Fungal Disease Awareness Week

September 15-19, 2025

9/15 | Testing and antifungals

9/16 | Fungal diseases and One Health

9/17 | Neglected tropical diseases

9/18 | Fungal pneumonias

9/19 | Fungal diseases and drug resistance

cdc.gov/fungal

Is there a fungus among us?

Improving histoplasmosis and blastomycosis surveillance in Connecticut

September 17, 2025
Dr. Melissa Morales, MD, MPH
Healthcare Associated Infection/ Antimicrobial Resistance (HAI/AR) Program Coordinator

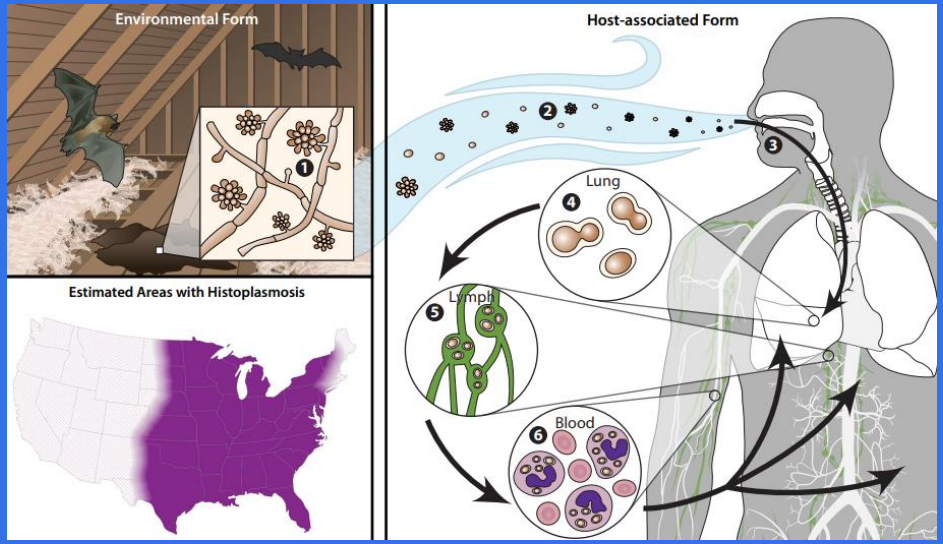
Table of contents

Learning Objectives

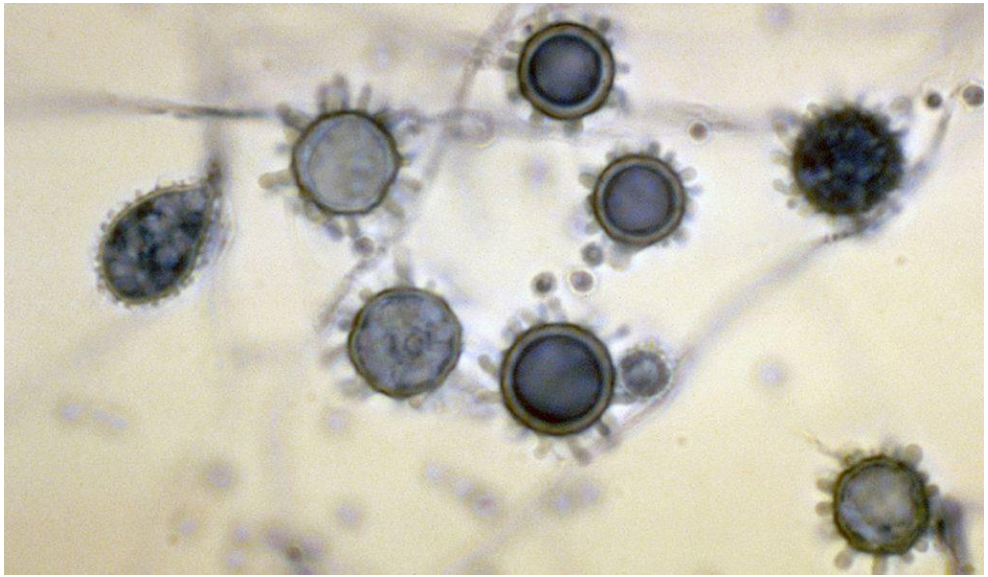
At the conclusion of this activity, participants will be able to:

- ► Define the geographic location of *Histoplasma* and *Blastomyces* in the United States.
- ► Identify the environments in which *Histoplasma* and *Blastomyces* are found.
- ► List activities that increase histoplasmosis and blastomycosis risk in humans.
- ► Recall the incidence and death rate of histoplasmosis and blastomycosis.
- ► Recognize signs and symptoms as well as the multiple clinical presentations of histoplasmosis and blastomycosis infection.
- ► Recognize histoplasmosis or blastomycosis should be suspected in a patient presenting with community acquired pneumonia.
- ► Employ the appropriate testing algorithm if histoplasmosis or blastomycosis is suspected.
- ► Recall and implement the Connecticut Department of Public Health protocol for reporting of histoplasmosis and blastomycosis.
- ► Name three reasons why endemic mycosis surveillance is important.
- ► Acquire additional knowledge from the educational resources listed.

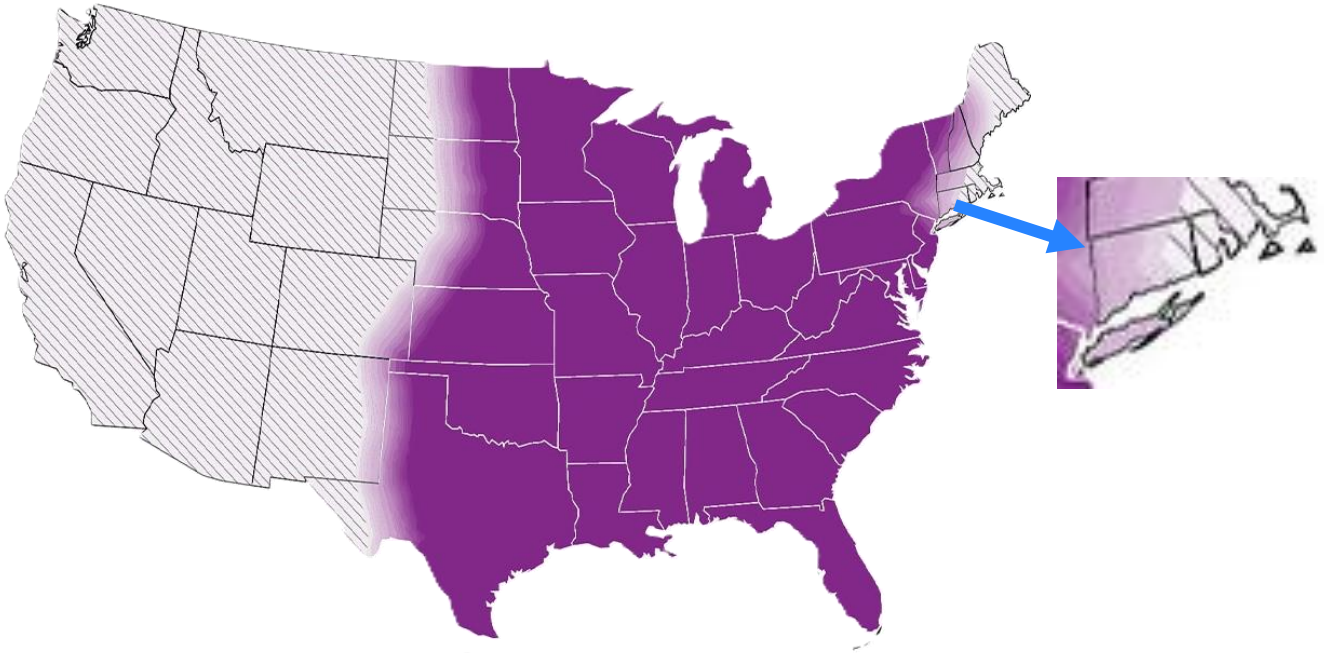
Histoplasma capsulatum and Histoplasmosis



A thermally dimorphic fungus, *Histoplasma capsulatum* grows as a **mold** at 71.6– 84.2°F in the environment and as a **yeast** at 98.6°F.



Where does *Histoplasma capsulatum* live?

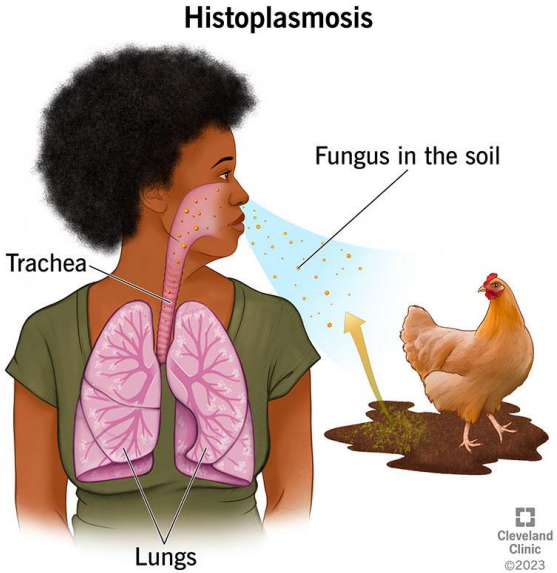


Histoplasma mainly lives in the soil in the **central and eastern** United States, particularly areas around the Ohio and Mississippi River Valleys

Areas with Histoplasmosis | Histoplasmosis | CDC

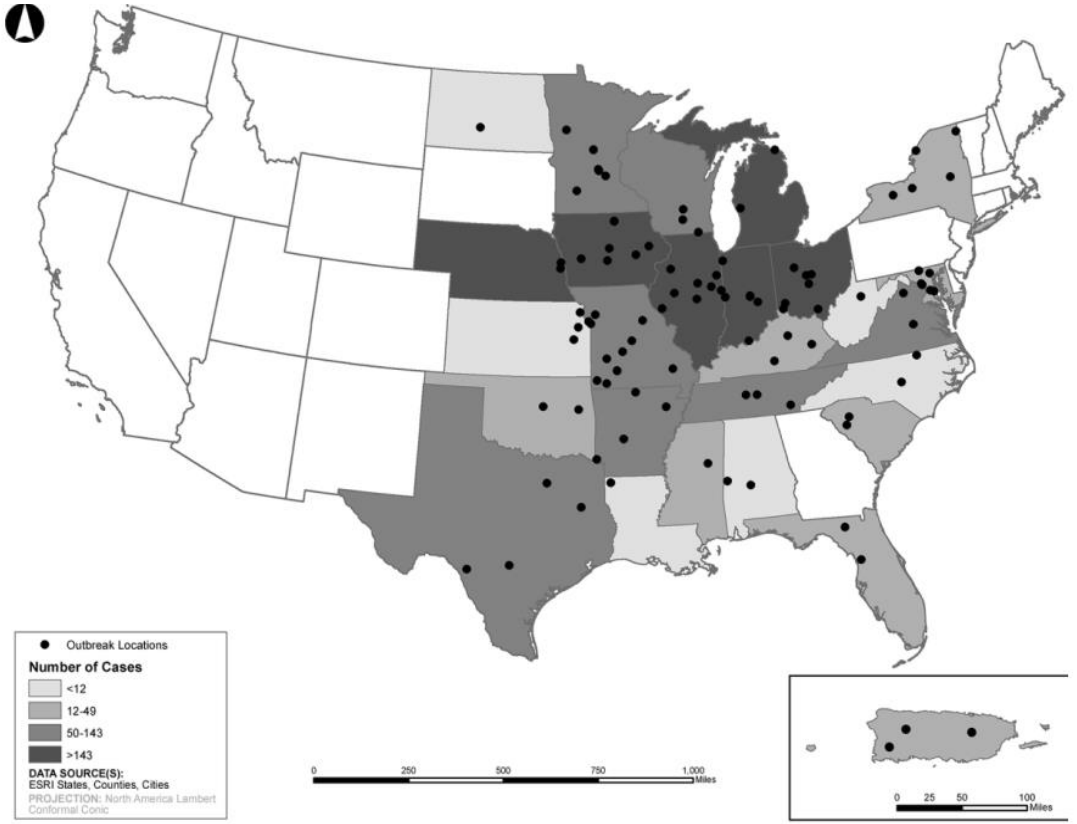
Histoplamosis

A lung infection, or pneumonia, caused by inhaling spores of *Histoplasma*.

