

Molecular Detection of *Histoplasma capsulatum* in Antarctica

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] Hello, I'm Sarah Gregory, and today I'm talking with Dr. Luciana Trilles, a researcher at the Oswaldo Cruz Foundation in Rio de Janeiro, Brazil. We'll be discussing detection of *Histoplasma capsulatum* in Antarctica.

Welcome, Dr. Trilles.

[Luciana Trilles] Hi, Sarah. Thank you for having me today.

[Sarah Gregory] Let's start off with what is *Histoplasma capsulatum*?

[Luciana Trilles] *Histoplasma capsulatum* is a microscopic fungus that lives in the soil in endemic regions, mainly the soils rich in bat and bird droppings.

[Sarah Gregory] What is systemic mycosis?

[Luciana Trilles] Systemic mycoses are a group of diseases caused by a group of dimorphic fungi, that is, they have different morphologies in the environment and in parasitism. In the environment, they are filamentous fungi, and in the host (in parasitism), they become yeast. They are endemic in different geographic regions. The infection can start after inhalation of fungal spores and can cause primary lung injury that can regress naturally or can spread to other organs, including the central nervous system. Besides, they are capable of causing outbreaks.

[Sarah Gregory] You found it in the Antarctic Peninsula. Where exactly did you find it there? In ice, in the dirt? In bird droppings?

[Luciana Trilles] We collected water, soil, bird droppings, feces of mammals. But *Histoplasma* was detected in the soil and in penguin dropping samples in an environmental preservation area, on a beach on the Potter Peninsula with a rich presence of birds and mammals.

[Sarah Gregory] Why were you there looking for it there?

[Luciana Trilles] We are there to do the surveillance of pathogens in Antarctica, where there's fungi, bacteria, viruses and parasites, especially the ones capable of causing outbreaks, so that we can work on forecasting and minimize the possible impacts on people's health in Antarctica and in other continents, as well.

[Sarah Gregory] And how did you detect it? What tests were used?

[Luciana Trilles] We extract the DNA of the whole environmental sample and then amplify a specific part of the DNA of *Histoplasma capsulatum*. Then we sequenced this part of the DNA and compared with the international database of sequences for confirmation.

[Sarah Gregory] And apparently, it gets airborne. How does it...what causes it to get airborne?

[Luciana Trilles] The air currents, of course, can cause it to get airborne, but also human activities, such as cleaning chicken coops and abandoned buildings, revolving soil for, for example, constructions. Also, what's very common is entering caves for leisure or professional activities. So those are some examples that cause histoplasmosis outbreaks.

[Sarah Gregory] And who or what does it affect? Does it affect people? Birds? All mammals? Who does it affect?

[Luciana Trilles] Yeah. Many specific species of mammals can be infected, including bats and humans. The birds, probably not because of the high body temperature. But the birds can carry it on their bodies to other places and disseminate the fungi in the environment.

[Sarah Gregory] What kinds of symptoms do people get? Do birds and mammals get the same symptoms?

[Luciana Trilles] Yes. The symptoms are non-specific. Usually, the symptoms resolve spontaneously, and these range from simple general malaise to a severe and prolonged respiratory infection. So fever, headache, cough, retrosternal pain, asthenia and fatigue--they are usually present, but dyspnea only in severe cases. And the symptoms of chronic histoplasmosis are very similar to those of tuberculosis, leading very often to misdiagnosis. And yes, the other animals (the other mammals) have similar symptoms.

[Sarah Gregory] Can it be transmitted from person to person or zoonotically from animal to person?

[Luciana Trilles] No. The disease cannot be transmitted from person to person or animal to person or spread between animals, okay? The infection is always from the environment.

[Sarah Gregory] Is there a treatment for people for it?

[Luciana Trilles] Yes, there's a treatment, although the treatment is long and toxic. There are very few antifungal drugs that can successfully treat the mycosis. And the high lethality of the disease in some regions is mainly due to the late diagnosis, because you remember that I said that the symptoms are non-specific. So the most important is the early diagnosis.

[Sarah Gregory] What's the geographic range of histoplasmosis and where is it mostly found? And what kind of environment?

[Luciana Trilles] *Histoplasmosis* has been reported in all continents but Antarctica, of course, because no one lives there. The prevalence varies from low in Europe and Oceania to moderate in Africa and South Asia to high in the American continent. Latin America is the region with the largest number of cases reported.

[Sarah Gregory] Was it a surprise to find it in the Antarctic Peninsula?

[Luciana Trilles] We knew that we could find some of the species we are looking for because of the migratory animals. What we did not expect was to find histoplasmosis agent in 25% of the first analyzed samples, because this percentage is similar to the endemic regions. It's a very high rate of positivity.

[Sarah Gregory] *Histoplasma* has different clades specific to different regions. Tell us about them.

