

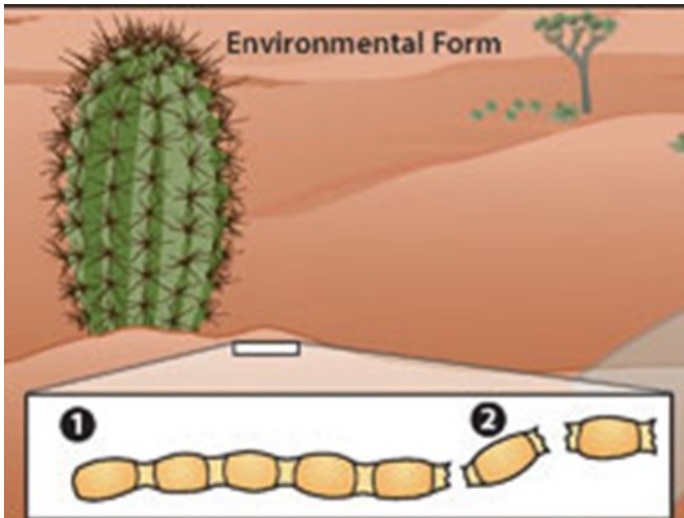
Environmental Fungal Diseases

What can we learn together?

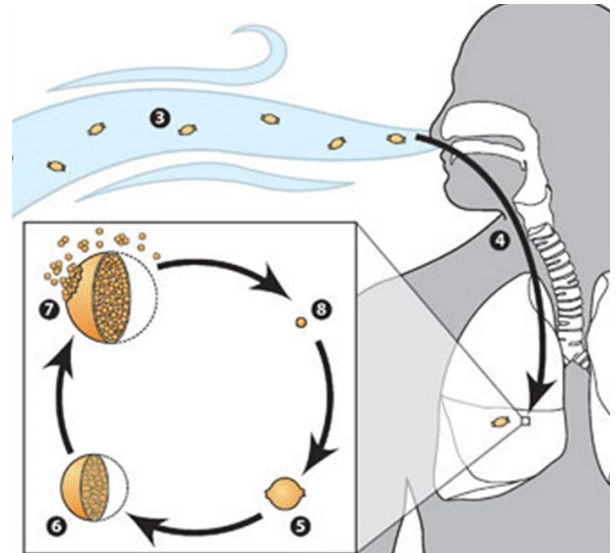
Orion McCotter, MPH
Mycotic Diseases Branch

HAQAST
Madison, WI
July 17, 2018

Coccidioidomycosis (Valley fever)



Environmental form
Coccidioides spp.



Host-associated form
Coccidioidomycosis
(Valley fever)

