

Transcript: CDC COCA Call - From Cave to Clinic: Managing Histoplasmosis in Returning Travelers

January 15, 2026, 2 – 3PM EST

KI

Khan, Ibad (CDC/OD/OC) 0:12

Good afternoon.

I'm Captain Ibad Khan and I'm representing the Clinician Outreach and Communication Activity, COCA, with the Office of Emergency Risk Communication at the Centers for Disease Control and Prevention.

I would like to welcome you to today's COCA Call From Cave to Clinic: Managing Histoplasmosis in Returning Travelers.

All participants joining us today are in listen only mode.

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At the conclusion of today's sessions, participants will be able to accomplish the

following:

Identify counseling points for travelers engaging in activities that pose a heightened risk for *histoplasma* exposure.

Describe the epidemiology of travel associated histoplasmosis, including risk factors related to bat inhabited cave exposure.

Review various control measures for preventing worker exposure to *histoplasma*.

Outline appropriate diagnostic approaches for patients presenting with community acquired pneumonia.

And, summarize treatment options and resources for mild, moderate and severe histoplasmosis.

After the presentations, there will be a Q and A session.

You may submit questions at any time during today's presentation via the MS teams platform.

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I would now like to welcome our presenters for today's COCA Call. We're pleased to have with us Dr. Ria Ghai, an Epidemic Intelligence Service officer in the Mycotic Diseases Branch in the Division of Foodborne, Waterborne and Environmental Diseases in the National Center for Emerging and Zoonotic Infectious Diseases, at the Centers for Disease Control and Prevention.

We have Captain Marie de Perio, the Associate Director for Science in the National Institute for Occupational Health at the Centers for Disease Control and Prevention, and Dr. Mitsuru Toda, the acting team lead of the Mycotic Diseases Branch in the Division of Foodborne, Waterborne and Environmental Diseases in the National Center for Emerging and Zoonotic Infectious Diseases at the Centers for Disease Control and Prevention.

It is my pleasure now to turn it over to Dr. Ghai. Dr. Ghai, please proceed.

Thank you so much and hello everyone.

Thanks for joining us today. So, I will be starting us off and I'd like to go to our first subject, which is the introduction and background.

Next slide please.

Next slide please.

So histoplasmosis is caused by *histoplasma* species, which are environmental fungi that are typically found in the soil. And while there's multiple species within the *Histoplasma* genus globally, the species responsible for most infections in North and South America is *Histoplasma capsulatum*. Infection almost always occurs when airborne spores are inhaled.

And it's also important to remember that a person with histoplasmosis is not contagious to others because it's not spread between people or between people and animals. When multiple cases occur within a household, a workplace, a community, this reflects shared environmental exposure rather than transmission.

Next slide please.

Histoplasma grows best in nitrogen rich soil, particularly soil that's been enriched with bird or bat droppings.

And it's the soil itself, rather than the direct contact with birds or bats that serves as a source of infection.

The primary risk factors for infection include when contaminated soil is disturbed, so activities such as tree planting, landscaping, digging or construction can all increase the risk of spore inhalation.

Next slide please.

Birds and bats are frequently discussed in relation to *histoplasma*, but their roles are somewhat different and important to distinguish. So, birds are not considered reservoirs for *histoplasma*, rather it's their droppings that are rich in nitrogen and that can enrich soil. Areas contaminated with accumulated bird droppings such as around roofs, breeding sites, or in coops can result in heavily contaminated soil where fungal blooms can occur.

In contrast, evidence suggests that bats can actually harbor *Histoplasma* and may therefore act as reservoirs.

This fungus, the fungus, is excreted into the environment by bat guano, and this helps explain why caves where bats roost, which we'll focus on today, are high risk

settings for exposure. Next slide, please.

One important note is that while contact with birds, bats, or their droppings has been identified in about 77% of histoplasmosis outbreaks, only about 25% of patients with sporadic or non-outbreak associated disease report these exposures, and that might be because they might not recall the types of daily activities that can lead to exposure. Next slide please.