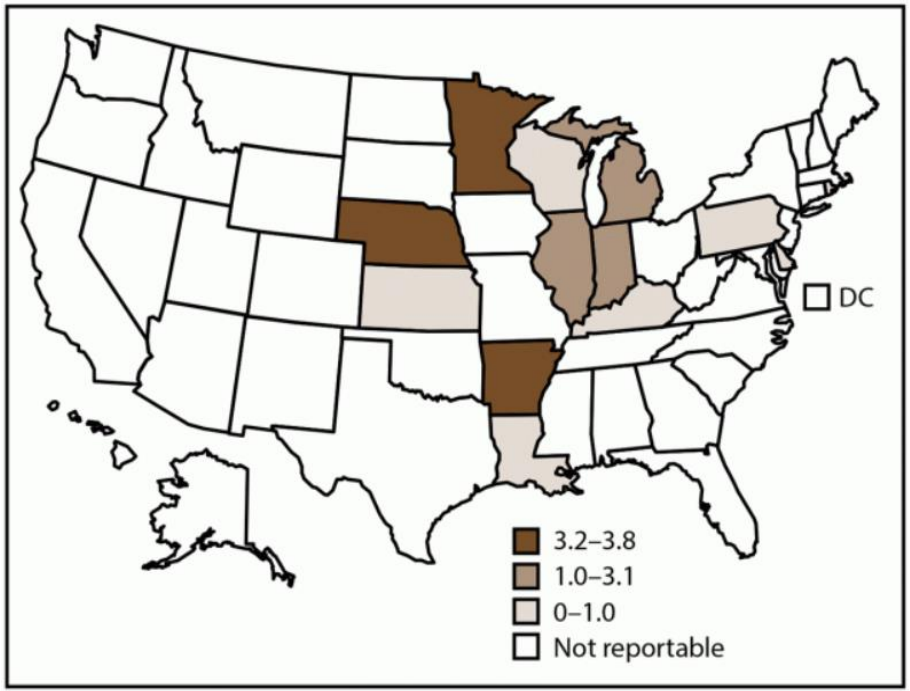


Locations of 105 outbreaks and related case counts by state, 1938-2013

Outbreak: ≥2 cases of histoplasmosis associated with a common environmental source.



2019 Surveillance for Histoplasmosis



- 1,124 cases
- 56% male / 44% female
- 54% hospitalized
- 5% mortality
- Death count: 20

Abbreviation: DC = District of Columbia.

* Cases per 100,000 population, calculated using state-specific denominators estimated from 2019 U.S. Census Bureau data.

What environments does *Histoplasma capsulatum* thrive in?

Soil contaminated with bird or bat droppings →
↑ nitrogen/phosphate → favorable for growth

Locations of concern:

- Chicken coops or farm buildings with large accumulations of bird droppings
- Abandoned buildings
- Bird roost sites
- Caves
- Wood lots

Activities that can increase risk of histoplasmosis

- Exploring caves
- Cleaning chicken coops
- Landscaping and farming
- Gardening and yardwork
- Wood cutting and gathering
- Cleaning, remodeling, or tearing down old buildings

Heavy exposure usually occurs with activities that disturb a **large accumulation** of droppings in an **enclosed area**, such as a cave or an attic.

In many cases, patients recall no specific exposure

CDCphoto/attic Reducing Risk for Histoplasmosis | Histoplasmosis | CDC

Individual risk factors for severe histoplasmosis infection

Having HIV/AIDS

Being the recipient of an organ transplant

Taking medications
(e.g., corticosteroids or TNFα-inhibitors)

Being an adult over the age of 55

Being an infant

Histoplasmosis is transmitted when spores are released into the air after contaminated soil is disturbed

- **Cannot** be spread between people (except via transplant) OR between people and pets

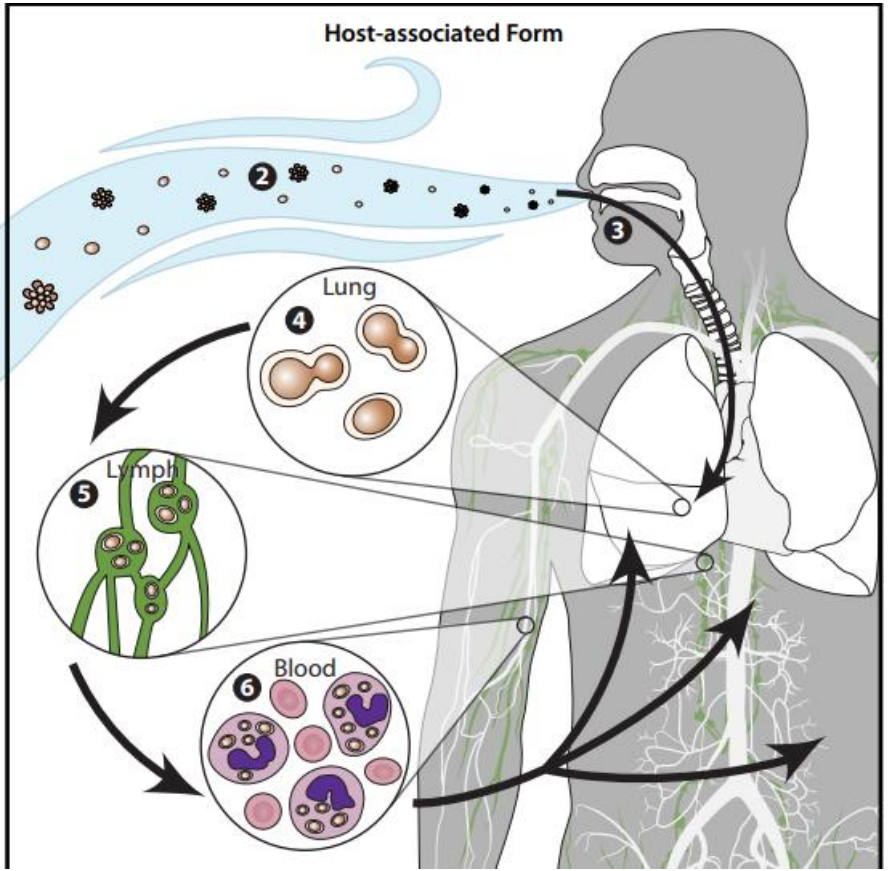
Pathogenesis of *H. capsulatum*

Inhalation of *Histoplasma* microconidia into the lungs

Transformation of microconidia into yeast

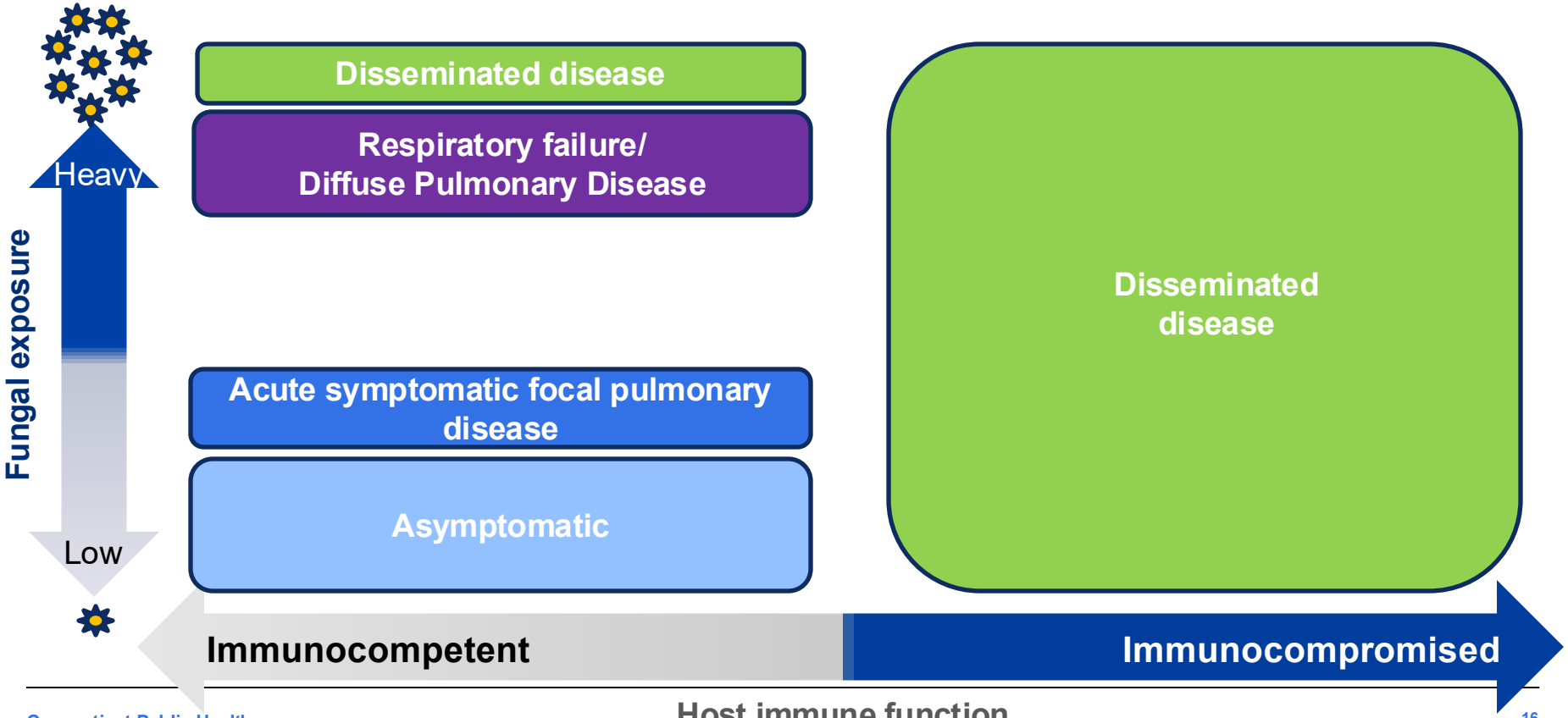
Response of the host immune system to the infection

Spreading of the organism via lymphatics by macrophages



histopathogenesis1 histopathogenesis2 How People Get Histoplasmosis | Histoplasmosis | CDC

Clinical manifestations vary substantially depending on fungal exposure and host immune function

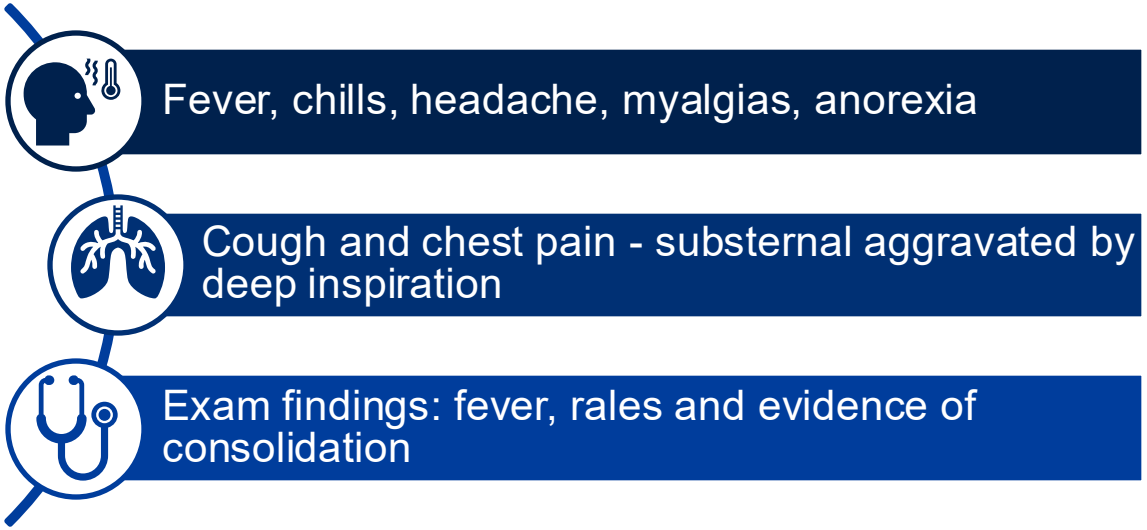


Acute pulmonary disease: typically mild, self-limiting

Low fungal load in an immunocompetent host

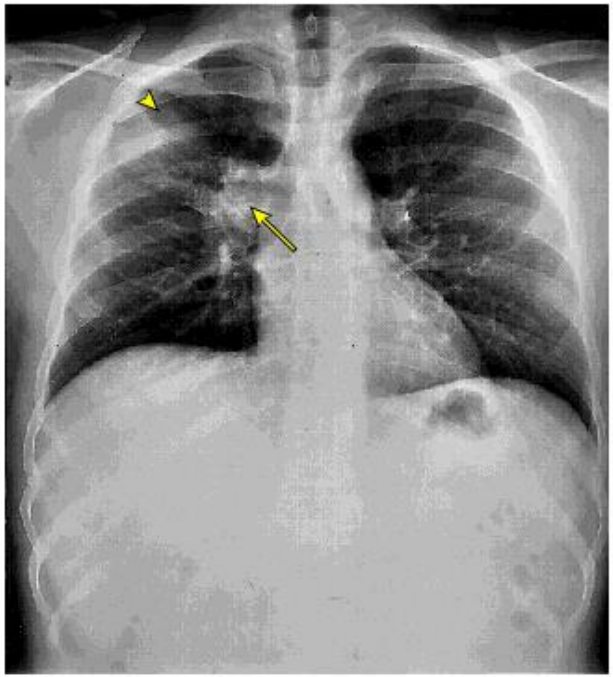
<5% develop symptoms

Symptoms start
2-4 weeks after exposure



Symptoms resolve within weeks
Fatigue and weakness may persist for months

Acute histoplasmosis



Chest x-ray from a patient with acute pulmonary histoplasmosis shows enlargement of right hilar lymph nodes (arrow) and a patchy right upper lobe infiltrate (arrowhead).

Courtesy of Joseph Wheat, MD.

