

Could antibiotic-resistant "superbugs" become a bigger killer than cancer?

BY HOLLY WILLIAMS

APRIL 21, 2019 / 7:00 PM / CBS NEWS

When antibiotics were first used in the 1940s they were a revolution in medicine. Before that, diseases like pneumonia and tuberculosis were often a death sentence, and even an infected scratch could be fatal. Since then, antibiotics have saved hundreds of millions of lives. But now many of these drugs are becoming ineffective.

Scientists say it's a problem of our own making. We've used antibiotics so freely, some bacteria have mutated into so-called "superbugs." They've become resistant to the very drugs designed to kill them. A study commissioned by the British government estimates that by 2050, 10 million people worldwide could die each year from antibiotic resistant bacteria. That's more than currently die from cancer. To understand the danger posed by superbugs, we start with the story of David Ricci.

In 2011, at the age of 19, David Ricci volunteered to teach orphans in Kolkata, India. His walk to work ran alongside these train tracks.

David Ricci: I remember the trains, when they would pass by, were just really close to you. And had caught my sleeve and threw me in front of it.

Holly Williams: How far were you dragged for?

David Ricci: Probably about 50 meters.

Holly Williams: And was the pain immediate?

David Ricci: My leg was pinned between two of the wheels as soon as I tried to stand up and realized that, you know, my leg was like hamburger.

Ricci survived the amputation of his leg and a medical evacuation home to Seattle, only for his doctors to discover a microscopic organism that could kill him.

David Ricci: My doctor said: "David, I need to tell you something really hard. You have an infection we've never seen before."

Holly Williams: Doctors in the U.S. hadn't seen much of this?

David Ricci: They'd never seen it, they didn't, they didn't even know how to treat it.

The infection growing inside Ricci's leg was caused by bacteria with genetic mutations that turned them into superbugs, resistant to 19 different antibiotics.

His doctor told us that in desperation, he had to reach back in time to an antibiotic called colistin that was discovered in the 1940s. For decades it was rarely used because in high doses it can cause irreversible organ damage. Ricci suffered kidney failure three times.

Holly Williams: What did it do to you?

David Ricci: It felt like my organs were disintegrating. It's just felt really, really strange, something I'd never felt before, like I was dying from the inside out.

But after six months, the colistin helped beat back Ricci's infection. And he learned to walk again.

We went to the neighborhood where the superbug that nearly killed David Ricci was found in 2009 in Delhi, India.

Ramanan Laxminarayan: This is old Delhi.

Ramanan Laxminarayan is an economist and a senior research scholar at Princeton University. He's been tracking the rise of superbugs for nearly 20 years. He says what happened to Ricci was more than just bad luck, it was the result of our misuse of antibiotics.

Ramanan Laxminarayan: We took antibiotics for granted. We thought that we could use them like sugar pills, that they were safe and that resistance was just something that biologists worried about that you'd never actually see in real life.

Holly Williams: You've called antibiotics a shared global resource. What do you mean by that?

Ramanan Laxminarayan: It's a lot like, you know, the fish in the ocean. If you fish, there's less fish for everyone else. So every time you use antibiotics, there's less effectiveness for everyone else.

If there's a frontline in the fight against superbugs, it's in places like this: the neonatal intensive care unit at Chacha Nehru Children's Hospital in New Delhi. Sixty-thousand Indian babies are dying every year from drug resistant infections.

Holly Williams:.. This is a little boy and he has an infection?

Dr. Mamta Jajoo: Yes.

Dr. Mamta Jajoo told us the antibiotics she routinely used 10 years ago are no longer effective. That's forced her to use colistin, the toxic "last line" antibiotic given to David Ricci.

Holly Williams: So he has an infection and the only antibiotic that it's sensitive to is colistin?

Dr. Mamta Jajoo: Colistin.

Holly Williams: That's the only antibiotic that will work?

Dr. Mamta Jajoo: Yes.

Holly Williams: Is he likely to recover?

Dr. Mamta Jajoo: Yeah.

Holly Williams: So he is improving?

Dr. Mamta Jajoo: He's improving. The baby's improving. He started opening the eyes, looking here and there, and hopefully by tomorrow we'll take him out of the ventilator.

That's good news for this baby, but the World Health Organization warns our arsenal of antibiotics is running out and we could be facing a post-antibiotic era.

Ramanan Laxminarayan: Much of what we consider modern medicine depends on effective antibiotics. It's not just about newborns dying of infections in faraway places.

Holly Williams: Are there modern medical procedures that we take for granted that simply wouldn't be possible if we didn't have access to effective antibiotics?

Ramanan Laxminarayan: Everything that we think of whether it's cancer chemotherapy, transplants, hip replacements, knee replacements, colorectal surgery, all of these require effective antibiotics to perform.

To understand how quickly bacteria become resistant to even the most powerful drugs, we visited Harvard University biologist Michael Baym. He showed us an experiment first done in the lab of Roy Kishony.

On what looks like a miniature football field, Baym pours a solution containing ciprofloxacin -- or cipro -- a broad spectrum antibiotic.

Holly Williams: This has no antibiotic?

Michael Baym: This one has no antibiotic.

Holly Williams: This one?

Michael Baym: This one has just over what the bacteria are able to survive.

Holly Williams: It should kill them?

Michael Baym: It should kill them.

Holly Williams: The next pool?

Michael Baym: Ten times as much.

Holly Williams: Okay.

Michael Baym: A hundred times as much.

The center zone of the table contains a thousand times more cipro than bacteria should be able to survive. Then Baym drops E. coli bacteria at both ends of the table.

Michael Baym: There are about a million bacteria in there.