Histoplasma alongside *Coccidioides* and *Blastomyces* are commonly called fungal pneumonias, as well as dimorphic fungi, and they're called dimorphic because they exist as mold in the environment and yeast in the body. In the environment, the mold form has hyphae which produce spores and those are aerosolized and inhaled by the lungs by a susceptible host.

The warmer temperature inside a host signals the transformation into an oval budding yeast and those yeast are then phagocytized by immune cells and transported to the regional lymph nodes.

From there, they can travel to other parts of the body [and the lungs].

Next slide please.

In the United States, we estimate *Histoplasma* is endemic to soils in central and eastern states.

Worldwide, it's also believed to be endemic to South America, southern parts of Africa and Southeast Asia. However, because histoplasmosis is both under diagnosed and under surveilled, the actual range of the fungus might be larger than these maps depict.

Next slide please.

So for example, a study that used data from Medicare fee for service beneficiaries looked at the incidence of endemic mycoses across the U.S. and shows that many cases are identified outside of traditionally established endemic regions.

So for histoplasmosis you can see some high incidence areas along the west coast. Some of these pockets could be potentially areas of emerging endemicity.

And some might be related to travel. Next slide please.

And that's what brings us to our primary topic for the day, which is about histoplasmosis outbreaks that occurred in travelers who visited bat inhabited caves. And for this, we need to take a tour of what we know about histoplasmosis and caves. Next slide, please.

So the reason we're holding the call for you all today is to spread awareness after an uptick in travel-associated histoplasmosis outbreaks in 2025.

Typically, we might hear of one outbreak every few years, but last year we, in collaboration with our partners, supported three investigations.

They all occurred in this fairly small geographic region, with cases reported after travel to Puerto Rico, Costa Rica, and Belize.

In Costa Rica and Belize outbreaks, groups of travelers visited the location for a holiday. In the Puerto Rico outbreak, the group traveled for work and as you can see from the red human icons in each, the majority of travelers, between 67 and 92%, became sick after returning from travel.

And they all had another important feature in common, too.

Next slide please.

In all three outbreaks, travelers visited bat inhabited caves as part of their travel plans.

And through epidemiologic investigation, we identified this exposure as the most likely source of histoplasmosis. Next slide, please.

So from here I'd like to zoom in and tell the story of one of these three outbreaks, which occurred in Costa Rica. Next slide, please.

And it occurred among an extended family that went on a family vacation together almost exactly one year ago today, over the Christmas holidays.

And we've since published the epidemiologic and clinical findings of this investigation as an *MMWR*. Next slide, please.

This is the family's composition, so at the top you can see we have a matriarch and then below her three adult children, their spouses, and their kids residing in Georgia, Washington and Texas.

Altogether, it was a group of 13-8 females, 5 males that went to Costa Rica. Next slide, please.

And we know about this family and their vacation because of this highlighted person. Next slide please.

After returning from Costa Rica, he visited his primary care provider because he was experiencing chest pain and had difficulty breathing, among other symptoms. Next slide.

A chest X-ray showed lung nodules, which raised concern of lung cancer, so his doctors requested he present to a hospital,

Next slide.

Which he did.

His presumptive lung cancer diagnosis held for one day until finally next slide, please.

A pulmonary specialist collected a travel history and that travel history revealed his recent family trip to Costa Rica as well as next slide, please.

A tour of caves inhabited by bats.

From there he was referred to an ID physician who began to suspect histoplasmosis.

Next slide please.

The physician began his patient on a course of antifungal medications and collected blood to test for *histoplasma*.

He also contacted my branch, the Mycotic Diseases Branch, after his patient disclosed that others in his extended family group were also feeling sick.

From there we launched a multi-state investigation looping in state and local health departments in Georgia, Washington, and Texas. Next slide please.

And what we found out is that during the tour they participated in, the family reported crawling and squeezing through tight spaces.

They also saw bats and a lot of bat guano. Next slide, please.

The Cave tour occurred on Christmas Eve, December 24th. Two people in the family group started developing gastrointestinal symptoms on January 1st. The rest of the family became symptomatic January 6-12, and the most common symptoms were headache, extreme tiredness, fever and night sweats.

Next slide please.

Six family members sought health care for illness.