[Luciana Trilles] Molecular studies identified different genetic lineages in the *Histoplasma capsulatum* species, and they are different enough to become new species in the near future. And those different lineages, they are related to different geographical regions. For example, we have the North American lineage, the Panama lineage representing the Central American, and the Latin American lineages (there's more than one) that includes the isolates from South America. So we detected in Antarctica three different genetic lineages. All of them are very closely related

to the Latin American lineage, what make sense, if you think since the Peninsula Antarctica was already linked to South America in the past, and also many animals from the peninsula migrates to South America in the Antarctic winter and go back to Antarctica in the summer.

[Sarah Gregory] Antarctica is considered the most isolated and inhospitable continent. What's going on with human intervention there stirring this up? Who are these people and what are they doing there?

[Luciana Trilles] In the past, Antarctica used to be explored only by fishers and whalers. But over the past two or three decades, however, the intensity of human activity has continued to increase, driven by not only explorers but also scientific researchers, station support personnel, and more recently, by a lot of tourists.

[Sarah Gregory] Dr. Trilles, what's unique about your study?

[Luciana Trilles] Usually, the environmental source of an infectious disease is studied after an outbreak occurs and when many people get sick, but there is no case of histoplasmosis in Antarctica. By studying the Antarctic environment, we are trying to anticipate knowledge of a potential threat to public health.

[Sarah Gregory] Why don't you tell us briefly about your study now.

[Luciana Trilles] We detect the DNA of fungi that are agents of systemic mycoses because they grow...they are fungi that grow very slow (slower than most fungi). But we also make the culture of the material to identify a possible new species that has pathogenic potential.

[Sarah Gregory] What were your conclusions?

[Luciana Trilles] *Histoplasma capsulatum* is present in King George Island, Antarctica, and those who carry out soil removal in the region, researchers or workers need to be more careful and should use a personal protection instrument (like masks, at least) so they will not be a risk to be infected.

[Sarah Gregory] What does this study add to public health?

[Luciana Trilles] This study demonstrates that Antarctica is not so isolated and there is probably a constant exchange of microorganisms between Antarctica and other continents, either by human action, migratory birds, or air and sea currents.

With global warming, previously frozen regions can expose pathogens not yet known, or with greater virulence. That is why we must keep monitoring the presence of pathogens in the region. Those unknown organisms can be exported to the other continents and become a potential threat to humans and other animals.

[Sarah Gregory] How big a threat is this *Histoplasma* right now, then?

[Luciana Trilles] We do not have an accurate incidence of histoplasmosis because it is not a noticeable disease. We know that exposure to a huge inoculum of conidia, even in a host with normal immune function, can lead to severe pulmonary infection. When the person exposed to *Histoplasma capsulatum* is immunocompromised, even a small inoculum can lead to a severe infection with widespread dissemination (it means, dissemination to other organs).

[Sarah Gregory] Is there something you recommend going forward for dealing with this threat?

[Luciana Trilles] In our day to day, there is no way to avoid inhaling these fungi. We can avoid inhaling the large number of fungal spores by using a protective mask when performing any risk activity, such as cleaning chicken coops and abandoned places. That is why we need to monitor the presence of the fungus in the environment to know which regions are endemic and inform health teams of the possibility of this fungal infection occurring. So the patient will have a faster diagnosis, early treatment and a better prognosis.

[Sarah Gregory] People are made so aware of the dangers of antimicrobial resistant pathogens, and certainly viruses now, but we don't hear much about deadly fungi. How would you rate them compared to bacteria and virus?

[Luciana Trilles] Fungi are not as virulent as viruses or bacteria, as they are not transmitted from person to person. But they are infections with a slower course. The treatments are very long and they are toxic, because the fungal cells are more similar to the human cells. So there is a high rate of treatment dropout, relapses and disabling sequelae. Besides, there are few drug options for fungal infections, and with the continued use, some strains can become resistant to the most used drugs, the azoles.

[Sarah Gregory] Tell us about your job and how living in Brazil you are involved in study of Antarctica? And I understand you are going back soon. I'd like to hear about that.

[Luciana Trilles] I work in the mycology laboratory of the National Institute of Infectious Diseases. It's a National Reference laboratory for systemic mycosis. I am a biologist, curator of the culture collection of pathogenic fungi and responsible for the investigation of environmental sources of systemic mycoses outbreaks.

And we are in Antarctica because the Brazilian government has a program that promotes research projects in Antarctica (the PROANTAR). And in my Institution (Fiocruz), eight research groups from different areas came together to construct this project and study the pathogens in Antarctica.

Yes, next week I am traveling to Antarctica again to collect samples at the same sites we already studied and also new sites that we have not been yet. And this trip is always carried out with the logistical support of the Brazilian navy. So the trip, we will fly to Chile, and from Chile we take the navy ship to Antarctica. It's a trip that lasts four or five days.

[Sarah Gregory] Despite a somewhat iffy connection today, it was a pleasure talking with you, Dr. Trilles.

[Luciana Trilles] You're welcome.

[Sarah Gregory] And thanks for joining me out there. You can read the October 2022 article, Molecular Detection of *Histoplasma capsulatum* in Antarctica, online at [cdc.gov/eid](https://www.cdc.gov/eid).

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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