Holly Williams: Okay, in that little drop?

Michael Baym: In that little drop. So the bacteria start at both sides and they race to the center.

In just a few days, some of the E. coli bacteria figure out how to resist the cipro and survive in what should be a deadly environment.

Michael Baym: And if you look very closely right here, they're starting to grow into the center.

Holly Williams: Which is by far, the strongest antibiotic?

Michael Baym: By far the strongest.

Holly Williams: Stronger than you would ever give to a patient?

Michael Baym: Exactly.

Holly Williams: And yet, they're beginning to evolve, to mutate.

Michael Baym: This is evolution happening. Each one of these little things that you see on it, that's a mutant. That's a mutant that's developed resistance and started to grow.

Holly Williams: That means that the E. coli has already outwitted cipro?

Michael Baym: In 12 days.

Each time we take an antibiotic, bacteria can develop the same kind of resistance in our bodies, which is why the overuse of the drugs is so dangerous.

Americans are among the highest consumers of antibiotics in the world. More than 250 million prescriptions are written every year. One-third of them unnecessary, according to the centers for disease control.

And in India – and many other developing countries – antibiotic use is on the rise and you can often buy the drugs over the counter, no prescription required.

Holly Williams: This is where your average person in Delhi would buy their medicine?

Ramanan Laxminarayan: Yeah, exactly.

All you need here, is the money to pay the bill.

Holly Williams: Can we get some cipro? Do you have cipro?

For just a few dollars we bought ciprofloxacin and amoxicillin, both vitally important antibiotics used to treat infections all over the world. And then, without even discussing symptoms, we asked for a bottle of colistin, the same powerful antibiotic that saved david ricci and the babies in the intensive care unit.

Holly Williams: This is colistin?

Ramanan Laxminarayan: This is colistin.

Holly Williams: That's the last line antibiotic?

Ramanan Laxminarayan: Absolutely.

Humans aren't the only ones being dosed with colistin. Ramanan Laxminarayan took us to this poultry farm outside Delhi.

Holly Williams: Oh, watch out.

Where they mix their feed with four different types of antibiotics, including colistin. Antibiotics make animals grow faster and stave off infection. It's a practice pioneered in the United States, where over a dozen different antibiotics are approved for use in farm animals.

Holly Williams: And what is the problem with giving these chickens antibiotics?

Ramanan Laxminarayan: If you look around us, the chicks are eating constantly. There are antibiotics in that feed, which means that their bacteria are being exposed to the antibiotics on a constant basis, and constantly selecting for resistance.

Holly Williams: What does that mean, "selecting for resistance?"

Ramanan Laxminarayan: It means that the bacteria in those chicken are being exposed to antibiotics, which kill off the bacteria that are sensitive to the antibiotics, leaving behind only resistant bacteria which don't respond to antibiotics.

Holly Williams: So it means these chickens are being accidentally bred to create superbugs?

Ramanan Laxminarayan: Because they're being fed antibiotics every single day of their lives.

And once a superbug evolves in animals, it can spread to humans through soil, water, and the handling or eating of meat.

That's exactly what happened in China when pigs that were fed colistin developed a genetic mutation called MCR-1. It makes bacteria resistant to colistin. The findings were first published in 2015. Just three years later, MCR-1 was found in more than 40 countries.

In 2017, 69-year-old Jeff O'Regan became one of the first Americans to be found with MCR-1. He arrived at Massachusetts General Hospital delirious, and with a fever of 106.

Holly Williams: So they discovered that you'd been infected with a bacteria carrying this gene, MCR-1?

Jeff O'Regan: Yep. I became, like a famous person at the hospital. Very strange. Within a day or two of that a lot of different doctors were coming in to visit me, asking me a lotta questions.

Holly Williams: What were they asking you?

Jeff O'Regan: They were asking me where I've been in the last six months, what my travel is. You know, everything about my life.

Microbiologist and infectious disease doctor Sarah Turbett was worried the infection could spread, so she put O'Regan in isolation.

Holly Williams: Had you ever seen MCR-1 before?

Dr. Sarah Turbett: We had not. This was the first one that our lab had isolated.

Holly Williams: MCR-1 was first spotted in pigs in China. How does it end up in Jeff?

Dr. Sarah Turbett: It's a great question. It's not completely clear how it ended up in Jeff. It's entirely possible that he picked this up during his travel. I know he's been to the Caribbean, and MCR-1 has been reported in the Caribbean. And so it's possible that when he was there, he ate something that maybe wasn't well cooked or he picked it up and it just colonized his gastrointestinal tract.

The Centers for Disease Control is now tracking MCR-1 and told us they have found isolated cases in 19 states. The superbug is still in O'Regan's system and with colistin now no longer an option, he's relying on the one antibiotic left that can fight it.

Holly Williams: And if that bacteria became resistant to that one antibiotic that still works, what would happen then?

Jeff O'Regan: Right now that's my last line of defense.

Holly Williams: So you wouldn't survive without it?

Jeff O'Regan: I've been told that.

Holly Williams: Some people might hear this and think, "Well look, the best way to protect myself is just to not travel to India, not travel to other developing countries."

Ramanan Laxminarayan: There are resistant bacteria that are developed in the United States itself that you are susceptible to. You know, this is a global problem. It doesn't stay confined to any single place.

Holly Williams: As an individual? Can I have any impact on this problem?

Ramanan Laxminarayan: You as an individual can have a huge impact by first recognizing that taking antibiotics inappropriately is gonna do you far more harm than good. So even if you didn't care about resistance for other people, you might consider the fact that the antibiotics won't work for you when you really need them.

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