

Host: Robert Frederick

Welcome to The Conjectural — an experiment in science news to figure out a better way to decide what science news is, and how we should talk about science. The data for this experiment? Your feedback to TheConjectural.com. I'm Robert Frederick. In this episode, a story about an infectious disease that's gotten better and worse thanks to modern medicine.



There are three drug-resistant bacteria that the U.S. Centers for Disease Control and Prevention consider “[urgent threats](#),” requiring the highest level of monitoring, prevention activities, and medical attention. None of the three grab many traditional headlines, though. So not pneumonia or meningitis, not any forms of staph infection, strep, or salmonella, either. But one of these three “urgent threats” is deadlier than all the other drug-resistant bacterial diseases, combined.

Interviewee: Archie Clements

Clostridium difficile — it's transmitted by spores.

Host: Robert Frederick

Archie Clements is an infectious disease epidemiologist at Australian National University. The disease caused by *Clostridium difficile* sickens around half a million people each year in the United States of which around 29,000 died in 2011, the year [scientists studied](#). That's around the same number of people who die each year in the United States from automobile accidents. Archie says *Clostridium difficile* is a real problem in Australia, too.

Interviewee: Archie Clements

So the bacteria lives in your gut. Spores are passed out in the stool, in the feces. And then those spores disseminate in the environment. And those spores are highly resilient to the environment. They can survive for decades.

Host: Robert Frederick

And so spores may be found absolutely everywhere. Traditionally, though, Archie says scientists had considered *Clostridium difficile* infections a hospital problem. And people do tend to go to the hospital with a *Clostridium difficile* infection because of diarrhea —lots of it— that just won't stop.

Interviewee: Archie Clements

However, it's becoming much more of a community problem. There are a lot more cases of *Clostridium difficile* being identified in the community, in people who are not in hospital, haven't been in hospital, which suggests that there is a lot of transmission of *Clostridium difficile* happening out there in the community.

Host: Robert Frederick

The reason that's happening isn't exactly clear. Scientists really don't know if *Clostridium difficile* is coming from the hospital and going into the community or coming from the community and going into the hospital. It's likely both, because *Clostridium difficile* colonizes about 5% of the adult population and around 30% of babies — though without causing the infection. People who are colonized —it could be you, or me— aren't suffering, but still spread the spores, and wouldn't even know it.

Interviewee: Archie Clements

And in fact, the emergence of epidemic strains in the hospital could be an indicator of events that are happening out in the community.

**Host: Robert Frederick**

But what is happening in the community is quite the mystery and it will take more clues to solve it. Archie says he and other epidemiologists are focused in particular on studying pathways the disease has taken before.

Interviewee: Archie Clements

Things like the interaction between humans and animals in the community, food production system—the way that they operate—and exposure to antibiotics in the community.

Host: Robert Frederick

Yes, antibiotics, and especially broad-spectrum antibiotics, which kill lots of kinds of bacteria. At first it sounds paradoxical, but killing lots of kinds of bacteria in the body also kills the beneficial bacteria that otherwise keep *Clostridium difficile* under control. Because of this, the usual course of treatment for a *Clostridium difficile* infection is for the patient to stop taking antibiotics for any other reasons they might be prescribed. If that doesn't work, or for those who weren't taking any antibiotics in the first place, there are other, more specific antibiotics for treating a *Clostridium difficile* infection. Unfortunately, at least one strain of the bacteria is already resistant to one of these antibiotics. That resistance evolved here, in the United States, first identified in an outbreak 15 years ago in Pittsburgh, found again the next two years in Atlanta, then in Montreal, Canada and has now spread around the world.

Since then, the incidence and severity of *Clostridium difficile* infections has gone up. Coincidentally, so too has antibiotic use. In a [study](#) published last year by The Lancet, scientists calculated that global antibiotic use increased 36% during the 10-year period from 2000 to 2010. More recently? There just isn't the data available yet. But starting in 2007, here in the United States, several large pharmacies started offering some antibiotics for free as a way of attracting customers. Today, many pharmacies around the country do the same. No, that doesn't necessarily translate to more community exposure to antibiotics leading to more incidence of *Clostridium difficile* infections. But making antibiotics free kind of implies that we should be using them freely, or to stockpile free antibiotics for when we think we'll need them. Of course, it still requires a prescription to get antibiotics of any kind in the United States, at least, if you follow the law.