Valley fever impact on Patients

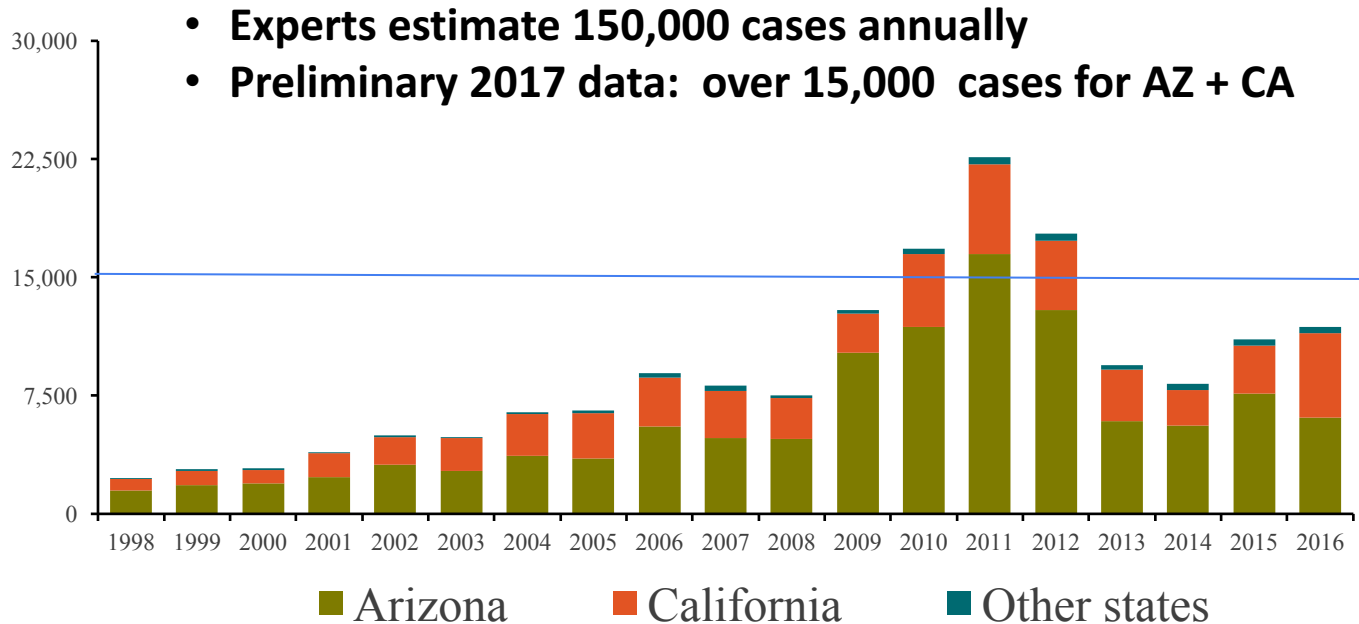
Symptoms last median of 120 days

- 40% require hospitalization
 - ~\$50,000 a visit
- 1% life-threatening or disseminated disease
- 75% miss >14 workdays



<http://www.centerforhealthjournalism.org/valleyfever/putting-valley-fever-front-burner>

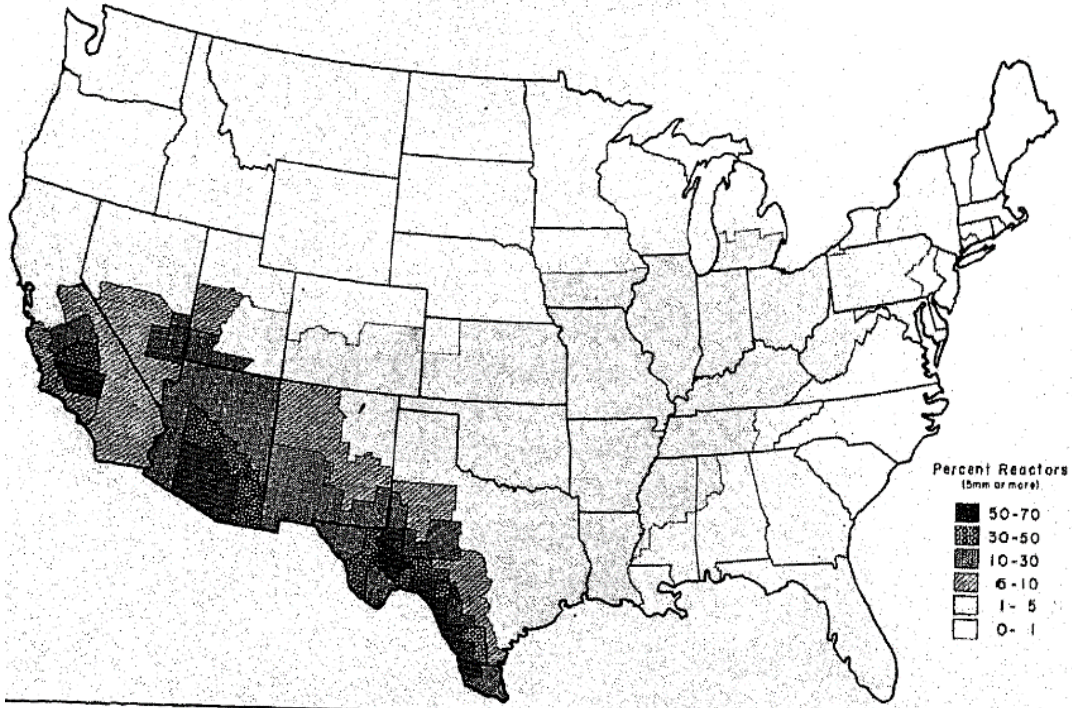
Reported Cases of Coccidioidomycosis in the U.S., 1998-2016



• As reported in the National Notifiable Diseases Surveillance System

Where is it?