UpToDate®

Acute pulmonary disease

Low fungal load in an immunocompetent host

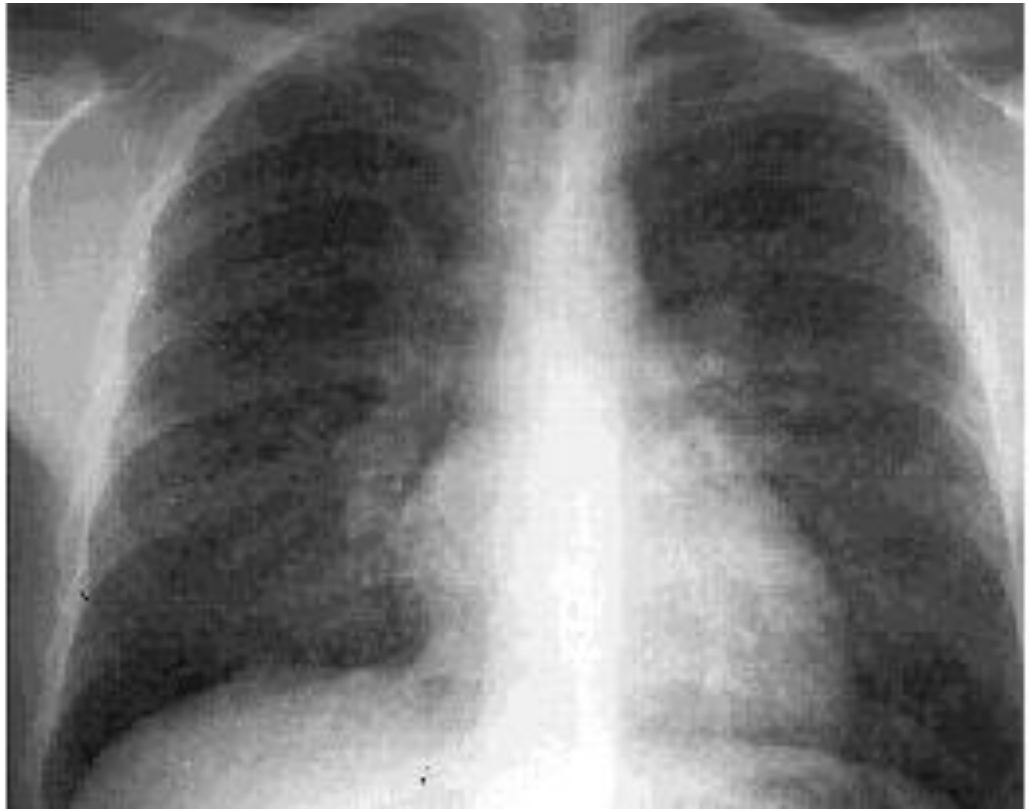
- Chest x-ray typically shows **focal infiltrates** and **mediastinal or hilar lymphadenopathy** or may be **normal**
- **Cavitary lesions**, although rare, may be seen in those with underlying obstructive lung disease

Acute diffuse pulmonary disease

High fungal load in an immunocompetent host

Respiratory failure and extrapulmonary dissemination

May remain dyspneic and fatigued for months



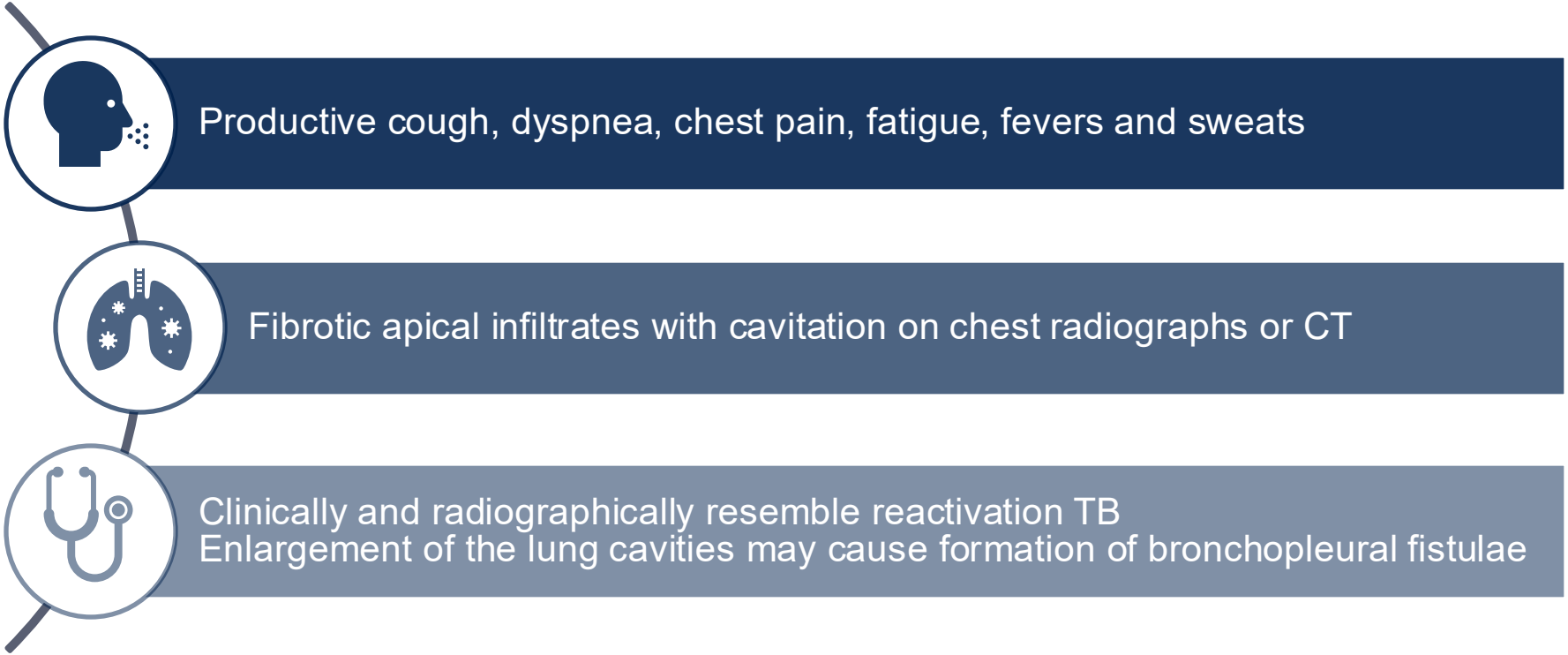
Diffuse reticulonodular pattern

Courtesy of Joseph Wheat, MD.

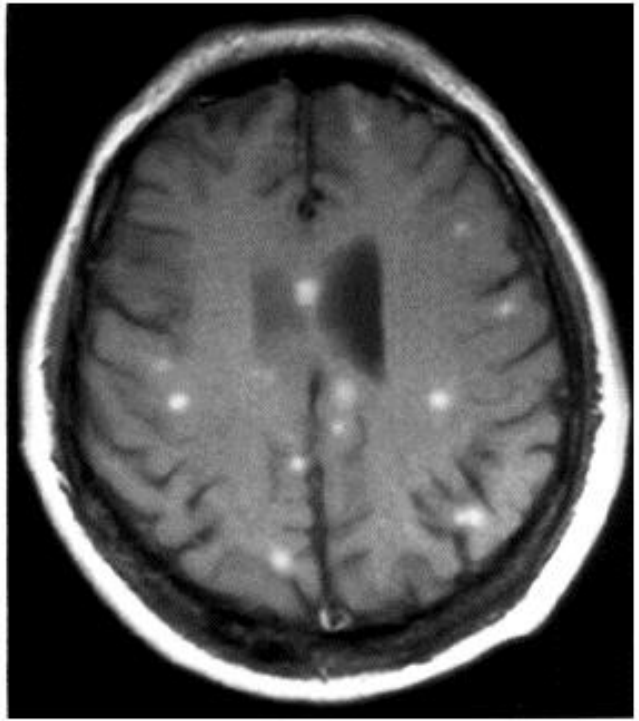
UpToDate®

AcutediffusepulmonaryCXR2 AcutediffusepulmonaryCXR

Risk of chronic pulmonary histoplasmosis is higher in those with underlying lung disease



Acute disseminated histoplasmosis

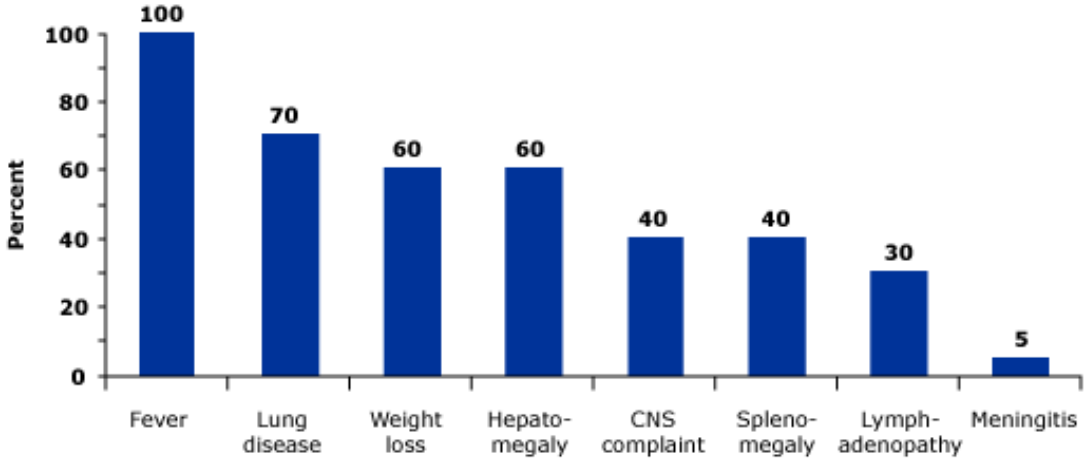


Courtesy of Joseph Wheat, MD.

UpToDate®

- Fever and fatigue
- Exam findings: Hepatosplenomegaly, pancytopenia, shock, respiratory distress, hepatic/renal failure, obtundation and coagulopathy.

Clinical findings in disseminated histoplasmosis



CNS: central nervous system.

Frequency of the major clinical findings in 66 episodes of disseminated histoplasmosis.

Data from Sathapatayavongs B, Batteiger BE, Wheat LJ, et al. Medicine (Baltimore) 1983; 62:263.

UpToDate®

People at risk for disseminated histoplasmosis

Immunocompromised

Solid organ transplant recipients

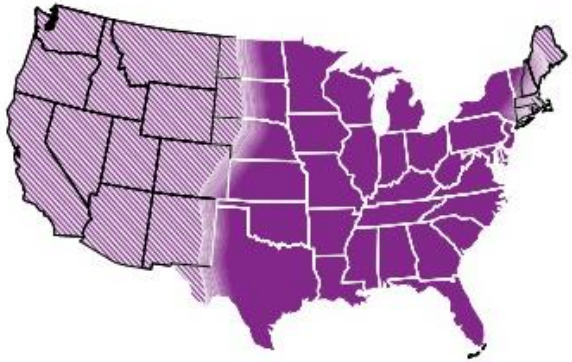
- Can be infected by donor organ

TNF-alpha inhibitor takers

- Screen for exposure before treatment initiation
- Antigen screening **not** recommended

Think Fungus: When to suspect histoplasmosis?

Patient living in or having traveled to a disease-endemic area
(note: although less common, people have acquired disease outside of the shaded regions)



Areas *Histoplasma* is more likely to live

Potential range of *Histoplasma*

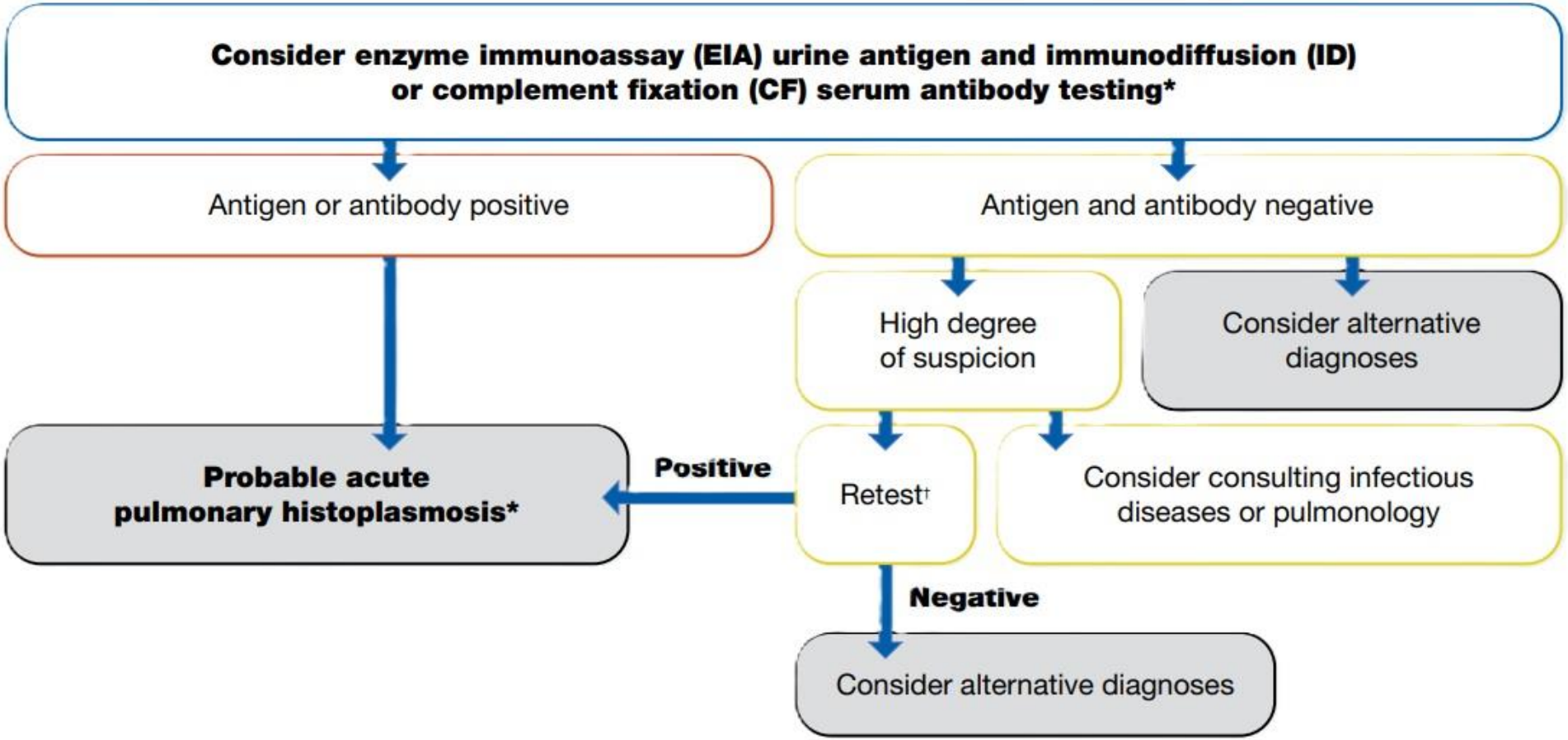
These maps are approximations. *Histoplasma* is not distributed evenly and may not be present everywhere within the shaded areas. It may also be present outside of the areas indicated.