Those are the ones that are filled in here. Above their heads, you can see how many times each went to a healthcare provider. Our index patient with the asterisk was the person--the only person in this outbreak that was hospitalized.

The rest went to their primary care provider or urgent care.

Next slide please.

All patients that sought treatment except for the wife of the index patient were prescribed something.

Unfortunately, their prescriptions were of antibiotics, which you can see in orange, which are unfortunately not effective for fungal infections. Next slide.

Others were also prescribed corticosteroids in red, which can even make fungal infections worse.

Next slide.

In fact, it was only the hospitalized index patient that was eventually treated with antifungal medications, in green, and that was after repeated healthcare visits,

worsening symptoms, and earlier prescriptions that failed to alleviate his symptoms.
Next slide please.

After learning about the index patient's diagnosis, other family members were tested for fungal infections.

Two people, including the index, were positive for *histoplasma* on blood antigen tests.

One was not tested by blood antigen, but did have a chest X-ray that's similar to the index patient was abnormal and therefore suggestive of histoplasmosis, and two were negative for *histoplasma*.

However, we do have evidence to suggest that *histoplasma* antigen tests might not be sensitive enough to pick up an infection in someone mildly ill.

Next slide please.

So zooming back out on this outbreak, what we see is a 100% attack rate.

We have one person, the family matriarch, who did not go into the cave as part of the excursion and didn't get sick. But everyone who went into the cave on the cave tour was exposed and became ill; next slide.

This pattern of higher than expected attack rates was true in the other outbreaks we investigated also.

In Puerto Rico, there was one person who did not enter the cave, and so we consider them not exposed, and they also didn't become sick--in grey.

There was another person who did enter the cave.

So was exposed, but still did not become sick--in blue.

In Belize, all three family members entered the cave, but only two became sick in the month after travel.

Next slide please.

So to exit this cave example and summarize our results, high attack rates were common in the outbreaks of histoplasmosis we investigated last year, even in groups of otherwise healthy people without underlying or immune compromising conditions. We also saw high rates of misdiagnosis or delayed diagnosis with many patients receiving antibiotics or steroids that weren't effective for treating histoplasmosis.

Next slide please.

So let's do a quick knowledge check.

In the Costa Rica case study, what was considered the epidemiologic link to *histoplasma* exposure?

A. Traveling to Costa Rica, B. Entering a bat-inhabited cave.
C. Not wearing a mask on the cave tour or D. Not washing hands after the cave tour.
Next slide please.

And the answer is B which was entering the bat-inhabited cave.

From here, I'd like to Passover to Doctor Marie de Perio to help us understand how we can mitigate the risk of histoplasmosis in occupational settings.

D De Perio, Marie A. (CDC/NIOSH/OD) 19:12

Thank you.

Thanks everyone for joining. So, while only one of the recent cave related outbreaks was directly work related, we know that histoplasmosis has long been associated with work.

It's quite possible that the local workers in Puerto Rico and Belize were affected, but they might have different healthcare seeking behaviors than returning travelers. Next slide, please.

So there was a nice review paper of histoplasmosis outbreaks in the United States over a 75-year period and approximately 1/3 of the 105 outbreaks have been work related.

Reported work related histo outbreaks have occurred among bridge workers, construction or demolition workers, farmers, landscapers or tree removal workers, camp counselors, and microbiology lab workers.

Other jobs considered to be at risk include extraction and forestry and hunting industries.

Next slide please.

Multiple occupational factors may influence the potential for transmission of an infectious agent, such as *Histoplasma* in the workplace, and we often discuss them as workplace factors and worker factors. In fact, a lot of what we know about *histoplasma* transmission in caves is extrapolated from findings from a histoplasmosis outbreak among workers removing bat guano from and cleaning out tunnels without respiratory protection in the Dominican Republic back in 2015.

And there's a photo of one of the tunnels shown here. So this outbreak had a high attack rate affecting 32 of 36 relatively healthy workers.

And it was a severe outbreak with 28 hospitalizations, 9 requiring intensive care and three deaths.

The workplace factors, which include things like workplace characteristics like, so

these outbreaks were associated with caves, which are small enclosed areas with poor ventilation, and furthermore caves tend to have cool temperatures, and high humidity, which favors fungal survival.