Skin Testing Studies late 1940s early 1950s



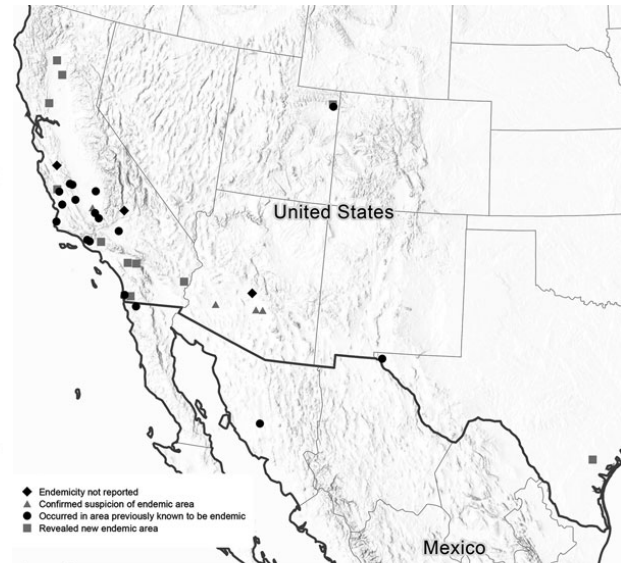
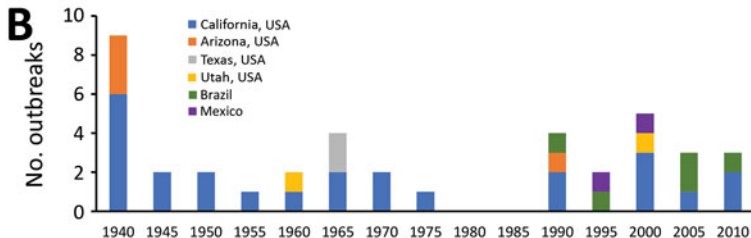
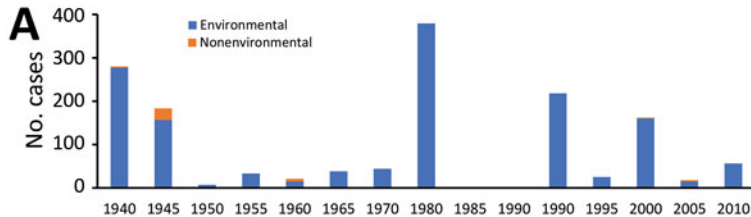
Prevalence of sensitivity to coccidioidin, with special reference to specific and nonspecific reactions to coccidioidin and to histoplasmin.
EDWARDS PQ, PALMER CE. Dis Chest. 1957 Jan;31(1):35-60.