CAP of unknown etiology not responding to a course of empiric antibiotics

OR

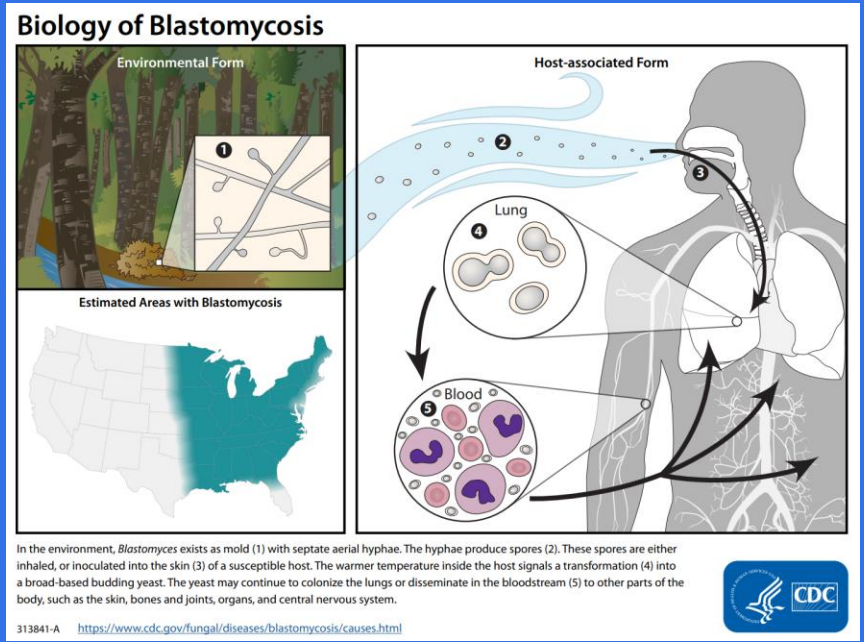
Initial CAP visit if:

- Notable exposure to bird or bat droppings (cave or demolition/remodeling exposure; note that many patients do not recall a specific exposure) OR
- Chest X-ray showing new nodules or lymphadenopathy OR
- Link to known histoplasmosis outbreak

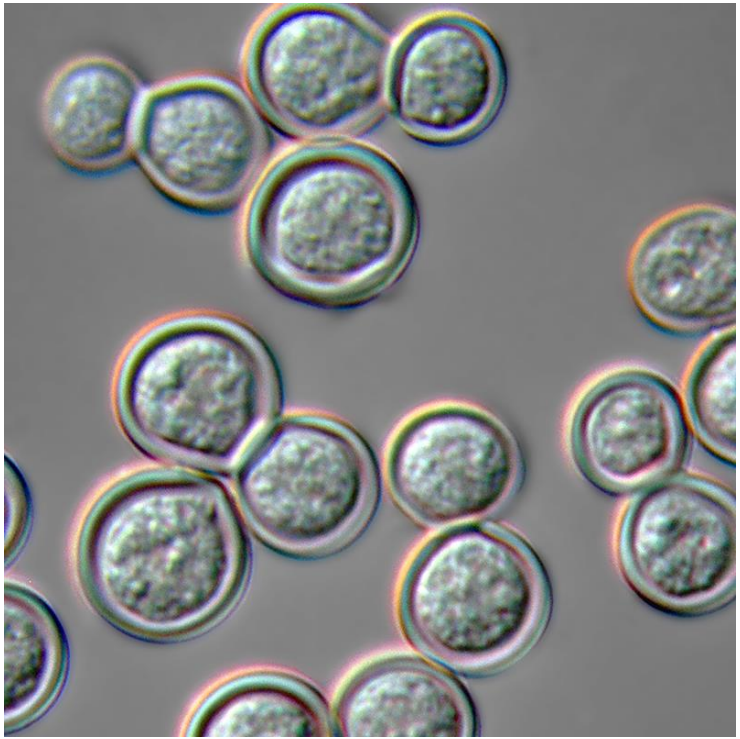


More on diagnostic testing later……

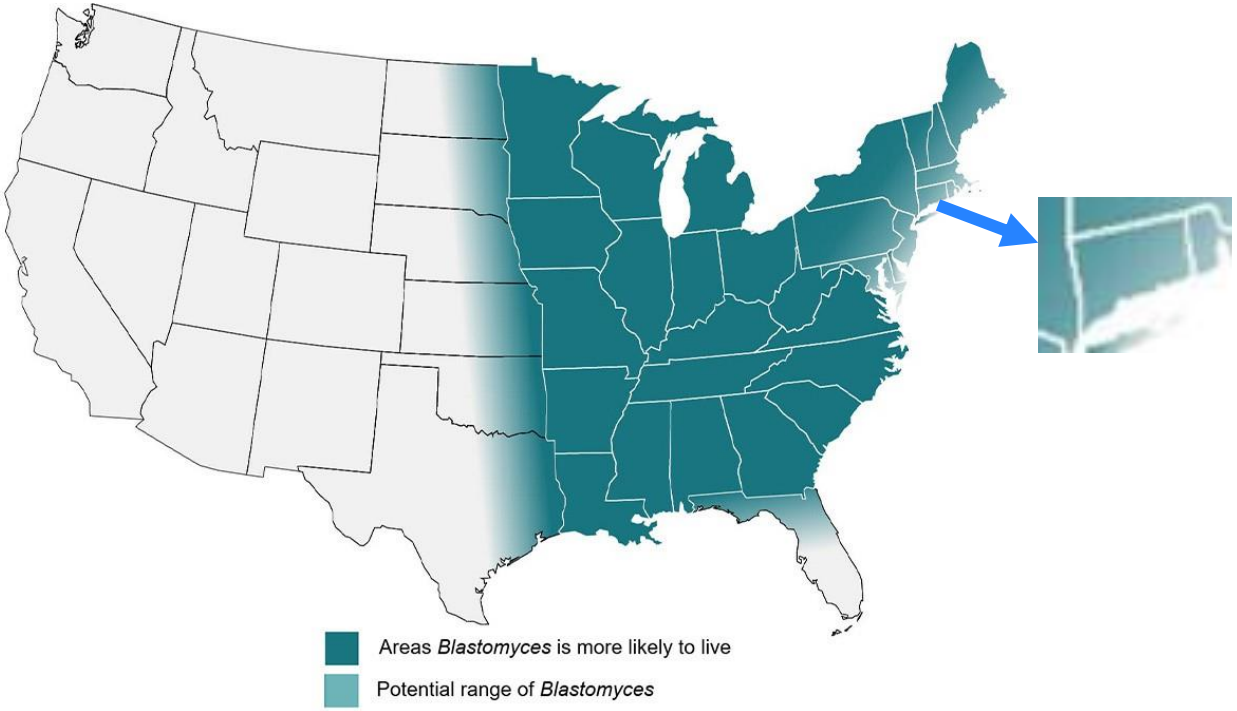
Blastomyces and Blastomycosis



A thermally dimorphic fungus, *Blastomyces* grows as a mold in the environment at 71.6-73.4 °F and a yeast in 98.6 °F



Where does *Blastomyces* live?

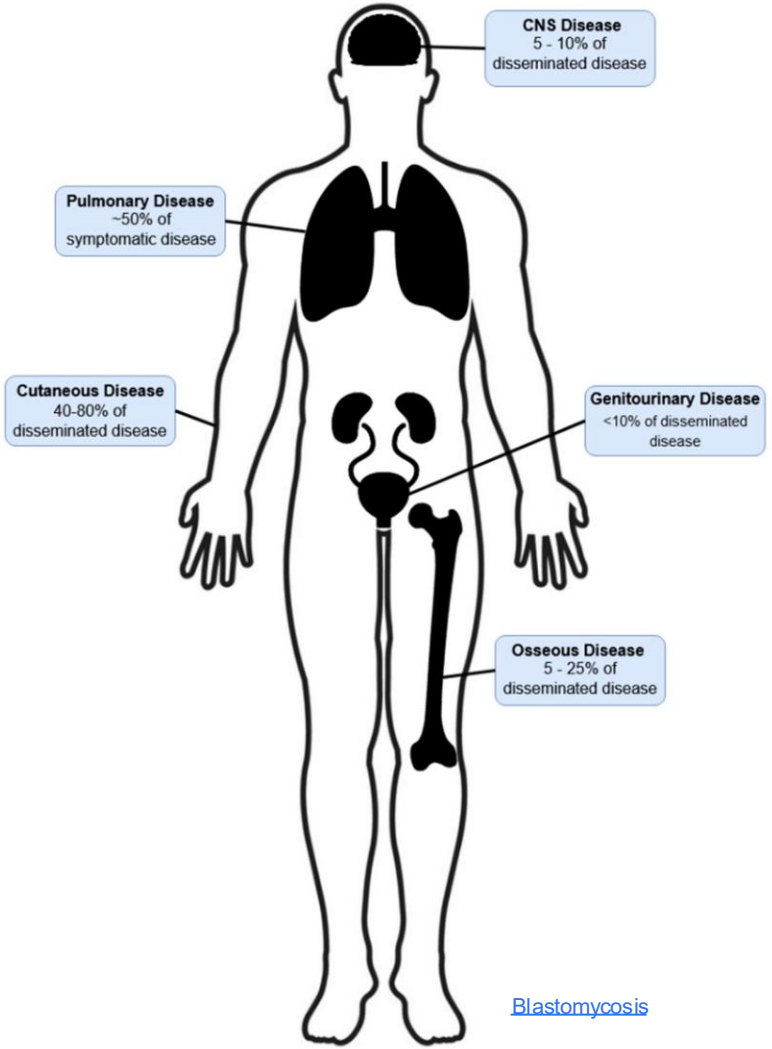


Blastomyces live in the soil in the **midwestern, south-central and southeastern** U.S., but the exact geographic location of the fungus is unknown.

Blastomycosis

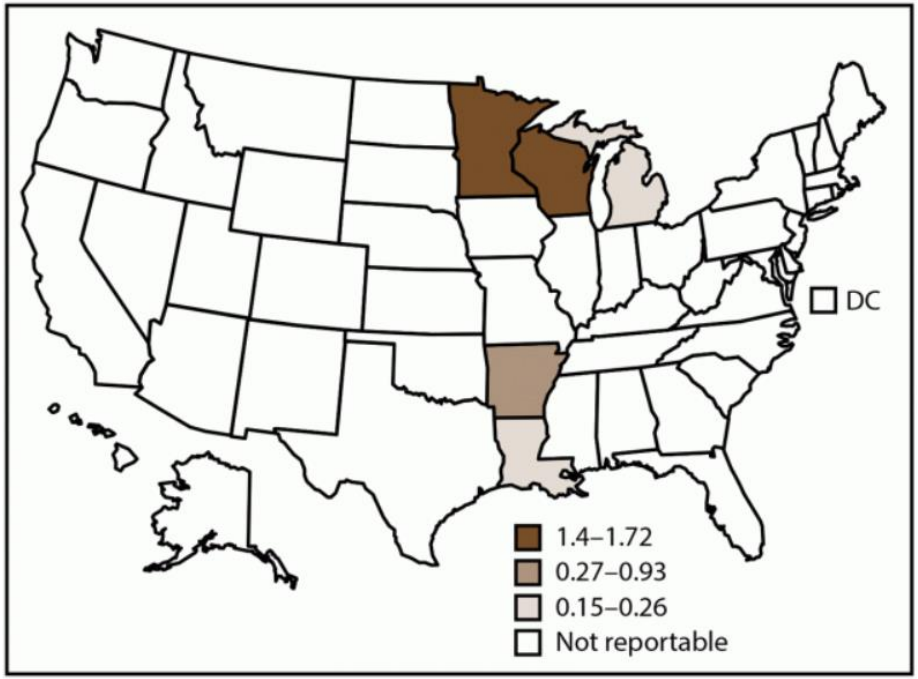
An infection mostly caused by breathing in spores of the fungus *Blastomyces*.