So what are the work practices?

Do workers disrupt soil as part of their job?

What are the work processes?

Do they hand dig or do they use machinery?

And what are the controls in place to minimize exposures? And then we have worker factors including the individual workers immunity and/or susceptibility play a role, socioeconomic, cultural, and language factors also play a role in disease transmission, especially with training.

And finally, there can be complex labor management relations.

We find that contract workers sometimes fall through the cracks when it comes to worker safety and health, and we did see this in the Dominican Republic outbreak with the tunnel workers as they were recruited from a neighboring village and contracted to work. Next slide, please.

There are several activities including many work activities that are associated with histoplasmosis beyond working in caves. So these include disturbance of large accumulations of bat or bird droppings like scraping droppings from a bridge, shoveling droppings from a building, or cleaning a chicken coop.

Soil disruption activities like digging or excavation, and then plant matter disruption like removing trees or landscaping and then demolition, construction, or renovation all have been associated with histoplasmosis.

Process next slide please.

So this is a graphic of the hierarchy of controls, which is an approach that we use in occupational safety and health to minimize exposures.

So after I explain this graphic, I'm going to detail our approach to making recommendations to protect workers and some of these recommendations could be adopted to protect travelers.

So the preferred approach is to eliminate or substitute out the hazard. And we know this is not always possible for infectious diseases.

The next preferred approach is to use engineering controls to remove the hazard from the process, or by placing a barrier between the hazard and the employee.

Engineering controls protect employees effectively without placing primary responsibility of implementation on the employee.

Administrative controls are employer dictated work practices and policies to reduce or prevent hazardous exposures; and then finally, personal protective equipment or PPE, is the least effective means for controlling hazardous exposures.

Proper use requires a comprehensive program, and a high level of employee involvement and commitment. PPE should never be used as a sole method for controlling hazardous exposures, and PPE also involves training a worker on how to use the PPE, but also how to put it on and take it off. Next slide please.

We have a nice histo topic page on the CDC NIOSH website that has recommendations for prevention and control measures for histo.

So following the hierarchy of controls, we start with elimination.

For the outbreaks in the Dominican Republic and in Puerto Rico, we did ask the question about whether or not people still need to access the tunnel or the cave, or could they be sealed?

In these instances, we were told no.

So another way to eliminate the hazard is to exclude bats and birds from entering a building or a structure.

And this can be achieved through multiple ways, including identifying and sealing entry and exit points, installing and maintaining light and roosting areas, constructing bat houses near former roosts, considering visual deterrents like balloons, flags or lights, and then using mechanical anti-roosting systems like angled and porcupine wires. We often make these recommendations for excluding bats from a building, but it is really difficult to implement this in a natural setting like a cave.

So we had to go further down the pyramid.

Next slide please.

Engineering controls such as controlling dust generation when removing bird or bat droppings has come up as a potential measure to reduce exposures to people who enter caves.

So anything that will control dust is helpful.

For example, carefully spraying dry, dusty material with water instead of shoveling or sweeping it can remove, can reduce the amount of aerosolized material.

An alternative method is to use an industrial vacuum cleaner with a high efficiency filter to collect the material.

It's important to dispose of waste properly and safely according to local requirements. It's also important to control aerosolized dust during construction, excavation and demolition, and this can be done by using heavy equipment within

closed cabs and HEPA filters and covering truck beds carrying dirt and debris from work sites. Next slide please.

Administrative controls include contracting with a professional company that specializes in handling hazardous waste for cleaning up large amounts of bird or bat droppings.

Specific recommendations applicable to caves include developing a site safety plan, posting health risk warnings, providing hazard communication and training to workers, including contractors. For the travel associated cave outbreaks, risk communication with workers and visitors is an important administrative control.

Next slide.

Finally, we have some PPE recommendations for workers in medium and high risk activities which do involve respiratory protection.

I note that these may not be applicable to or feasible for the average tourist, but they can be considered for those who are spending a lot of time in caves and potentially disrupting bat droppings.

Respiratory protection is tough to recommend because there's still a lot of unknowns about the effectiveness of various levels in preventing disease.