Outbreaks

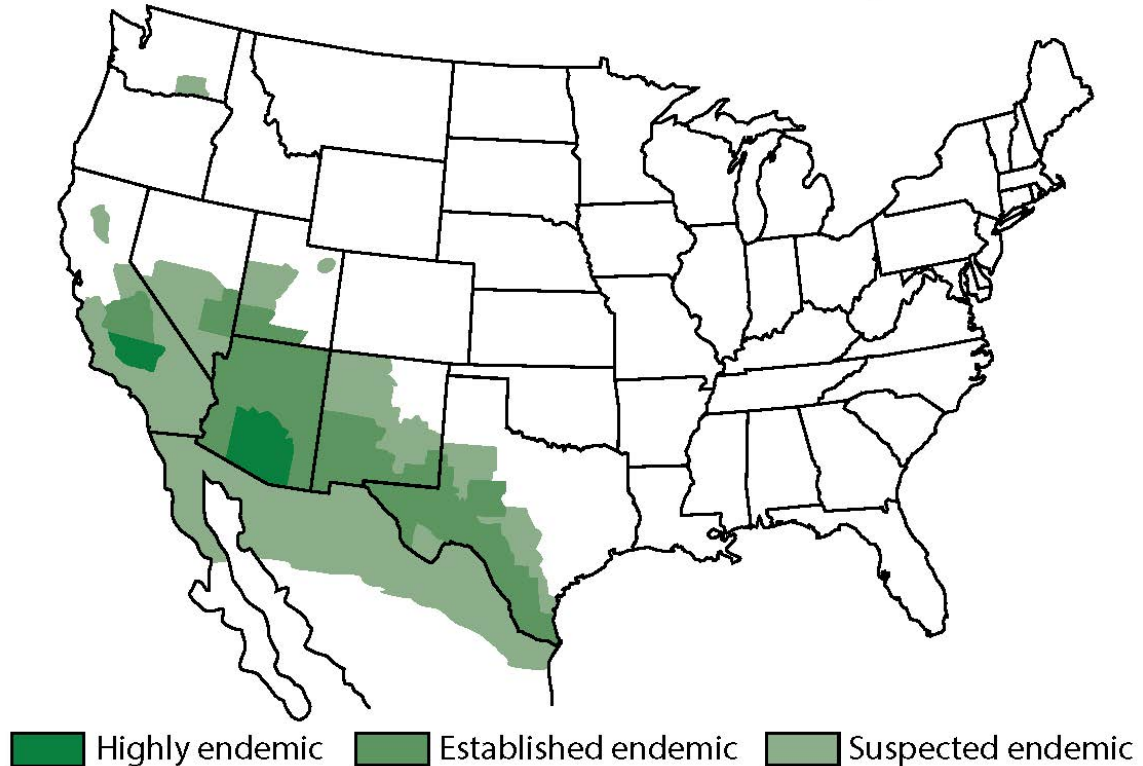
Coccidioidomycosis Outbreaks, United States and Worldwide, 1940–2015

Michael Freedman, Brendan R. Jackson, Orion McCotter, and Kaitlin Benedict

Author affiliations: Children's Hospital of Pittsburgh, Pittsburgh, Pennsylvania, USA (M. Freedman); Centers for Disease Control and Prevention, Atlanta, Georgia, USA (B.R. Jackson, O. McCotter, K. Benedict)



Understanding the geographic range



Environmental Aspects

Precipitation, Drought, Soil Moisture

- Complex life cycle in environment
- Preceding precipitation, soil moisture for fungus to grow
- Period of drought for soil to be disturbed

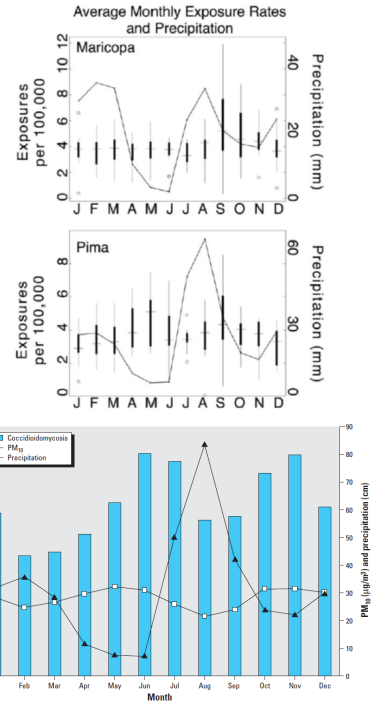


Figure 2. Mean monthly coccidioidomycosis incidence in Pima County, Arizona, based on estimated exposure date, with mean monthly precipitation and mean monthly PM₁₀ concentrations, 1992–2003.