Infection may begin in the lungs and spread to other organs.



Blastomycosis

2019 Surveillance of Blastomycosis



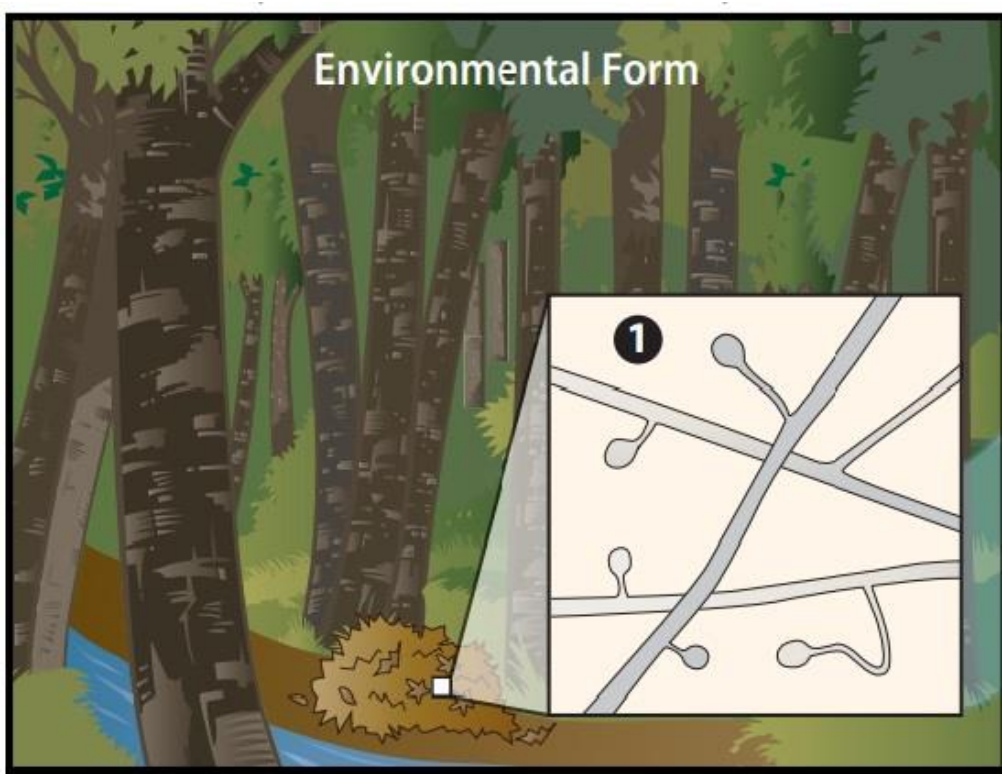
- 240 Confirmed & Probable Cases
- 70% Male
- 30% Female
- 65% Hospitalizations
- 9% Mortality
- Death count: 20

Abbreviation: DC = District of Columbia.

* Cases per 100,000 population, calculated using state-specific denominators estimated from 2019 U.S. Census Bureau data.

What environment does *Blastomyces* thrive in?

Moist soil and
decomposing plant matter
like wood and leaves.



What Causes Blastomycosis | Blastomycosis | CDC

Activities that can increase risk of blastomycosis

In areas where *Blastomyces* live:

- Forestry work
- Hunting
- Fishing
- Camping
- Digging and excavation

High winds can also increase risk

Wear an N-95 at construction sites to help prevent blastomycosis

Individual risk factors for blastomycosis

Having HIV/AIDS

Being the recipient of an organ transplant

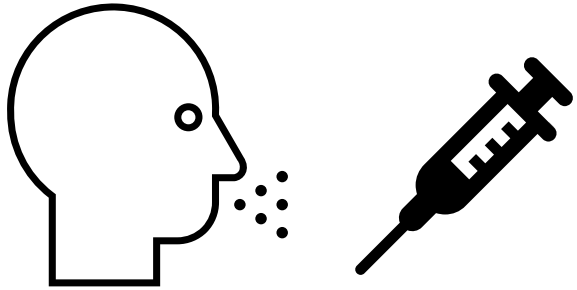
Taking medications
(e.g., corticosteroids or TNFα-inhibitors)

Being pregnant

Being a child

Blastomycosis is transmitted when spores are inhaled, or rarely via inoculation through the skin

- **It is possible, but rare** to spread infection between infected **animals and people**. An animal bite or inoculation through a contaminated needle (in the lab or a vet's office) can cause infection

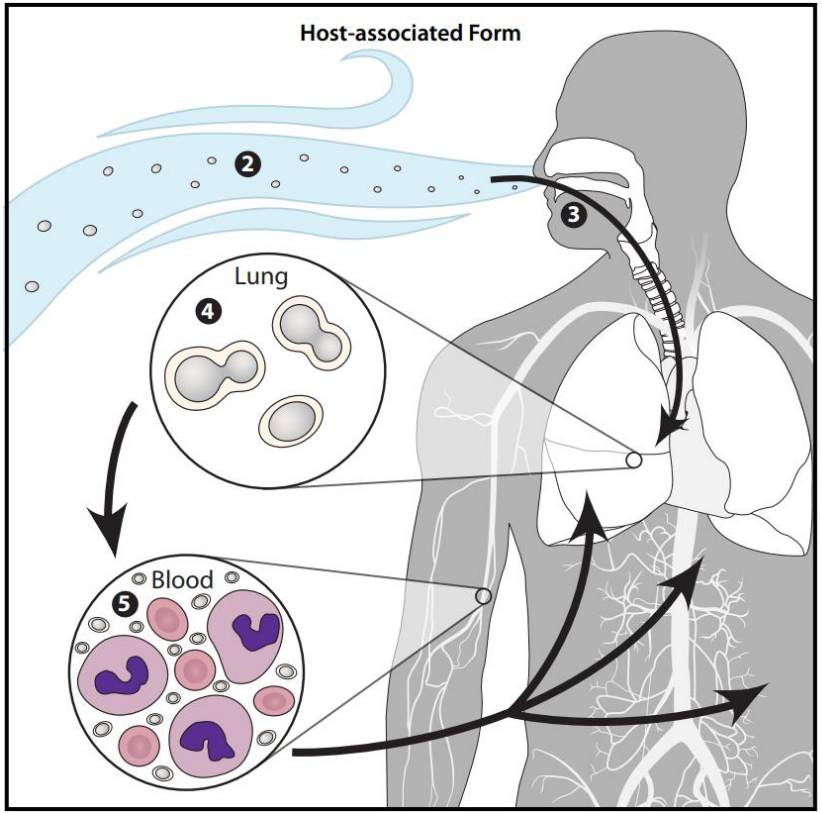


Risk Factors for Blastomycosis | Blastomycosis | CDC

Pathogenesis of *Blastomyces*

Inhalation *of Blastomyces* from soil and decomposed wood

- Transformation of microconidia into yeast
- Host immune response to infection
- The yeast form is resistant to immune response
- Yeast may colonize the lung or spread to other parts of the body



pathogenesis1 pathogenesis2 How People Get Histoplasmosis | Histoplasmosis | CDC

Acute pulmonary blastomycosis

Symptoms begin
3-6 weeks post exposure

If left untreated

- Spontaneous resolution, **rare**
- ARDS*, **rare**
- Dissemination
- Chronic pneumonia

Fever, weight loss, night sweats

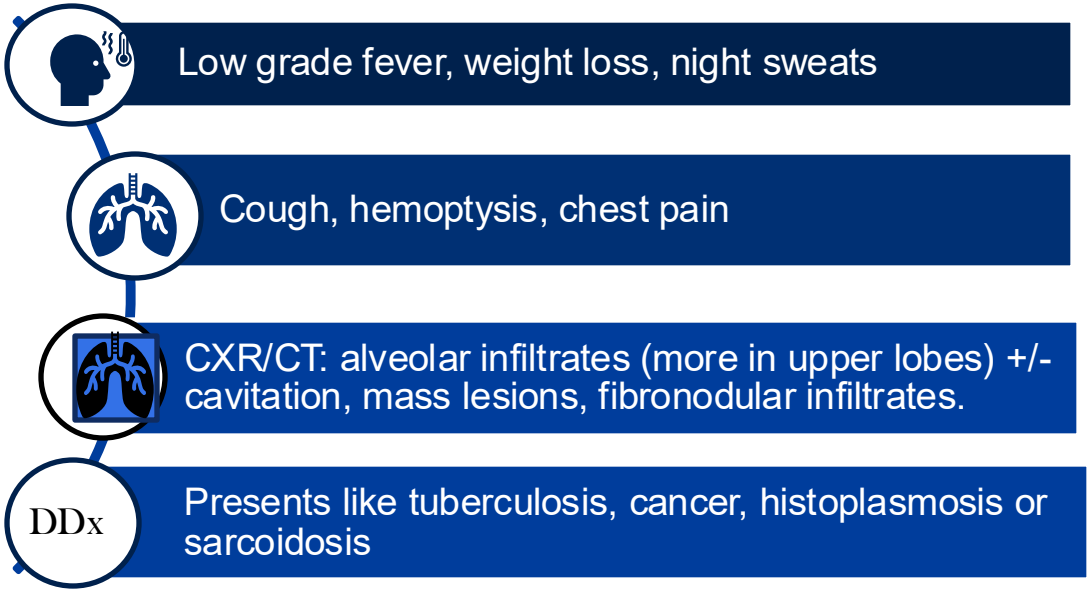
Cough (initially non-productive, then purulent) and shortness of breath

Exam findings: fever, rales and evidence of consolidation

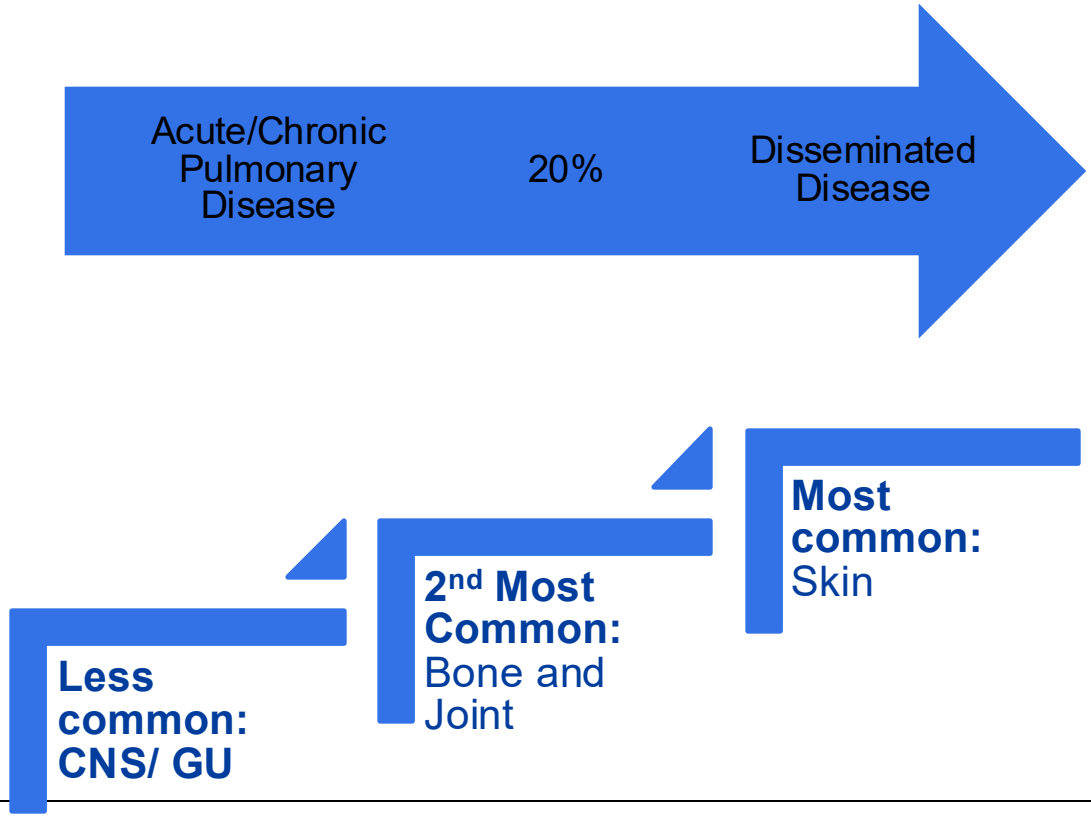
CXR: Alveolar infiltrate/ mass lesion. **CT:** Nodules, consolidation +/- cavitation or tree in bud opacities. Small pleural effusions are frequent. **Lack of hilar adenopathy favors blastomycosis over histoplasmosis**