We consider high risk activities to include remediating sites with known *histoplasma*, disrupting large accumulations of bird or bat droppings, removing trees at large bird roosting sites, and disrupting bat droppings in caves and tunnels. In the United States, employers are required to provide medical evaluations, training and fit testing to workers who need to use respirators at work, next slide please.

Here's some additional PPE that can be worn by workers to prevent exposures to *histoplasma*.

So these recommendations depend on the nature of the work.

But they can include eye protection, gloves, coveralls, and disposable shoe coverings or boots. For tourists, wearing this PPE is not going to be feasible or desired, however, for traveling workers who plan on spending a significant amount of time in caves, these components can be considered.

For enclosed settings like caves and tunnels, though, it's important to weigh the risks and benefits of wearing PPE, as one should take into account the added risk of heat stress. Next slide please.

So I'm going to close with a knowledge check question.

So which of these controls are not part of the hierarchy of controls?

A. elimination B. engineering C. categorization, and D. administrative.

Next slide please.

And the answer is C, categorization. That is not part of the hierarchy of controls. So now I'm going to turn it over to Doctor Toda to talk about the clinical aspects.

TM

Toda, Mitsuru (CDC/NCEZID/DFWED/MDB) 28:25

Thank you so much.

So now the passing ways to recognize and treat travel associated histoplasmosis especially in places where histoplasmosis is not endemic. Next slide please.

I'll start with discussing about how to recognize histoplasmosis in patients. Next slide, please.

Based on estimates, as high as 85 to 99% of people who are exposed to *histoplasma* spores in the environment don't become sick.

Of the people who do become ill, most experience mild or moderate self-limiting illness. Rarely, illness might progress to severe forms or disseminated disease.

So going back to the outbreaks we presented earlier in the call, this is why the high attack rate among the majority of travelers was unusual. Next, please.

In terms of clinical spectrum of histoplasmosis, severity of illness depends on the fungal inoculum, host immunity, and clinical management.

Most travelers in the outbreak we investigated were healthy individuals with few or no underlying conditions.

We suspect that the reason for this large portion of people becoming ill was a result of a high dose of fungal inoculum.

This emphasizes the reason why we need to be aware of cave exposure as being unique route of infection. Next, please.

Histoplasmosis and other fungal pneumonias like blastomycosis and coccidioidomycosis are like a chameleon because the symptoms and radiologic findings can mimic other lung infections like TB.

Many patients with histoplasmosis are misdiagnosed with bacterial or viral pneumonia and sometimes even lung cancer. As we saw in our Costa Rica investigation.

These misdiagnoses, you can imagine, can have consequences in terms of the like diagnosis, but also a psychological effect as well. Next please.

For the most part, when people do develop symptoms, they may experience mild or non-specific symptoms like fever, cough, fatigue, headache, night sweats, and muscle aches, which are also present in other lung infections.

Radiologic results are also non-specific, so to diagnose a patient with histoplasmosis or other fungal pneumonias like blastomycosis or coccidioidomycosis, laboratory testing is really key.

Next please.

But in reality, what we've seen in outbreaks and beyond is that patients need to not only be quite ill, but also persistent with their healthcare providers to receive appropriate diagnosis and also treatment. For example, patients with fungal pneumonias often times experience delays in diagnosis with a median time between seeking health care to diagnosis being about a month. The majority will receive antibiotics, which again are not effective in treating fungal infections, and it also impacts antimicrobial stewardship. And will see a healthcare provider three or more times often that primary care urgent care or emergency care before they're actually being tested for fungal pneumonia.

Next please.

When you hear histoplasmosis, many clinicians may think that histoplasmosis is associated with HIV AIDS.

It's an important risk factor to consider.

Especially outside the U.S. context, but in recent decades, that's not no longer the case.

More common risk factors now in the U.S. include autoimmune disease, cancer and diabetes.

And this this may be due to the increased access of antiretroviral therapy.

Next slide please.

Thinking more specifically about diagnosis and travelers, CDC has what's called a Yellow Book, which is a resource to help recognize travel associated illnesses, including histoplasmosis.

The Yellow Book is intended for healthcare professionals and compiles travel health guidance.

