
- Cough, possibly producing blood-tinged phlegm (sputum)
- Fever and night sweats
- Headache
- Muscle pain
- Nausea and vomiting
- Rash
- Sore throat
- Swollen lymph nodes (lymphadenopathy)
- Vision problems

People with certain conditions or risk factors may develop more severe illness:

- Those 65 years and older
- People with diabetes
- People with HIV/AIDS
- People with organ transplants
- Pregnant women
- People with weakened immune systems through medications (immunocompromised individuals)

Diagnosis
In most cases, physicians rely on the patient's history of travel or residence in an area where Valley fever is common as the criteria for diagnosis.

The fungus is most often identified by examination of a blood sample or a sample of a body fluid or tissue that has been stained with a dye and examined under a microscope.

If the fungus can be cultured (grown) in a laboratory, it usually confirms the diagnosis.

Treatment
A course of antifungal medications is usually needed.

Prognosis
Most cases of Valley fever recover fully. However, people may develop complications depending on their age and underlying conditions.
Symptomatic coccidioidomycosis following a severe natural dust storm. An outbreak at the Naval Air Station, Lemoore, Calif.

Williams PL, Sable DL, Mendez P, Smyth LT.

Abstract
Eighteen newly diagnosed cases of symptomatic coccidioidomycosis developed two to four weeks following exposure to a severe natural dust storm. The population at risk consisted of 26,000 residents of the San Joaquin Valley with access to health care at the Naval Hospital, Lemoore, Calif. Eight patients were white, and ten were nonwhite. The number of cases per 100,000 was estimated to be 36 for the white group and 254 for the nonwhite group. The disease was disseminated in four patients, and all were from the nonwhite group. One patient with disseminated disease, a black man, died. These data suggest that nonwhites may be relatively more susceptible to acquiring primary disease, in addition to developing disseminated disease. Dust storms of this magnitude must be considered a threat to health for populations living within areas endemic for coccidioidomycosis.


A coccidioidomycosis outbreak following the Northridge, Calif, earthquake.


Epidemic Intelligence Service (EIS), Community Disease Control, County of San Diego Department of Health Services, CA, USA.

Abstract
OBJECTIVE: To describe a coccidioidomycosis outbreak in Ventura County following the January 1994 earthquake, centered in Northridge, Calif, and to identify factors that increased the risk for acquiring acute coccidioidomycosis infection.

DESIGN: Epidemic investigation, population-based skin test survey, and case-control study.

SETTING: Ventura County, California.

RESULTS: In Ventura County, between January 24 and March 15, 1994, 203 outbreak-associated coccidioidomycosis cases, including 3 fatalities, were identified (attack rate [AR], 30 cases per 100,000 population). The majority of cases (56%) and the highest AR (114 per 100,000 population) occurred in the town of Simi Valley, a community located at the base of a mountain range that experienced numerous landslides associated with the earthquake. Disease onset for cases peaked 2 weeks after the earthquake. The AR was 2.8 times greater for persons 40 years of age and older than for younger persons (relative risk, 2.8; 95% confidence interval [CI], 2.1-3.7; P<.001). Environmental data indicated that large dust clouds, generated by landslides following the earthquake and strong aftershocks in the Santa Susana Mountains north of Simi Valley, were dispersed into nearby valleys by northeast winds. Simi Valley case-control study data indicated that physically being in a dust cloud (odds ratio, 3.0; 95% CI, 1.6-5.4; P<.001) and time spent in a dust cloud (P<.001) significantly increased the risk for being diagnosed with acute coccidioidomycosis.

CONCLUSIONS: Both the location and timing of cases strongly suggest that the coccidioidomycosis outbreak in Ventura County was caused when arthrospores were spread in dust clouds generated by the earthquake. This is the first report of a coccidioidomycosis outbreak following an earthquake. Public and physician awareness, especially in endemic areas following similar dust cloud-generating events, may result in prevention and early recognition of acute coccidioidomycosis.
Point-source outbreak of coccidioidomycosis in construction workers.