Interviewee: Joy Greene

They absolutely require a doctor's prescription, yes.

Host: Robert Frederick

That's Joy Greene, a clinical professor at a new pharmacy school that opens next year at High Point University in North Carolina. Her resume includes opening and managing pharmacies, too. I ask Joy to read the list of antibiotics that are available for free at the local pharmacy.

Interviewee: Joy Greene

Amoxicillin, Ampicillin, Cephalexin, Ciprofloxacin, Penicillin VK, TMP/SMZ, Ceftriaxone.

Host: Robert Frederick

Are these all broad-spectrum antibiotics?

Interviewee: Joy Greene

No, I would not consider those to be all broad-spectrum. Now a couple of those are, but Amoxicillin, Cephalexin, Penicillin VK, they're not quite as broad-spectrum as like a Ceftriaxone that's on the list.

**Host: Robert Frederick**

Are there narrow-spectrum antibiotics for every single type of disease?

Interviewee: Joy Greene

No. There are no quick-fixes. So, we do have narrow-spectrum antibiotics, but you see what's happened over the years is many times patients are not taking those antibiotics appropriately, they do not finish the full course of therapy, so many times these bugs have become resistant to those narrow-spectrum antibiotics.

Host: Robert Frederick

Is there any way of monitoring those patients who are not taking their full dose of antibiotics to try to ensure that they do?

Interviewee: Joy Greene

So now there are many community pharmacies who will have their pharmacist call the patient three or four days after an antibiotic has been picked up to say "How are you feeling? Remember your antibiotic full course of therapy is 10 days. Make sure you finish the full course of therapy." But really, we leave that up to the patient.

Host: Robert Frederick

Is there any kind of feedback mechanism about antibiotics — from the pharmacist to the physician or to a regulatory body of any kind?

Interviewee: Joy Greene

Unfortunately, no. Now, if we were talking about controlled substances, which in society is considered more dangerous than antibiotic use, then I would say yes, many states have a state registry. However, you know, antibiotics are still considered pretty harmless, and for physicians, they're not as concerned about someone abusing antibiotics, and so we don't have a monitoring system in place.

Host: Robert Frederick

Improper use of antibiotics may not seem to be as dangerous to the individual patient as controlled substances are — the steroids, narcotics, and pain relievers that have been highly regulated in the U.S. since passage of the 1970 Controlled Substances Act. But it is becoming increasingly clear that we, as a society, have been misusing antibiotics, which is also dangerous to the individual in the form of widespread, deadly, and now drug-resistant bacteria. So far, the response by the U.S. federal government has been to make proper antibiotic stewardship a [national priority](#), starting in 2014 with, for example, the national goal of a 50% reduction in the incidence of *Clostridium difficile* infection by the year 2020 compared to estimates from 2011. But bacteria go everywhere, so these are global problems, says Archie Clements of Australian National University.

Interviewee: Archie Clements

You know, the fact that the environment, people, animals, are all interrelated. And if something goes wrong in one area of the Earth system, that can impact on other areas of the system. So we

probably need to be thinking a bit more broadly than we do now with traditional epidemiology, and not so focusing so much on diseases as clinical problems but as manifestations of planetary problems. These are planetary systems problems, so we should probably be focusing on the big picture.



Host: Robert Frederick

But focusing on the big picture has been hard to do for the world's governments. And when it comes to antibiotics, when it's your loved one suffering from an infection, and antibiotics available today would lead to a faster recovery, what would you do?

You've been listening to The Conjectural. Thanks to Archie Clements of Australian National University and Joy Greene of High Point University. Find us online at TheConjectural.com where you can give feedback and other support, download a transcript, and subscribe to the show. Follow me on Twitter @TheConjectural. I'm Robert Frederick. Thanks for joining us!