You can find the link at the bottom of the page to access the Yellow book.

Next, please.

This Yellow book describes 2 points of consultation where clinicians can help travelers mitigate risks of *histoplasma* exposure.

First, in the pre travel visits, which is the best opportunity to educate the traveler about the health risks before they're encountered.

It's an opportunity to ask about adventure travel, and communicate potential health

hazards. In the case of travelers who were visiting the caves, clinicians might educate their patients about histoplasmosis and recommend that they seek healthcare early if they become ill during or after travel.

It also gives travelers options to decide whether or not to avoid or mitigate risks, depending on their underlying conditions and risk for developing disseminated histoplasmosis, as well as circumstances and cost.

Next please.

The second point of consultation is after the patient is ill and after they've returned from the travel.

It's important for clinicians to ask about recent travel in patients that present for clinical evaluation. For histoplasmosis, this is especially important with patients with persistent non-specific respiratory symptoms.

In patients have a history of recent travel it's important to solicit a complete history, which includes the element we list in the table.

A history of present illness, itinerary, details and activities during travel.

And when considering histoplasmosis as a potential diagnosis, this travel history can help clinicians understand if symptoms align with those that typically present, like fever, cough, fatigue, chills, headache and chest pain, for example. And this history will also be helpful in understanding if there are notable exposures to area that are known to be a risk for *histoplasma*, such as bat inhabited caves, and whether the time from exposure to symptom onset aligns with what we would expect in the incubation period of three to 17 days for histoplasmosis. Next please.

Now I'll move on to talk about testing recommendations. And diagnosis might not be straightforward and might not--testing might not be easy to order at some places, since it's often times a sent out test.

I'll walk you through the options in the next few slides.

Next please.

So in our current Infectious Disease Society of America, or IDSA's community acquired pneumonia guidance, testing for fungal pneumonias, including histoplasmosis is not actually recommended.

Instead, it focuses on treatment with empiric antibacterials and states that fungal pneumonias are not common pathogens.

But, because we recognize that clinicians may not be thinking about testing for histoplasmosis and that there are gaps that exist, and the fact that the symptoms are indistinguishable from bacterial or viral infections.

We worked with partners to publish and develop a simple algorithm that could be referenced by clinicians.

I'll go through them in the next few slides.

Next please.

So these testing algorithms are for fungal pneumonias again, which includes histoplasmosis, blastomycosis and coccidioidomycosis.

CDC developed this in partnership with the Mycosis Study Group, recognizing that fungal pneumonias are often misdiagnosed or diagnosed late, which again could lead to potentially life threatening treatment delays.

The link to this algorithm can be found at the bottom of this slide.

Next please.

And we actually did a COCA Call previously dedicated to the algorithm, and you can find the recordings in the link here.

So this algorithm for histoplasmosis starts off by identifying patients living in or having traveled to a disease endemic area, and identifying patients with community acquired pneumonia or CAP with unknown ideology not responding to a course of empiric antibiotics.

Or those with CAP with notable exposures to bird or bat droppings like the cave examples that we mentioned today, or chest X-rays showing new nodules or lymphadenopathy or linked to known histoplasmosis outbreak.

So if the if a patient fits this profile then next slide please.

Then consider urine antigen and serum antibody testing.

If either of these tests are positive, then the patient has probable acute pulmonary histoplasmosis. If antigen and antibody tests are initially negative yet clinical symptom—sorry, clinical suspicion remains high, such as a traveler with known exposure to bat inhabited caves and compatible symptoms.

Clinicians should repeat the antibody testing or consult infectious disease or pulmonary specialist for further workup.

These tests can come back negative if the infection is too early, resulting in low fungal load. If the if the patient is immunocompromised, which can hinder antigen response, and if the infection is localized and the fungus is not shedding into urine or blood.

Next slide please.

We should also note that *histoplasma* highly cross reacts with other dimorphic fungi like *Blastomyces*.

Some labs even have combined *Blastomyces* and *histoplasma* tests, which makes it impossible to distinguish between the two fungi.

As mentioned previously, the symptoms can be very similar and the fungal habitat for *histoplasma* and *Blastomyces* may overlap, so we would not be able to differentiate the infections based on potential places of exposure and the symptoms alone so.