*** Acute Respiratory Distress Syndrome -** diffuse inflammatory lung injury

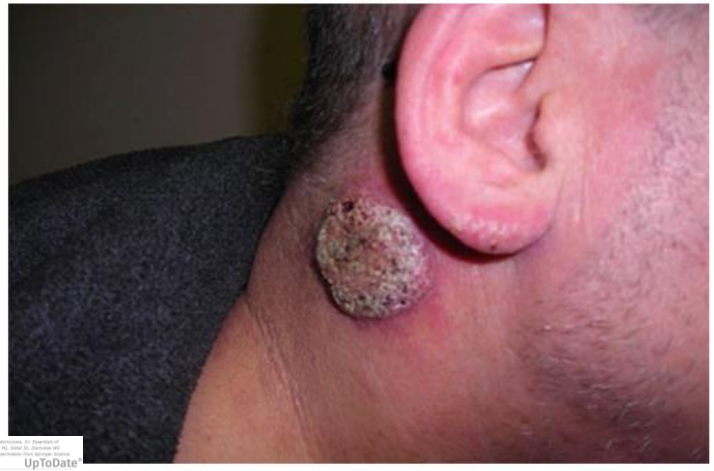
Chronic pneumonia in blastomycosis

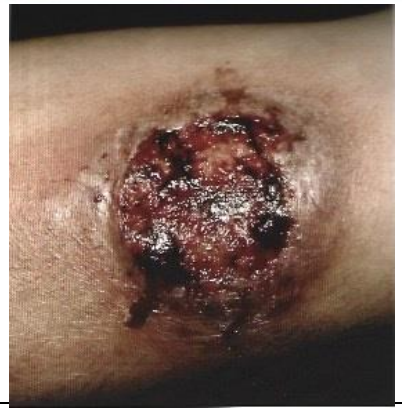


Disseminated blastomycosis



Cutaneous blastomycosis





Fitzpatrick's Color Atlas and synopsis of Clinical Dermatology, 5th Ed., page 747

Two cutaneous presentations

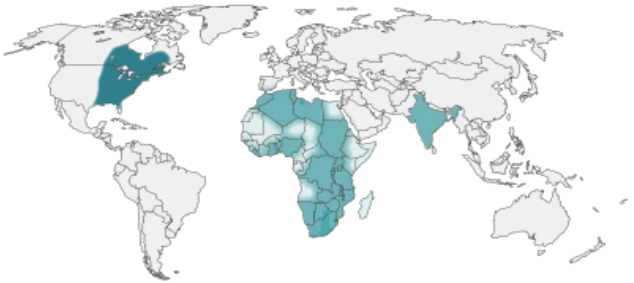
- Verrucous (wart like) lesion with irregular borders/ yeast filled microabscesses on the periphery
- Ulcerative lesions that bleed easily, with heaped up borders

Think Fungus: When to suspect blastomycosis?

Community-Acquired Pneumonia (CAP) When to Think Fungus: Blastomycosis

Accessible version: https://www.cdc.gov/fungal/diseases/blastomycosis/diagnosticalgorithms

Patient living in or having traveled to a disease-endemic area



Areas *Blastomyces* is more likely to live

Potential range of *Blastomyces*

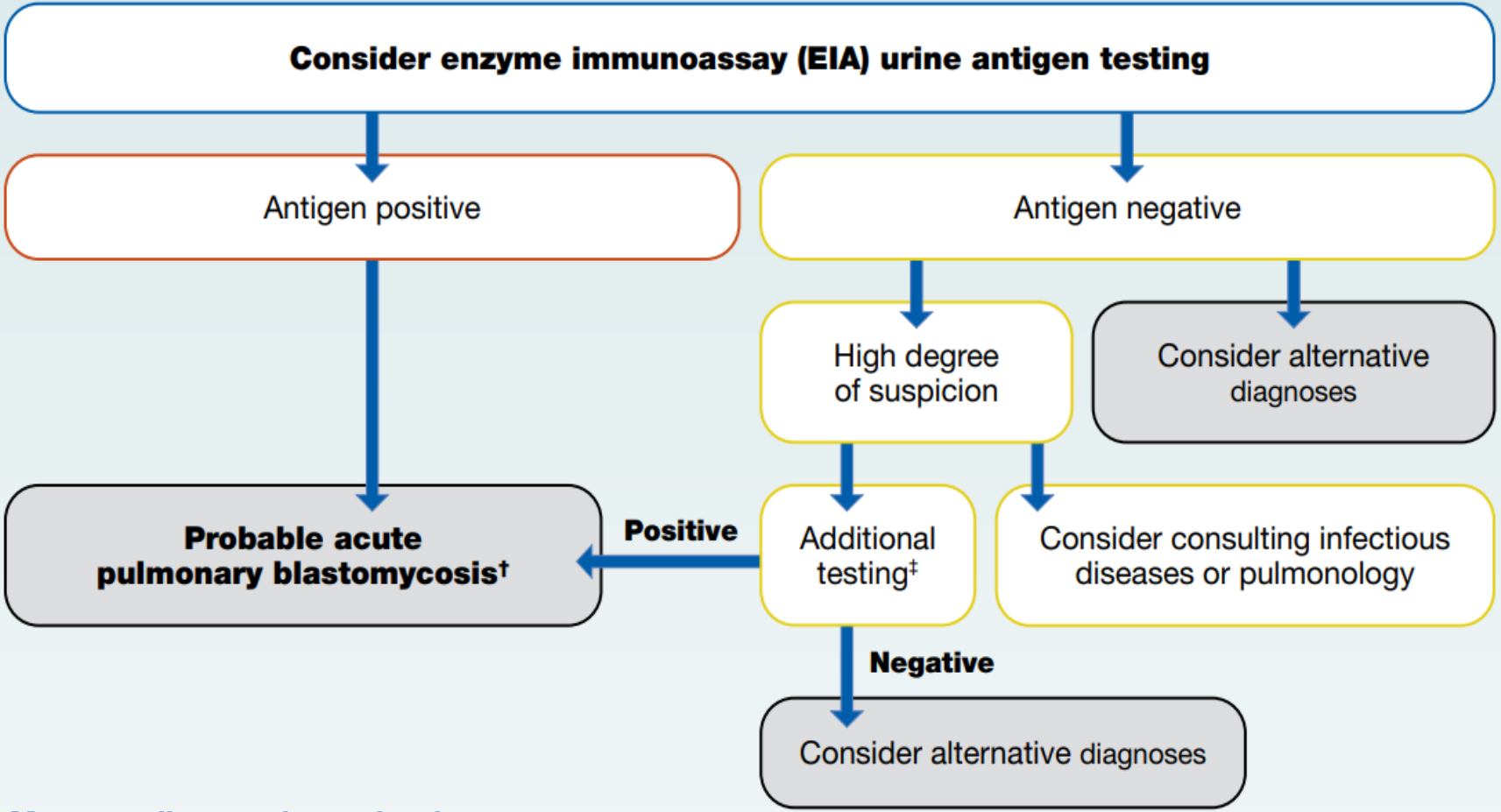
These maps are approximations. *Blastomyces* is not distributed evenly and may not be present everywhere within the shaded areas. It may also be present outside of the areas indicated.

CAP of unknown etiology not responding to a course of empiric antibiotics

OR

Initial CAP visit if:

- Skin lesions present* OR
- Link to known blastomycosis outbreak



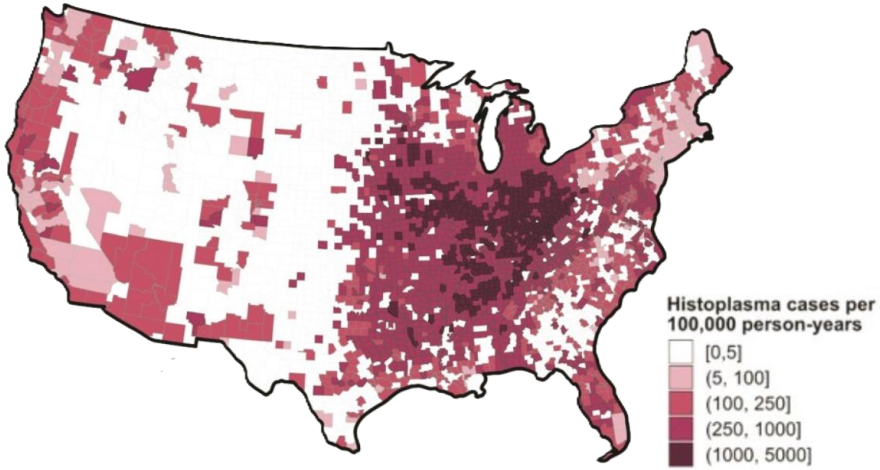
More on diagnostic testing later……

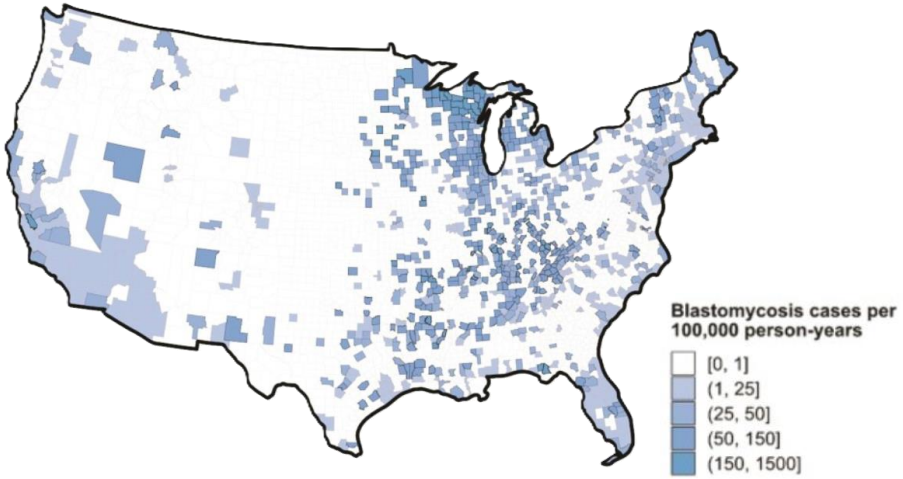
Why is it important to improve surveillance of these infections?

Public Health Surveillance

The continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation and evaluation of public health practice.

Our current understanding of where histoplasmosis and blastomycosis is endemic may not be accurate





Retrospective cohort analysis of 45+ million Medicare recipients, 2007-2016

The Geographic Distribution of Dimorphic Mycoses in the United States for the Modern Era

Increases in temperature and precipitation may cause geographical expansion of suitable living environment for fungus

Increasing awareness of histoplasmosis and blastomycosis through surveillance may decrease unnecessary antibiotic prescription

> 50% of patients receive **antibiotics** before diagnosis of histoplasmosis

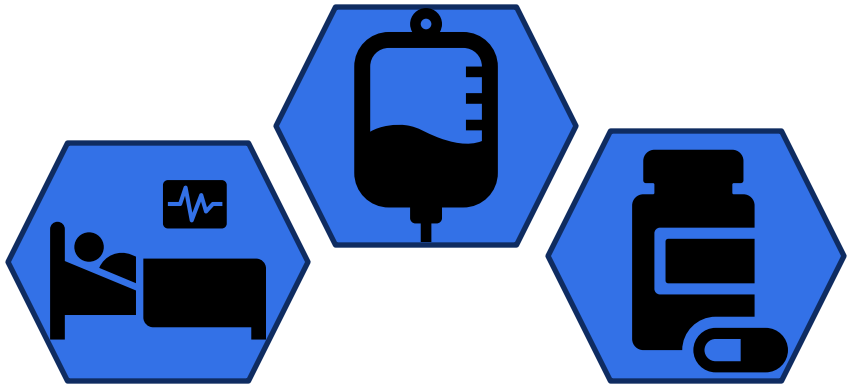
Most patients receive **≥ 2** rounds of **antibiotics** before being tested for an endemic fungal infection

Enhanced Surveillance for Histoplasmosis—9 States, 2018–2019

Diagnostic Delay and Antibiotic Overuse in Acute Pulmonary Blastomycosis

The immunocompromised population is increasing

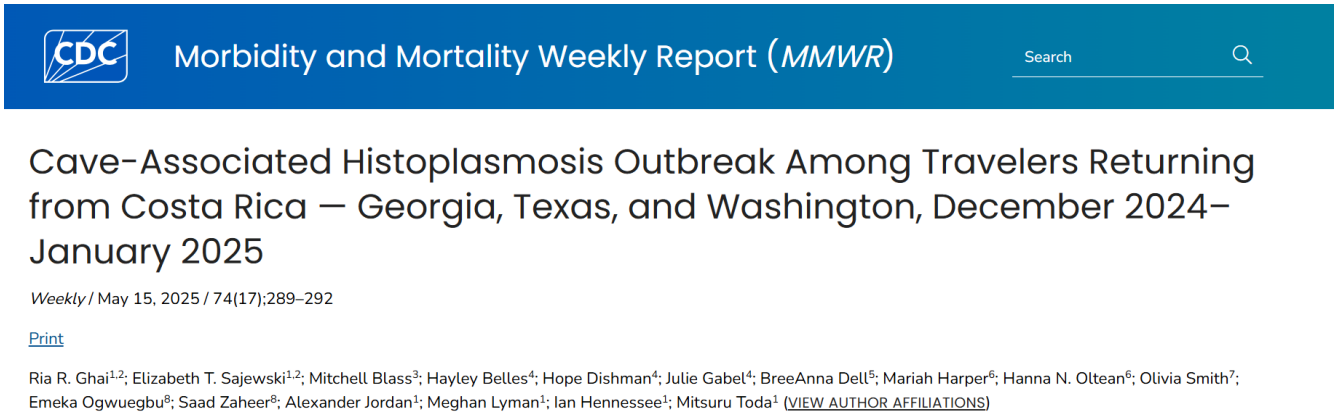
Improving surveillance would help clinicians and public health to better inform this population through educational efforts and enable targeted prevention.



Travel-associated Histoplasmosis and Blastomycosis may increase due to increase in travel

Domestic tourism is expected to **grow by 3% yearly**.