Comrie AC. Climate Factors Influencing Coccidioidomycosis Seasonality and Outbreaks. 2005. *Environmental Health Perspectives*, 113(6): 688692.

Tamerius, J.D. and Comrie, A.C., Coccidioidomycosis incidence in Arizona predicted by seasonal precipitation. 2011. *PLoS ONE*, 6(6): e21009.

Coopersmith EJ, Bell JE, Benedict K, Shriber J, McCotter O, Cosh MH. Relating coccidioidomycosis (valley fever) incidence to soil moisture conditions. 2017. *GeoHealth*, 1(1): 53–63.

What is the role of dust storms in transmission?

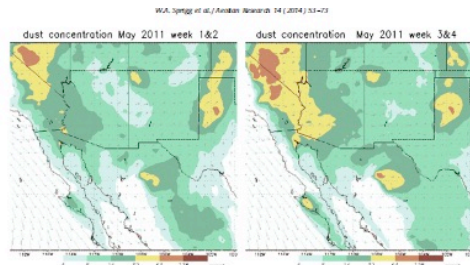


Fig. 14a. Model hindcast of surface dust concentrations ($\mu\text{g m}^{-3}$) averaged over (I) the first two weeks and (II) the last two weeks of May 2011.

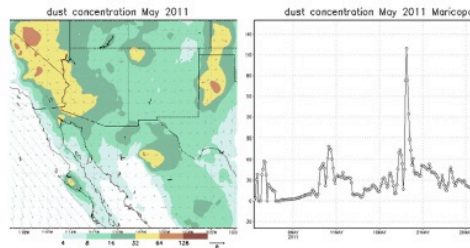
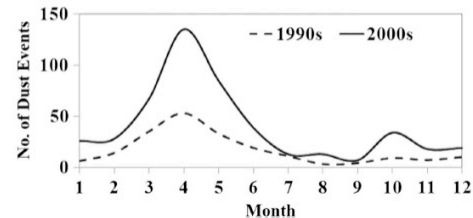
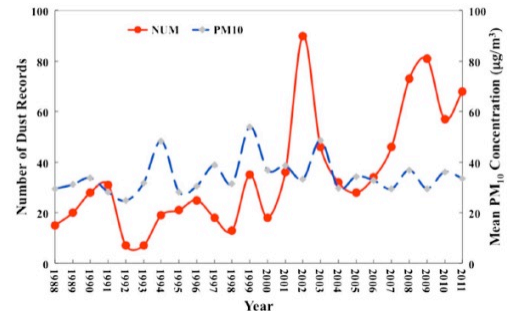


Fig. 14b. Model hindcast of surface dust concentrations ($\mu\text{g m}^{-3}$) averaged over the month of May 2011 and (II) the May 2011 evolution of dust concentration ($\mu\text{g m}^{-3}$) in Maricopa County, Arizona.



Intensified dust storm activity and Valley fever infection in the southwestern United States

Daniel Q. Tong^{1,2,3}, Julian X. L. Wang², Thomas E. Gill⁴, Hang Lei^{1,2}, and Binyu Wang¹

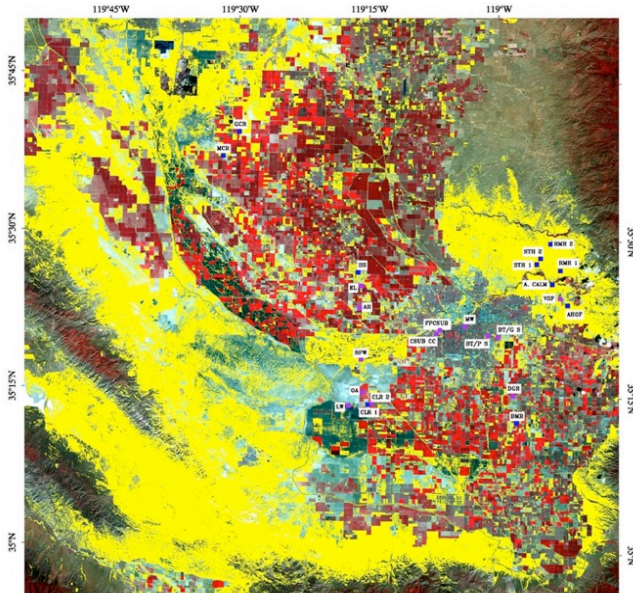
¹Center for Spatial Information Science and Systems, George Mason University, Fairfax, Virginia, USA, ²Air Resources Laboratory, National Oceanic and Atmospheric Administration, College Park, Maryland, USA, ³Cooperative Institute of Climate and Satellite, University of Maryland, College Park, Maryland, USA, ⁴Department of Geological Sciences, University of Texas at El Paso, El Paso, Texas, USA