This is not great for public health surveillance, but the good news is that the treatment for both infections are the same for the most part.

Next slide please.

Now I'll go over the treatment recommendations and wrap up our talk for today.

(Next slide) Please.

There's a new IDSA 2025 guidelines for mild and moderate histoplasmosis, which talks about treatment not being needed for asymptomatic or mild disease.

But for patients who are immunocompetent and who have mild or worsening or moderate disease, if the symptoms persist for over a month or worsen, itraconazole for six to 12 weeks should be considered for patients who are immunocompromised and who are mild, who are mild, who have mild or moderate symptoms.

Itraconazole for 6 to 12 weeks should be considered treatment of pregnant individuals should only be considered after carefully weighing the potential benefits and harms of treatment, ideally, in consult in consultations with maternal fetal medicine.

Specialists and infectious disease specialist, because the cases could be complex and highly variable, and if treatment isn't necessary, azoles should be avoided in the first trimester when possible, and liposomal amphotericin B should be used instead.

Therapeutic drug monitoring should be performed for patients receiving itraconazole.

Next please.

And for patients with chronic, severe or disseminated histoplasmosis, treatment may include long term itraconazole or liposomal amphotericin B. And these guidelines have not changed since 2007.

Next slide please.

And here's our last knowledge check question, where can healthcare providers find resources specific to caring for travelers?

- A. IDSA guidelines
- B. CDC testing algorithms for fungal pneumonias
- C. CDC Blue book
- D. CDC Yellow Book.

Next slide please.

The answer is D. CDC Yellow Book.

(Next) Slide please.

And we would like to end with one message.

Is to think fungus. Some of these fungal infections, including *histoplasma*, can really present as other viral or bacterial infections. And the misdiagnosis can delay appropriate treatment while the infection worsens and perpetuate antimicrobial resistance.

So thinking fungus early and soliciting travel history could really help lead to earlier diagnosis and appropriate treatment to save lives.

Next slide please.

We have so many partners to thank, including all the partners that assisted with our multistate outbreak investigations by interviewing patients, completing case report forms, participating in all the calls, and following up with patients.

We also had multiple CDC groups who have helped us in the investigation.

And we listed them in this slide. Thank you so much.

The moderator, I'll turn this back to you.

KI **Khan, Ibad (CDC/OD/OC)** 44:49

Presenters, thank you so much for providing this timely information to our audience. We will now go into our Q&A session.

Audience may submit questions via the MS Teams platform.

Again, Please note the ability to ask a question during the live webinar is limited to the first thousand attendees who join the webinar. If you are unable to ask a question during today's webinar, you may submit your question after the live session by emailing COCA@cdc.gov.

So we have quite a few questions regarding the case study you shared in Costa Rica. Our first question asks, did you look for any histoplasmosis cases among tour guides or others associated with that cave in Costa Rica?

GR **Ghai, Ria (CDC/NCEZID/DFWED/MDB)** 45:38

Yeah, I can start off with that.

That's a great question.

This is Ria, so I think one of the first things that we did with this outbreak was reach out to our CDC counterparts in the Central America Regional Office in the CDC,

Guatemala Country Office.

And they were kind enough to help us connect with the Costa Rica Ministry of Health.

And it was the Costa Rica Ministry of Health that ended up leading the outbreak in the context of what occurred within Costa Rica, including an extensive investigation of the cave itself as well as the tour operators that go into the cave. So, the long and short is really that the Costa Rica Ministry of Health handled the outbreak on in their country. But we do know that they did issue recommendations for all of the tour operators, including histoplasmosis in their liability and release forms that tourists have to sign when they go into the tour.

So it was more apparent that there was a risk of histoplasmosis in these caves and that the tourists entering it would know it earlier than after they became sick. Over.

KI Khan, Ibad (CDC/OD/OC) 47:01

Thank you very much for that.

Our audience were also interested in following up on the long timeline between symptoms and diagnosis.

And essentially I can try and sum up several questions and do one overarching theme, which would be at what point in the clinical timeline should clinicians pivot from, say, empiric antibacterial therapy to fungal testing?