There were approximately **59 million hikers in 2021**, up from 49.7 million hikers in 2019 and nearly double the amount in 2006.



Morbidity and Mortality Weekly Report (*MMWR*)

Search

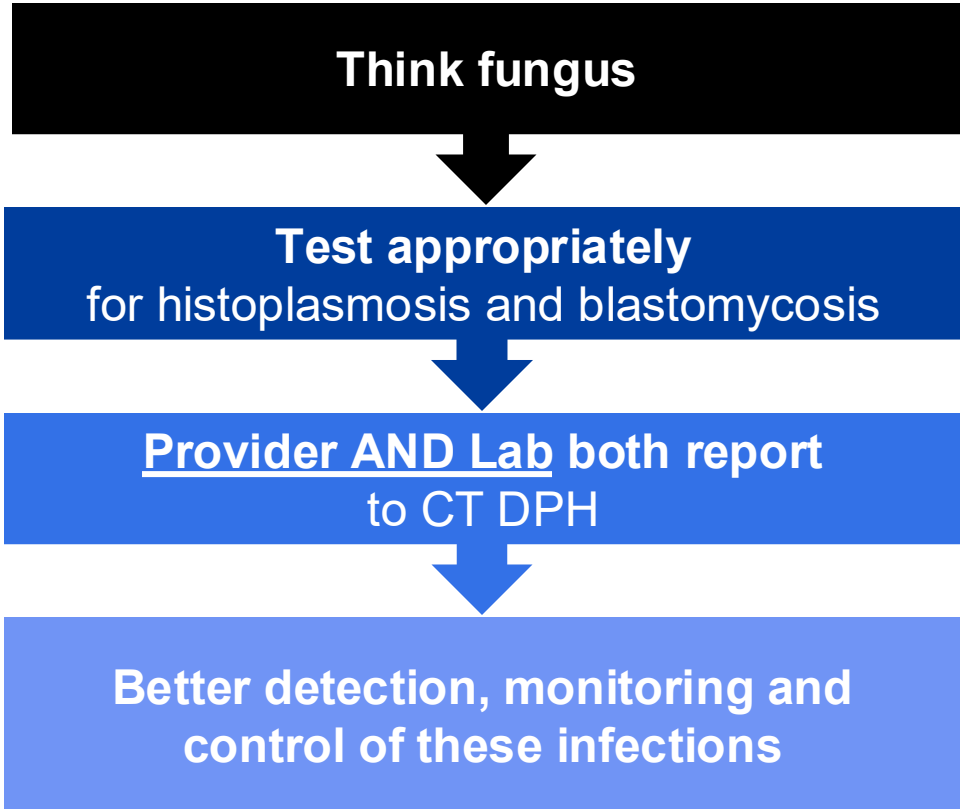
Cave-Associated Histoplasmosis Outbreak Among Travelers Returning from Costa Rica — Georgia, Texas, and Washington, December 2024–January 2025

Weekly / May 15, 2025 / 74(17);289–292

Print

Ria R. Ghai[1,2]; Elizabeth T. Sajewski[1,2]; Mitchell Blass[3]; Hayley Belles[4]; Hope Dishman[4]; Julie Gabel[4]; BreeAnna Dell[5]; Mariah Harper[6]; Hanna N. Oltean[6]; Olivia Smith[7]; Emeka Ogwuegbu[8]; Saad Zaheer[8]; Alexander Jordan[1]; Meghan Lyman[1]; Ian Hennessee[1]; Mitsuru Toda[1] (VIEW AUTHOR AFFILIATIONS)

How can we improve surveillance in Connecticut?


Think fungus
Test appropriately
for histoplasmosis and blastomycosis
Provider AND Lab both report
to CT DPH
Better detection, monitoring and
control of these infections

Laboratories modalities and testing

Methods	Pros	Cons
Antibody/Antigen 	• Quick turnaround times • Ag testing useful early in disease • Specimens: blood, urine, BAL	• Cross-reactivity • Sensitivity dependent on host immune status and disease course
Molecular 	• Quick turnaround times • Becoming more widely available	• Few performance-related studies
Culture 	• Highly specific • Higher sensitivity in chronic pulmonary histoplasmosis	• Long turnaround times • Requires invasive procedures • Personnel training • Specialized facilities • Lower sensitivity in acute/localized histoplasmosis
Histopathology 	• Highly specific • Relatively quick turnaround times	• Requires invasive procedures • Personnel training • Alert laboratory if suspicion blastomycosis

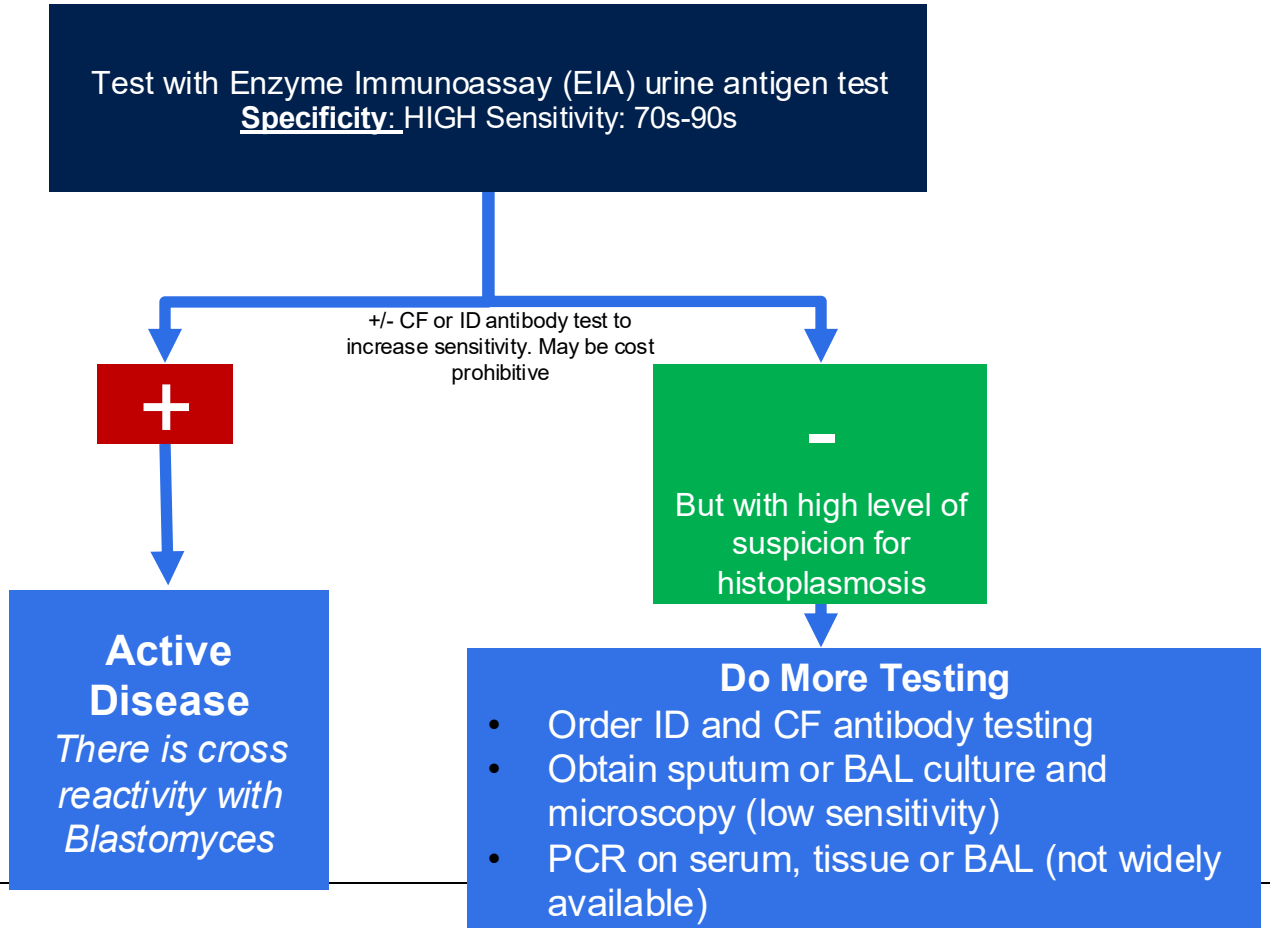
Diagnostic tests for histoplasmosis

Test	Sensitivity	Specificity	Population studied
Antibody tests			
EIA antibody[8]	98%	97% (high cross-reactivity with Blastomyces)	Immunocompromised & healthy populations
Complement fixation (CF) antibody[9]	72%–95%	70%–80%	Adult populations
Immunodiffusion (ID) antibody[9]	70%–95%	100%	Adult populations
Antigen tests			
EIA urine antigen[7]	79%	99%	Adult population, people living with HIV
EIA serum antigen[7]	82%	97%	Adult population, people living with HIV
Other tests			
Culture[10]	15%–85%	100%	Acute or subacute, disseminated disease
Microscopy/histopathology[10]	9%–43%	100%	Acute or subacute, disseminated disease

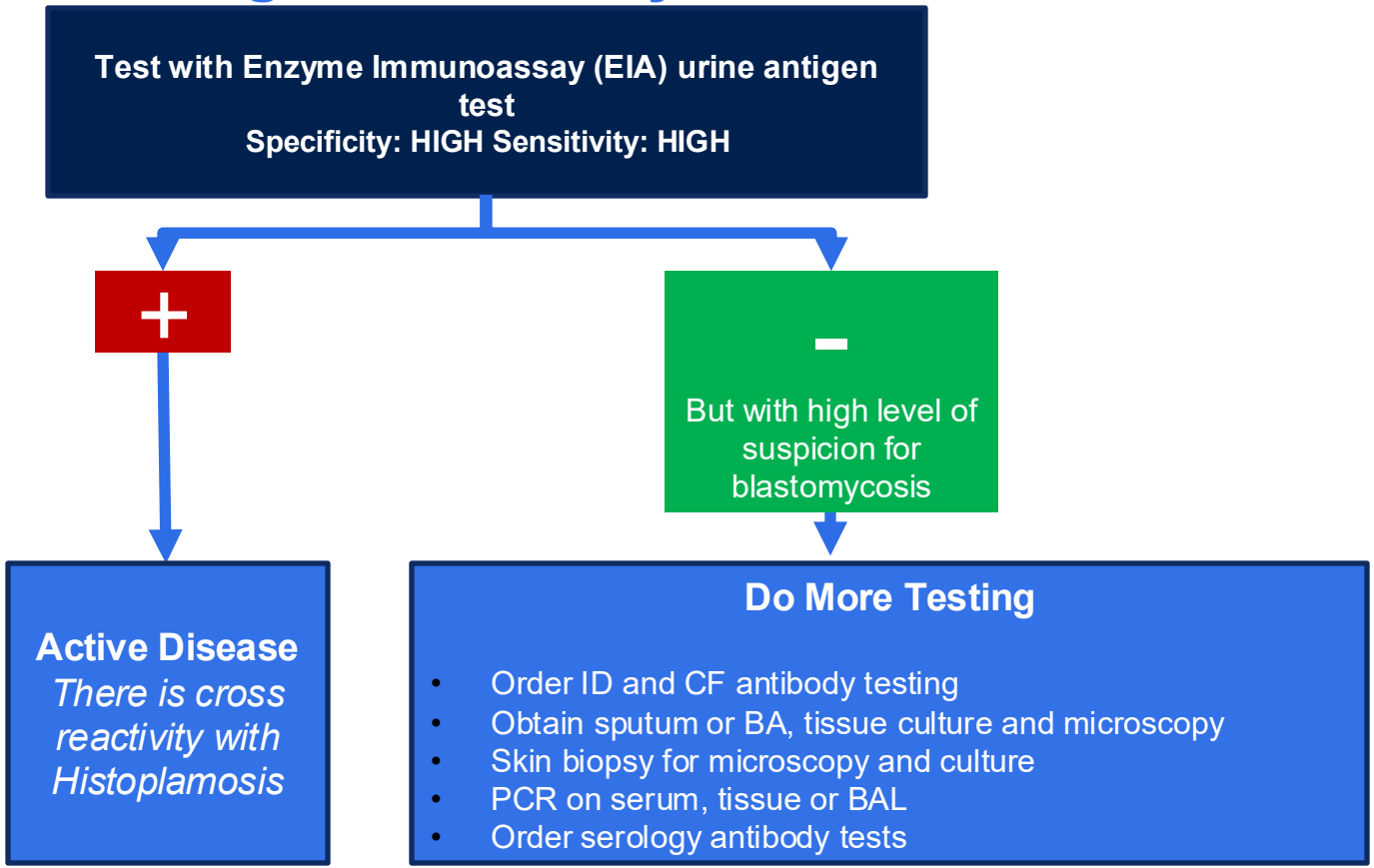
Diagnostic testing for blastomycosis

Test	Sensitivity	Specificity	Population studied
Antibody tests			
Complement fixation (CF) antibody[13,15,16]	9%–57%	30%–100%	Adult populations, outbreak settings
Immunodiffusion (ID) antibody[8,13–17]	28%–65%	100%	Adult populations, outbreak settings
Antigen tests			
EIA urine antigen[8–12]	76%–93%	High (but does cross-react with *Histoplasma*)	Adult populations
EIA serum antigen[8–12]	56%–82%	High (but does cross-react with *Histoplasma*)	Adult populations
Other tests			
Histopathology[18]	81%	100%	Adult populations
Cytology[8,18]	38%–97%	100%	Adult populations, pregnancy