Regional dust storm modeling for health services: The case of valley fever



William A. Sprigg^{a,b,*}, Slobodan Nickovic^{a,d,g}, John N. Gargiani^c, Goran Pejanovic^d, Slavko Petkovic^d, Mirjam Vujadinovic^{d,e}, Ana Vukovic^{d,e}, Milan Dacic^d, Scott DiBiase^f, Anup Prasad^b, Hesham El-Askary^{b,h}

Environmental sampling techniques have improved



Molecular detection of airborne *Coccidioides* in Tucson, Arizona

Nancy A. Chow^{1,*}, Dale W. Griffin², Bridget M. Barker^{3,4,5}, Vladimir N. Loparev⁶ and Anastasia P. Litvintseva^{1,*}

Combining Forces - The Use of Landsat TM Satellite Imagery, Soil Parameter Information, and Multiplex PCR to Detect *Coccidioides immitis* Growth Sites in Kern County, California

Antje Lauer^{1,*}, Jorge Talamantes², Laura Rosio Castañón Olivares³, Luis Jaime Medina², Joe Daryl Hugo Baal¹, Kayla Casimiro¹, Natasha Shroff¹, Kirt W. Emery⁴

¹ Department of Biology, California State University, Bakersfield, California, United States of America, ² Department of Physics & Engineering, California State University, Bakersfield, California, United States of America, ³ Laboratorio de Micrología Médica, Facultad de Medicina, Universidad Nacional Autónoma de México, Mexico City, Mexico, ⁴ County of Kern Public Health Services Department, Bakersfield, California, United States of America

Histoplasmosis



EMERGING INFECTIOUS DISEASES®

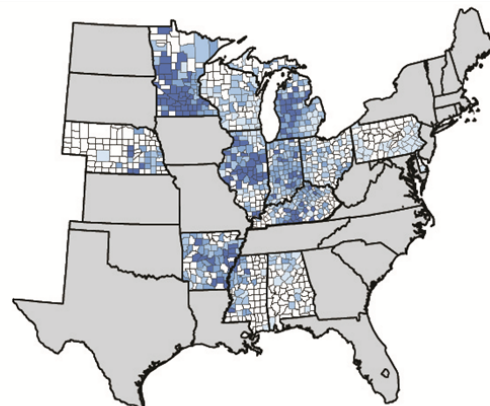
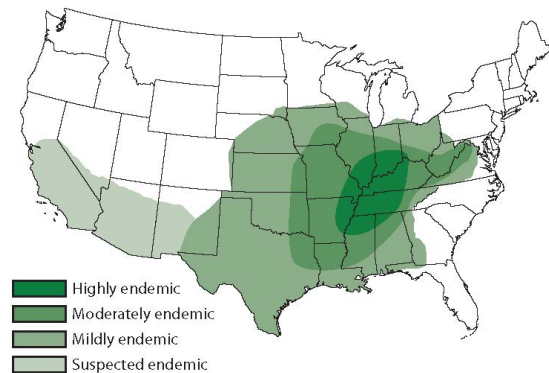
Volume 22, Number 3—March 2016

CME ACTIVITY - *Synopsis*

Epidemiology of Histoplasmosis Outbreaks, United States, 1938–2013

Kaitlin Benedict¹ and Rajal K. Mody

Author affiliations: Centers for Disease Control and Prevention, Atlanta, Georgia, USA