TM Toda, Mitsuru (CDC/NCEZID/DFWED/MDB) 47:36

I can take that one.

This is Mitsuru. In our clinical testing algorithm, we specified that when a patient fails one round of antibacterial, then testing for—and if the patients meet all of these other conditions in terms of having community acquired pneumonia, and having exposure to a known risk, then testing for *histoplasma* may be considered.

These—we have these algorithms not just for *histoplasma*, but for also

Coccidioides and *Blastomyces* as well, which are also considered fungal pneumonias.

KI Khan, Ibad (CDC/OD/OC) 48:43

Thank you very much for that and while we are on that topic, we have received a question actually about *histoplasma* and blastocyst given the information you shared about cross reactivity and the question asks, how should clinicians approach

diagnosis and management when lab results are indeterminate but **CL?**
Suspicion remains high.

TM **Toda, Mitsuru (CDC/NCEZID/DFWED/MDB)** 49:14

Yeah. So, the question is, could you repeat the question again, sorry.

KI **Khan, Ibad (CDC/OD/OC)** 49:19

Yeah, I think it's alluding to the cross reactivity between *histoplasma* and *Blastomyces* and is asking that how do you represent clinicians should approach diagnosis and management if lab results are indeterminate or inconclusive, but there is clinical suspicion.

TM **Toda, Mitsuru (CDC/NCEZID/DFWED/MDB)** 49:37

Right. So, for the most part, the treatment for blastomycosis and histoplasmosis.
Are the same for the most part.

So.

The testing comes back positive.

For for the tests then it might.

Be.

Good to consider.

Or or. Yeah, it might be good to consider testing web consultations with infectious disease doctors and pulmonologists.

But distinguishing between *Blastomyces* and *Histoplasma* may be very difficult, not just because of the cross reactivity portion, but also because the symptoms are might be very similar and because the exposure plays or the habitat of the fungi maybe also very similar to but there might be specific clinical signs and symptoms that may lead the clinician to diagnose one or the other, but just with the testing alone it would be very difficult to distinguish.

KI **Khan, Ibad (CDC/OD/OC)** 51:00

Thank you very much.

We also have questions that have come in regarding worker and traveler safety and one of these questions asks how do you recommend we should use the information on bat reservoirs and environmental exposure to inform counseling workers or travelers that are engaging in cave exploration or any wildlife related activities.

D De Perio, Marie A. (CDC/NIOSH/OD) 51:31

I can take this one.

This is Marie, I think, the hazard communication or risk communication part of this is a really important prevention measure for, you know, recreational travelers, but also workers, I mean, I think we know that there are certain medical risk factors for more severe disease and those patients could be counseled by their physicians, you know. In a discussion prior to travel and then I think there's, you know, some of the preventive measures that I outlined according to the **Hari** you give controls could be applied in both settings as well in terms of what you're actually going to do in the cave or how you might.

How one might protect themselves in a cave?

KI Khan, Ibad (CDC/OD/OC) 52:26

Thank you very much. And we have time for one more question.

And this question refers to the information you shared about corticosteroid use worsening histoplasmosis outcomes.

How should clinicians manage patients who have already received corticosteroids? Is there any specific guidance you have for them?

GR Ghai, Ria (CDC/NCEZID/DFWED/MDB) 53:02

Yeah, I can take a brief stab at this.

So if corticosteroids, there's some evidence in some instances that it might lead to worsening symptoms, but I think it really varies case by case in terms of what's been prescribed, how severe the illness is.

So this would--It's a difficult question to generalize. One specific answer to, but I think.

More generally.

Moving forward.

With potential appropriate treatment is useful in cases where illness might be mild but not resolving or worsening.

Or moderate illness that is also not getting better.

So I think just moving on to more appropriate treatments and ceasing steroids is the general answer.

But again, it's hard to provide specific context for something that could be really case

specific.

Back.

KI Khan, Ibad (CDC/OD/OC) 54:05

Thank you very much for that. And I want to thank all our presenters for answering these questions and their time and thank our audience for joining us today with a special note of gratitude to our presenters and their expertise.

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Again, thank you for joining today's COCA Call.

Have a great day.

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