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Abstract
Coccidioidomycosis results from inhaling spores of the fungus Coccidioides spp. in soil or airborne dust in endemic areas. We investigated an outbreak of coccidioidomycosis in a 12-person civilian construction crew that excavated soil during an underground pipe installation on Camp Roberts Military Base, California in October 2007. Ten (83.3%) workers developed symptoms of coccidioidomycosis; eight (66.7%) had serologically confirmed disease, seven had abnormal chest radiographs, and one developed disseminated infection, none used respiratory protection. A diagnosis of coccidioidomycosis in an eleventh worker followed his exposure to the outbreak site in 2006. Although episodic clusters of infections have occurred at Camp Roberts, the general area is not associated with the high disease rates found in California’s San Joaquin Valley. Measures to minimize exposure to airborne spores during soil-disrupting activities should be taken before work begins in any coccidioides-endemic area, including regions with only historic evidence of disease activity.

PMID: 19845993 [PubMed - indexed for MEDLINE]

Atmospheric movement of microorganisms in clouds of desert dust and implications for human health.

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Abstract
Billions of tons of desert dust move through the atmosphere each year. The primary source regions, which include the Sahara and Sahel regions of North Africa and the Gobi and Takla Makan regions of Asia, are capable of dispersing significant quantities of desert dust across the traditionally viewed oceanic barriers. While a considerable amount of research by scientists has addressed atmospheric pathways and aerosol chemistry, very few studies to determine the numbers and types of microorganisms transported within these desert dust clouds and the roles that they may play in human health have been conducted. This review is a summary of the current state of knowledge of desert dust microbiology and the health impact that desert dust and its microbial constituents may have in downwind environments both close to and far from their sources.

PMID: 17630335 [PubMed - indexed for MEDLINE]  PMCID: PMC1932751  Free PMC Article
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2. Aspergillosis and other fungal diseases
Chao et al. 2012: “Aspergillus is consistently the most frequently recovered fungal genus in both Asian and African dust events. In our study, A. niger was specifically identified in dust events. A. niger is a ubiquitous species, usually isolated from soils, plant litter, plant rhizospheres, seeds, dried fruits and nuts. It is one of the most commonly reported fungi from food, indoor environments, and outdoor niches, occasionally causing aspergillosis in immunocompromised patients (Klich 2002; St-Germain and Summerbell 1996).”

→ The New Mexico Office of Border Health is sponsoring a study in the border regions of New Mexico to assess Aspergillus levels in soil and consider that aspergillus-caused respiratory infections may be under-reported.

→ There are reports that aspergillosis may be under-diagnosed as a cause of respiratory infections in persons inhaling desert dust: symptoms may vary.

→ Appears to be a higher incidence in areas of new construction around Las Cruces, etc., where desert soils are being broken up for development.
Conjunctivitis (pink-eye) known to be associated with fungi in Asian dust in Taiwan
What are the health effects of this dust... other than from accidents? In particular, is there a respiratory health impact from dust storms?

3. Silicosis and crystalline silica
Most desert dust in the Southwest is comprised primarily of silica (silicon dioxide-quartz).

There is only one old (1970s) report tying silicosis in the Southwest possibly to dust storms.

There is some evidence that silicosis in residents of other parts of the world may be related to inhalation of dust.

Probably not a major concern for health effects of dust in our region.
IS INHALATION OF CRYSTALLINE SILICA PER SE A HEALTH RISK?

→ Most desert dust in the Southwest is comprised primarily of silica (silicon dioxide - quartz). Quartz is a crystalline silica.

→ Some studies have suggested that exposure to silica dust is a risk factor for a number of auto-immune diseases, and also for lung cancer.

→ This assertion is still controversial and the actual risks are uncertain and much less proven (in my opinion) than of other real risks to health from dust.

→ Certain crystalline silica minerals such as cristobalite are clearly posing a higher risk: but cristobalite is a rare mineral very uncommon in our dust.
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4. Hantavirus
Hantavirus cardiopulmonary syndrome

• Often fatal disease caused by exposure to the hantavirus
• “Sin nombre” hantavirus was originally identified in the Four Corners region
• Carried by the deer mouse- *Peromyscus maniculatus*

Transmission of the virus deposited in the droppings of the mouse can be facilitated during windy or dusty periods when the virus can get airborne and be inhaled.
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4. Asthma and Bronchitis
Asthma cases rise in kids due to dust

By Noimot Olayiwola/Staff Reporter

A rising number of children are suffering from asthma and bronchitis due to the dusty wind, which has enveloped the entire city since the past three days, it was found.