EMERGING INFECTIOUS DISEASES®

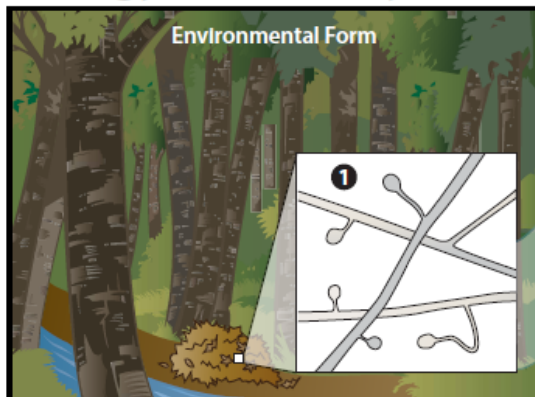
Volume 24, Number 3—March 2018

Synopsis

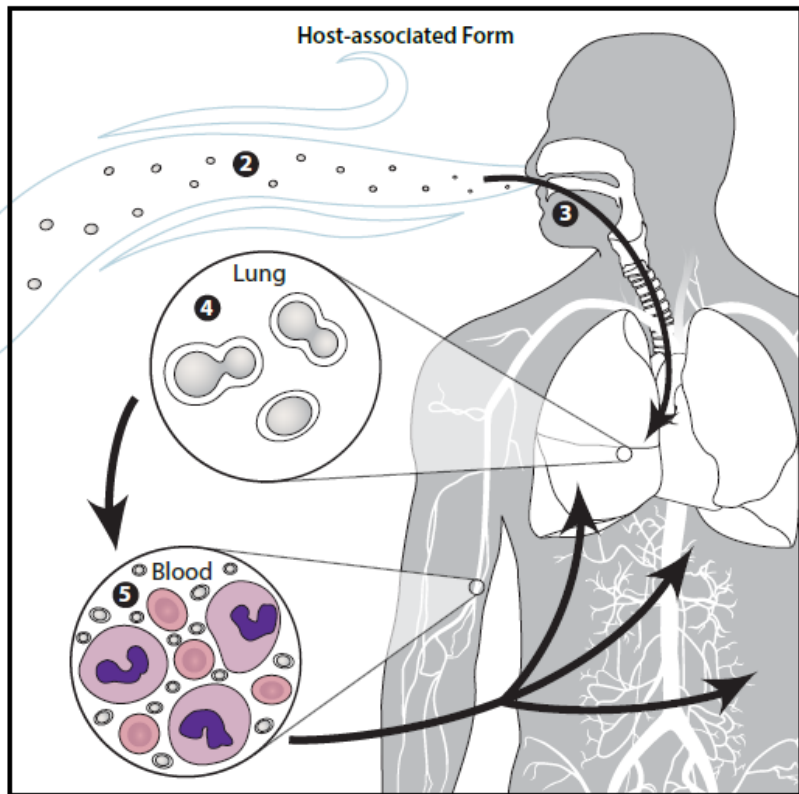
Multistate Epidemiology of Histoplasmosis, United States, 2011–2014¹

Paige A. Armstrong¹, Brendan R. Jackson, Dirk Haselow, Virgie Fields, Mallia Ireland, Connie Austin, Kimberly Signs, Veronica Fialkowski, Reema Patel, Peggy Ellis, Peter C. Iwen, Caitlin Pedati, Suzanne Gibbons-Burgener, Jennifer Anderson, Thomas Dobbs, Sherri Davidson, Mary McIntyre, Kimberly Warren, Joanne Midia, Nhiem Luong, and Kaitlin Benedict

