One World, One Health Podcast
Episode 9, Season 1 - Transcript
Guest: Dr. David Heymann

Fighting Superbugs With Shots: Vaccines and AMR

Maggie Fox 0:02
Hello, and welcome to One World, One Health with the latest ideas to improve the health of our planet and its people. I'm Maggie Fox. Planet Earth faces many challenges: pollution, climate change, and new and reemerging infectious diseases. This podcast is brought to you by the One Health Trust with bite-sized insights into ways to help. In this episode, we're talking about a huge threat to humanity, antibiotic resistant bacteria. The World Health Organization says drug resistant bacteria kill or help kill close to five million people a year. They evolve naturally. But when people overuse antibiotics or don't use them in the right way, it can help drive these mutations. And now the world is fighting the rise of new drug resistant superbugs. Can vaccines be used to help slow this rise?

We're speaking with Dr. David Heymann, who spent more than 25 years at the US Centers for Disease Control and Prevention 20 of them at WHO as well. And he's a professor of Infectious Disease Epidemiology at the London School of Hygiene and Tropical Medicine. He's helped in the fight against HIV, polio and COVID, measles, monkeypox and Ebola, as well as dozens of other infections. David, thanks so much for joining us.

David Heymann 1:24
Thanks, Maggie for having invited me.

Maggie Fox 1:26
Can we talk briefly first about the problem itself? How bad is the threat of antimicrobial resistance?

David Heymann 1:32
You know, many people talk about antimicrobial resistance as being a wicked problem. And it really is, because it's due to the antibiotics, we use it cure infection, but at the same time, they work on the bacteria which they're working against, and causes them to become resistant to the antibiotic. And therefore they're using antibiotics is many times the cause of having resistant organisms. And this happens in both the animal and human communities as you know.

Maggie Fox 2:02
So how might vaccines help?

David Heymann 2:05
Vaccines, like antibiotics are used in both animals and in humans, but vaccines have an added benefit because they not only prevent infection, and prevent deaths that come from those infections, but they actually prevent the use of antibiotics because those infections are not there. So vaccines have really been slighted in the in the agenda of antimicrobial resistance in both the animal and the human communities.

Maggie Fox 2:23

So let's talk a little bit more about the difference between using a vaccine to prevent an infection versus using an antibiotic to treat one. What are the two different things that vaccines and drugs do?

David Heymann 2:44
Well, drugs cure infections, so antibiotics are used to cure an infection once it develops, vaccines are used to prevent an infection. And therefore they not only prevent the use of antibiotics, because there are no infections. But they also save lives because infections many times kill.

Maggie Fox 3:03
Germs, such as bacteria, can develop resistance against both vaccines and antibiotics. But it's a much slower process with a vaccine. Is that right?

David Heymann 3:13
That's right. It's a much, much slower process. And in fact, for the bacterial vaccines, it's a process. It's a process that takes years and years and years, if it occurs at all. For example, we have a measles vaccine, which most people are aware of that measles vaccine has prevented measles since it was first introduced, and it hasn't become less effective in doing that job. So vaccines are quite stable, unlike antibiotics, which rapidly develop inability to treat infections,

Maggie Fox 3:46
And this is because of the way bacteria thrive and multiply, right? An antibiotic might target just one thing about the bacteria that kills it, whereas a vaccine usually targets multiple areas so that the immune system can fight it on different fronts so that even if the bacteria develops one mutation, if somebody's vaccinated against it, the body can adapt and fight that mutated form as well.

David Heymann 4:13
That's really it Maggie. And actually, that's why in persons with tuberculosis, for example, several different drugs must be used with different targets in order to really cure infections. Whereas if we had a vaccine that could prevent tuberculosis infection, that would not be a worry at all.

Maggie Fox 4:31
And that's a tough one, isn't it? People have been working on a tuberculosis vaccine for decades.

David Heymann 4:36
It is a tough one. And you know, hopefully with these new vaccine platforms that we've seen, developed for COVID-19, we will be begin to see vaccines that can deal with infections, which have been with us for many, many years, and just not been able to be treated effectively or were prevented ineffectively rather.

Maggie Fox 4:56
So the the technology that's been used to develop a COVID vaccine can be adapted to help fight TB as well?

David Heymann 5:03
We believe that those vaccines can be adapted to fight many infections. Yes. And hopefully that's the case. For example, we have gonorrhea, which is a sexually transmitted infection. Most antibiotics now are almost useless against this infection, and we're running out of antibiotics to treat gonorrhea. If there were a vaccine for gonorrhea, we could immediately begin to prevent infections and stop the use of

antibiotics. And there are vaccines that are under development. And I know that new platforms are being considered for them as well.

Maggie Fox 5:36
So why don't we have one already? Gonorrhea has been around probably for as long as people have been around.