"Since the dust storm began, we have noticed at the Paediatric Emergency Centres (PECs) across the country, a significant increase of between 15 and 20% of cases of asthma and bronchitis among children, especially those aged below five," PECs director Dr Khalid al-Ansari said yesterday.

According to him, out of a total of 1,200 emergency cases seen at the Al Saad PEC on Friday, some 360 had with both illnesses. Some 40 children were reported to be admitted for observation at the Hamad Hospital having suffered bronchial problems.

"Apart from these two major respiratory-related health problems, other cases we also received include fever, viral meningitis and gastro-enteritis. However, the high figure we recorded on Friday was not new because during early winter say around January, we usually record even higher number of cases," he said.

Asked whether the PECs have changed the rule not to prescribe cold and flu medications for children below five years, he said the ruling still remained as there were no new evidence that the drugs work in the children.

"This decision was made according to the recommendations of the US Food and Drugs and Administration (FDA) that those cough and cold medications do more harm than good to the children," he said.

However, the official said that medications will be prescribed if the affected children show signs of asthma or bronchitis or other serious respiratory health problems.

Dr al-Ansari advised parents to protect their children from the dust by keeping them indoors.
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Association of desert dust with respiratory disease such as asthma, bronchitis, sinus infections, pneumonia, etc. has been well established in the Caribbean; in Korea, Japan, and Taiwan; and in Australia. However, no studies had been done either with North American dust, or dust that has not travelled far from its source.
Hospital admissions for asthma and acute bronchitis in the Paso del Norte: the impacts of dust and low wind events

- Research Team:
  - Sara E. Grineski
  - Joan G. Staniswalis
  - Roberto Hurtado
  - Thomas E. Gill
  - Amista Salcido
  - Yanlei Peng (MS student)
  - Priyangi Bulathsinhala (MS student)
The Paso Del Norte area - El Paso and Ciudad Juarez - is more dusty than Arizona, we average about 15 dust storm days per year: and they are longer lasting. So these results may not hold here in Arizona.
• Ciudad Juarez, Mexico

Weeks when at least one dust storm happened had 8% more hospital admissions for asthma, respiratory infections, and pneumonia (combined) than weeks without a dust storm – although this was not statistically significant.
• El Paso, Texas

We found that hospital visits for both asthma and acute bronchitis were higher on dust storm days and immediately thereafter.
• El Paso, Texas

Both children and adults were 16% more likely to make hospital visits for asthma when there was a dust storm and immediately thereafter. The population overall was 11% more likely to visit the hospital during and immediately after a dust storm.

The population overall was 23% more likely to visit the hospital for acute bronchitis the day after a dust storm, and 33% more likely for children. The effect was much stronger for women and girls.

These were statistically significant results.
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These were statistically significant results.
Our peer-reviewed study was published last November.

Adults covered by Medicaid and adults without health insurance had higher risks of hospitalization for asthma and acute bronchitis after dust events.

Conclusions: Results suggest that there were respiratory health effects associated with dust events in El Paso, with stronger impacts among children and poor adults. Girls and boys with acute bronchitis were differentially sensitive to dust events.
Other issues

• Cardiovascular effects - heart disease/attacks?
Other issues

• Is Particulate matter *per se* a health hazard???
• Are desert dust events a natural event beyond the scope of USEPA PM standards?
Potentially toxic metals such as lead, zinc and arsenic have been detected in individual dust samples.
CONCLUSIONS

- Dust storms certainly do appear to pose health risks beyond those just due to vehicular accidents, etc.
- Respiratory problems, especially asthma and bronchitis, certainly do appear to become worse during and after dust storms, and certain populations are more sensitive.
- “Valley fever,” aspergillosis, and other disease-causing fungal pathogens can be transmitted in dust storms.
- Other diseases: the jury is still out.