Biology of Blastomycosis



Areas Endemic for Blastomycosis in the United States

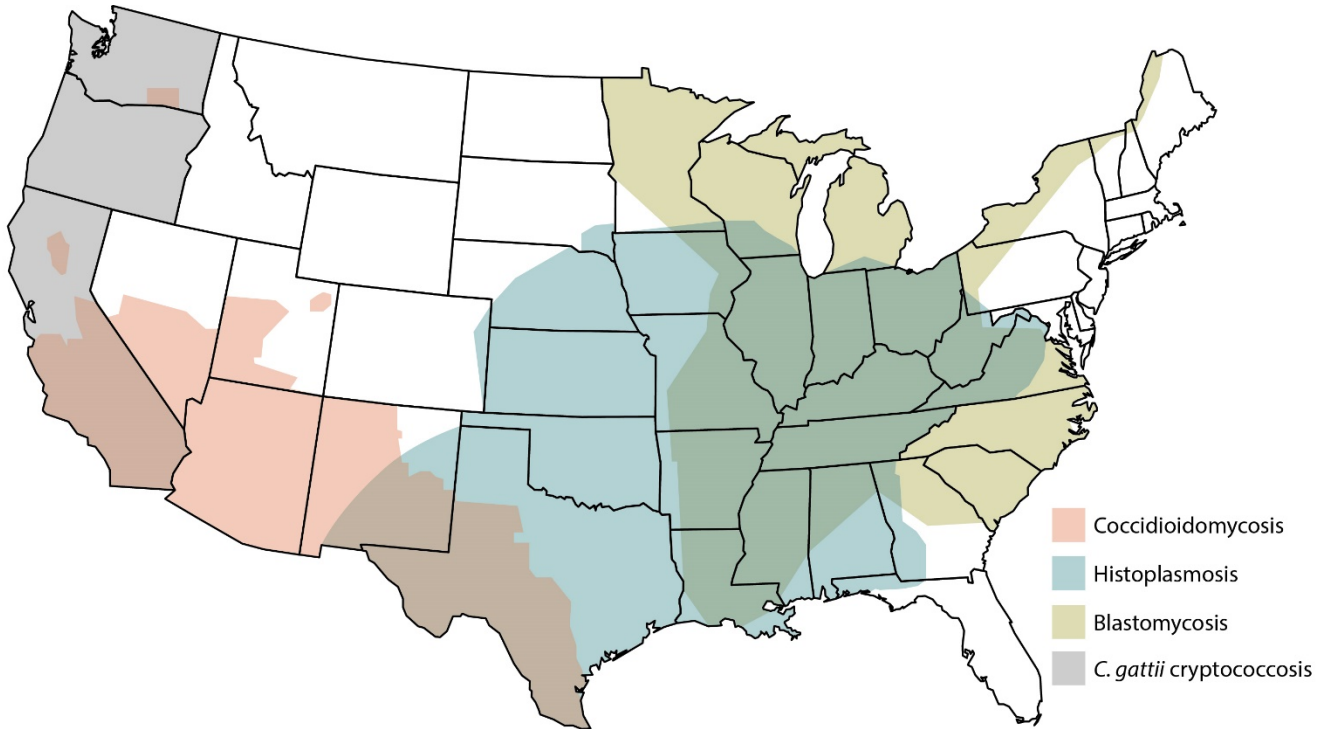


In the environment, *Blastomyces* exists as mold (1) with septate aerial hyphae. The hyphae produce spores (2). These spores are either inhaled, or inoculated into the skin (3) of a susceptible host. The warmer temperature inside the host signals a transformation (4) into a broad-based budding yeast. The yeast may continue to colonize the lungs or disseminate in the bloodstream (5) to other parts of the body, such as the skin, bones and joints, organs, and central nervous system.



Known endemic areas cover most of the US

Much more to be learned about the environmental aspects



Conclusions

- We need to build more collaborations to help better define ecological niche and understand areas of geographic risk
- Increased work and modeling can help improve understanding of environmental factors
- How can we work utilize some of these tools for fungal diseases?

Thank You

omccotter@cdc.gov

COUGH? FEVER? EXHAUSTED?



ASK YOUR DOCTOR TO TEST YOU FOR VALLEY FEVER



CDC

Division of Field Epidemiology
Communicable Disease Control and Prevention

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