David Heymann 5:41
That's a good question. And I think it's just because it's very difficult to develop vaccines against bacteria, whereas it's quite easy to develop them against a virus. But still, in all, we do have many bacterial vaccines. And if we can increase their use, we can decrease the use of antibiotics in both humans and animals. And, you know, vaccines, like antibiotics are really a One Health intervention, because we should use them in both populations. And I can give some examples. You know, in the animal kingdom, there's a vaccine that's been developed to treat salmon. In other words, baby fingerling salmon are vaccinated against diseases that cause them to have difficulty in growing and cause severe mortality. And fingerlings, by vaccinating salmon in fisheries in Scandinavia and in North America, production of salmon has increased. And the use of antibiotics to treat these infections, which used to be just broadcast in the water to treat salmon infections are no longer being used. So you can see Maggie that not only are there fewer antibiotics in the environment, there's healthier food that's being developed because it's been vaccinated.

Maggie Fox 6:59
So why aren't more companies investing in these vaccines that target antibiotic resistant bacteria?

David Heymann 7:05
That's why we just put out an article in The Lancet Infectious Diseases talking about broadening the mantra, and not just speaking about development of new antibiotics, but developing vaccines as well. We can't stop developing antibiotics, but we know that new antibiotics themselves will become less effective very rapidly, because resistance will develop. Yet for vaccines, we have a stable way of intervening and not only preventing the use of antibiotics, but preventing the infections and the deaths that these bacteria are causing,

Maggie Fox 7:40
And of course, it's possible to eradicate a pathogen. Smallpox is caused by a virus, but vaccination was actually used to eradicate smallpox, correct?

David Heymann 7:51
That's right. And the eradication of smallpox is very important, because now in persons who had smallpox, they had open sores across the whole body, and these sores became bacterially infected. So people with smallpox also had to be treated with antibiotics. So by eradicating smallpox, we've eradicated the disease. We've eradicated the mortality. And remember, back in 1967, there were about 2.7 million people who died from smallpox. So we've eradicated a disease, we've eradicated death. And we've also stopped the use of antibiotics and people with smallpox. So you can see the benefit of vaccines, both for disease and for antibiotic use.

Maggie Fox 8:39
That took a concentrated global effort, however, right? Eradicating smallpox, how hard was it?

David Heymann 8:45
Well, smallpox was an easy infection to eradicate, surprisingly, because every infection was clinically manifesting in the same way. So if you found a person with smallpox, you knew that there weren others around them, and they weren't sick with or infected if they didn't develop lesions. So what was done was, people were isolated in their homes, they were treated in their homes, all their contacts were vaccinated, as were 30 households around them or in apartment buildings a floor above and below. And by a ring vaccination strategy, it was very easy to get rid of this infection. Fast forward to polio, which has many, many, many asymptomatic infections. For every person who's paralyzed for every child paralyzed, there are up to 500 children who are infected and don't have any signs and symptoms. So you can see the difficulty in making sure that you vaccinate everybody who is exposed to someone with polio. You must do mass vaccination, rather than ring vaccination.

Maggie Fox 9:47
And when you have something like a respiratory disease, it's even worse.

David Heymann 9:50
That's right. And if you can get rid of respiratory infections, you can also prevent the bacterial infections that often occur. For example, preventing influenza by vaccination will prevent the need to treat pneumonias which occur, bacterial pneumonias, which occur after influenza onset. At the same time if you use vaccines that are available now, to prevent bacterial infections, bacterial lung infections in adults, you can in fact, by using the pneumococcal vaccine, prevent the use of antibiotics and people who get influenza and this is being done in risk populations for influenza. Throughout the world people, adults, are being vaccinated with a pneumococcal vaccine to prevent bacterial infections after influenza.

Maggie Fox 10:43
And that gets really confusing, doesn't it? Because there is the vaccine that it's called the pneumococcal vaccine. It protects against strep pneumonia, the bacteria that causes bacterial pneumonia, but then there are viral causes of pneumonia as well. I suppose that confuses people.

David Heymann 10:59
Yeah, it gets very confusing for everyone. Because what we have to do is imagine what happens when there is a viral infection. When there's a viral infection, in the lungs, the cells that are lining the lungs, many times are disrupted, and they're unable to put up a barrier to other organisms that come into the lungs. And so when a pneumococcal organism enters the lungs, it can cause an infection because of that weakness of the lining of the lungs caused by the viral infection. So we end up with two different infections, which is much more serious and one, of course, but that bacterial infection can be prevented by a vaccine as can the viral infection of influenza.

Maggie Fox 11:42
David, thanks so much for taking the time to share your thoughts with us.

David Heymann 11:46
Thank you very much.

Maggie Fox 11:49

Listeners can share this podcast, which is brought to you by the One Health Trust by email, Twitter, or your favorite social media platform. And let us know what else you'd like to hear about at OWOH@onehealthtrust.org. Thanks for listening.