Algorithm for testing for histoplasmosis



Algorithm for testing for blastomycosis



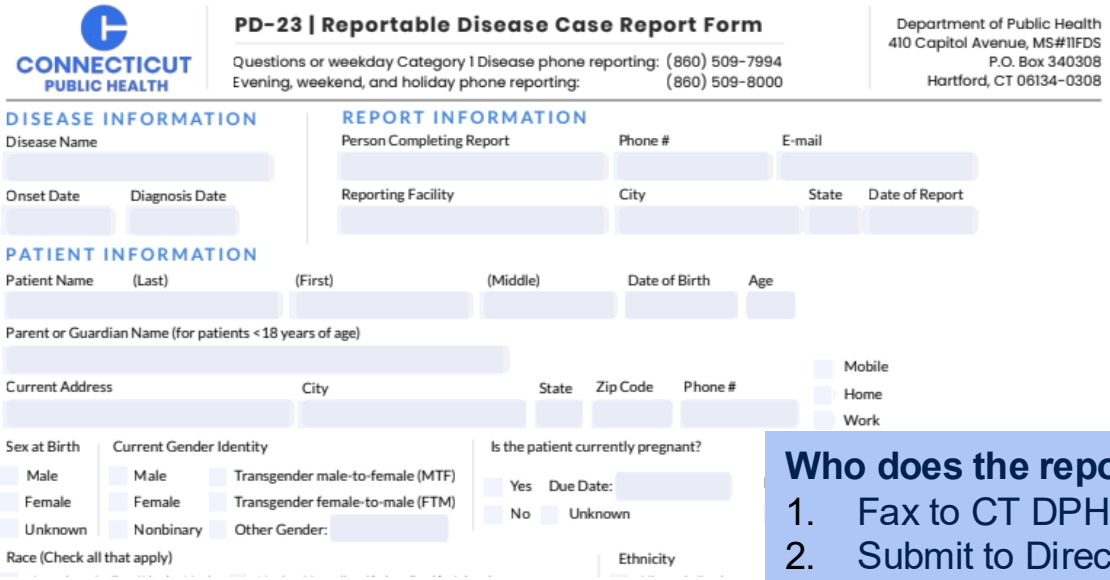
Report Cases to the Connecticut Department of Public Health

Histoplasmosis and blastomycosis were made reportable in CT as of July 1st, 2024

Both the lab and the provider must report to CT DPH because laboratory AND clinical criteria are needed to determine whether this is a case

The provider should report to CT DPH if there is **suspicion** of disease

Submit a Reportable Disease Case Report Form (PD-23) within 12 hours



CONNECTICUT PUBLIC HEALTH

PD-23 | Reportable Disease Case Report Form

Questions or weekday Category 1 Disease phone reporting: (860) 509-7994
Evening, weekend, and holiday phone reporting: (860) 509-8000

Department of Public Health
410 Capitol Avenue, MS#11FDS
P.O. Box 340308
Hartford, CT 06134-0308

DISEASE INFORMATION

Disease Name
Onset Date
Diagnosis Date

REPORT INFORMATION

Person Completing Report
Phone #
E-mail
Reporting Facility
City
State
Date of Report

PATIENT INFORMATION

Patient Name (Last) (First) (Middle)
Date of Birth
Age
Parent or Guardian Name (for patients <18 years of age)
Current Address
City
State
Zip Code
Phone #
Mobile
Home
Work
Sex at Birth
Male
Female
Unknown
Current Gender Identity
Male
Female
Nonbinary
Transgender male-to-female (MTF)
Transgender female-to-male (FTM)
Other Gender:
Is the patient currently pregnant?
Yes Due Date:
No Unknown
Race (Check all that apply)
Ethnicity

[More information about Provider Reporting]

Who does the report go to?

1. Fax to CT DPH: 860-920-3131
2. Submit to Director of Health for patient's town of residence
3. Keep a copy in the patient's medical record

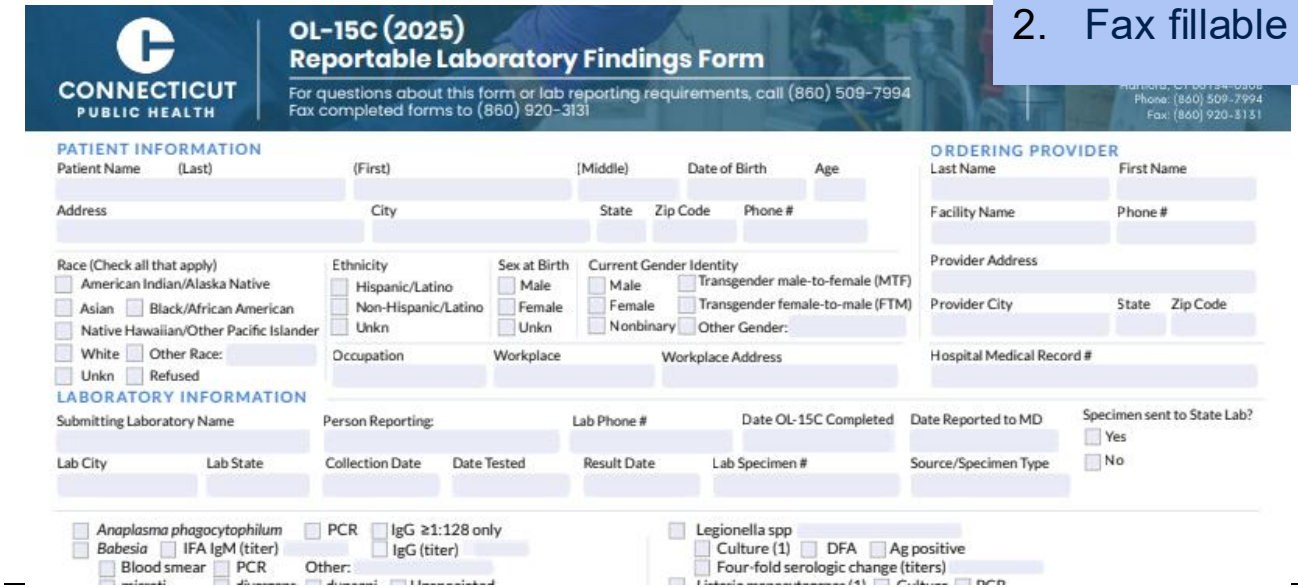
Stay tuned! Case report forms specific to histoplasmosis and blastomycosis are in development

4. What other clinical diagnoses did the patient have on or within 60 days before DISC?	□ Blastomycosis □ Cryptococcosis □ Coccidioidomycosis □ Other fungal infection (specify): _____ □ Community-acquired pneumonia □ Bacterial pneumonia □ Viral pneumonia □ Cancer □ Tuberculosis □ Other infection/disease not listed (specify): _____ □ None
5. Site of *Histoplasma* infection based on clinical impression on or within 30 days after DISC (select all that apply)	□ Lung □ Skin □ Bone □ Joint □ Central Nervous system □ No site identified □ Other (specify)
6. Was the patient hospitalized at an acute care hospital in the 60 days before to 60 days after DISC?	□ yes □ no □ unknown *If yes,* dates of admission of hospitalization most proximal to DISC, Admission date: _____-_____-_____ (mm-dd-yyyy) Discharge date: _____-_____-_____ (mm-dd-yyyy) □ still hospitalized *If yes,* Received ICU-level care in the 14 days *before* DISC?: □ yes □ no □ unknown Received ICU-level care in the 14 days *after* DISC?: □ yes □ no □ unknown Discharge ICD-10 diagnosis code(s): _____
7. Died within 60 days after DISC?	□ no □ yes, date of death _____ - _____ - _____ (mm-dd-yyyy) Cause(s) of death _____ If yes, did death occur in hospital? □ yes □ no □ unknown □ unknown
8. Did the patient have any outpatient, urgent care, and/or emergency department visits in the 60 days before to 60 days after DISC	□ Yes □ No □ Unknown If yes, how many visits? _____ (if more than one, fill out information below for each visit) Date of visit: - - (mm-dd-yyyy)

Laboratories report using the Reportable Laboratory Findings Form (OL-15C)

There are 2 ways to report

1. Electronically (preferred method!)
2. Fax fillable OL-15C to 860-920-3131



CONNECTICUT PUBLIC HEALTH

OL-15C (2025)
Reportable Laboratory Findings Form

For questions about this form or lab reporting requirements, call (860) 509-7994
Fax completed forms to (860) 920-3131

Phone: (860) 509-7994
Fax: (860) 920-3131

PATIENT INFORMATION

Patient Name (Last) (First) (Middle) Date of Birth Age

Address City State Zip Code Phone #

Race (Check all that apply)
American Indian/Alaska Native
Asian Black/African American
Native Hawaiian/Other Pacific Islander
White Other Race:
Unkn Refused

Ethnicity
Hispanic/Latino
Non-Hispanic/Latino
Unkn

Sex at Birth
Male
Female
Unkn

Current Gender Identity
Male
Female
Nonbinary
Transgender male-to-female (MTF)
Transgender female-to-male (FTM)
Other Gender:

Occupation Workplace Workplace Address

ORDERING PROVIDER

Last Name First Name

Facility Name Phone #

Provider Address

Provider City State Zip Code

Hospital Medical Record #

LABORATORY INFORMATION

Submitting Laboratory Name Person Reporting: Lab Phone # Date OL-15C Completed Date Reported to MD

Specimen sent to State Lab?
Yes
No

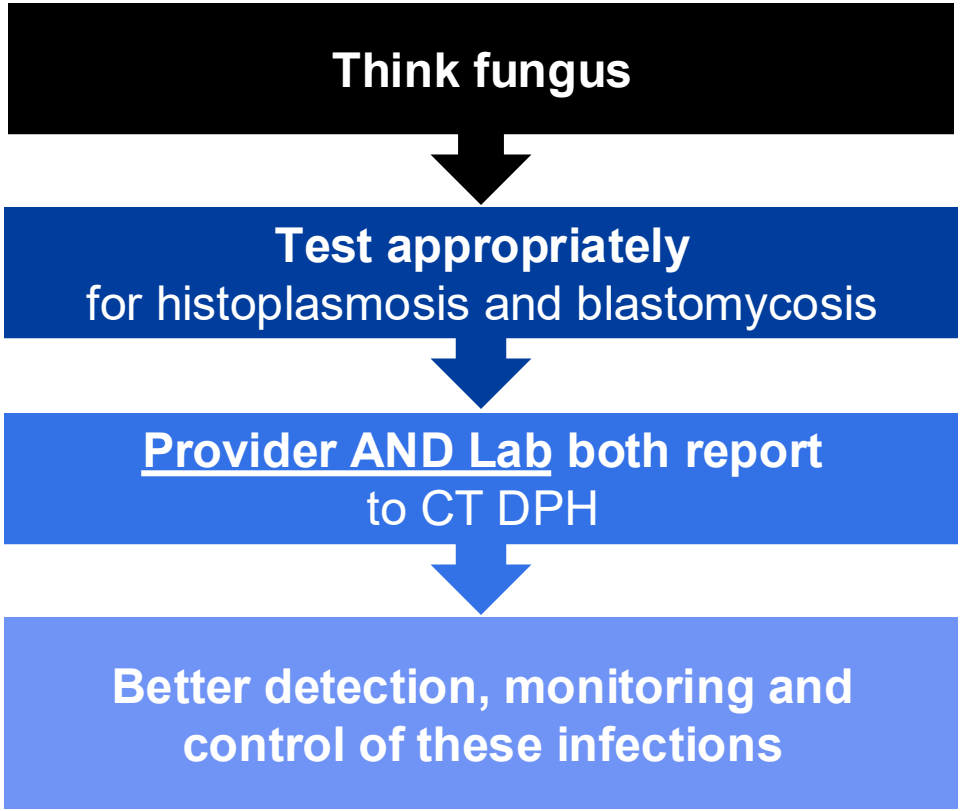
Lab City Lab State Collection Date Date Tested Result Date Lab Specimen # Source/Specimen Type

Anaplasma phagocytophilum PCR IgG ≥1:128 only
Babesia IFA IgM (titer) IgG (titer)
Blood smear PCR Other:

Legionella spp
Culture (1) DFA Ag positive
Four-fold serologic change (titers)

[More information about Laboratory Reporting]

Its takes all of us to improve surveillance of histoplasmosis and blastomycosis!



Resource	Name of Resource / Link
Diagnosing algorithms webinar	Webinar Thursday, September 21, 2023 - Algorithms for Diagnosing the Endemic Mycoses Blastomycosis, Coccidioidomycosis, and Histoplasmosis (cdc.gov)
Stat Pearls Histoplasmosis	https://www.ncbi.nlm.nih.gov/books/NBK448185/
Best Practices in the management of fungal pneumonia: Primary Care and Emergency Medicine Perspectives	https://funguseducationhub.org/best-practices-in-management-of-fungal-pneumonias-primary-care-and-emergency-medicine-perspectives/
Patient stories of blastomycosis	Blastomycosis Personal Stories | Blastomycosis | CDC
Patient stories of histoplasmosis	Histoplasmosis Personal Stories | Histoplasmosis | CDC

***Reference links are located at the bottom right corner of each slide**

Thank You!