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Seven things to know about Ebola

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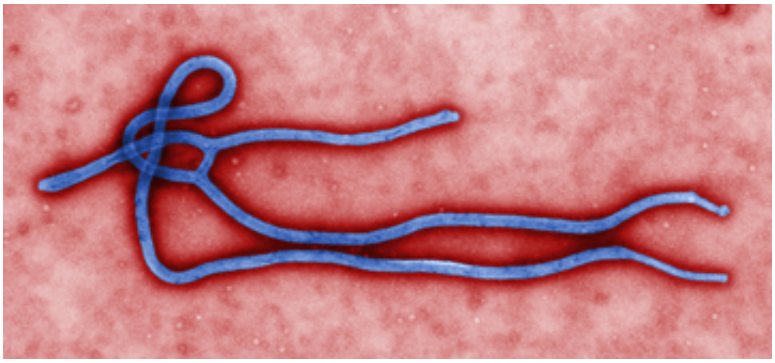

Ebola virus. Credit: CDC

The death toll from the Ebola outbreak in West Africa has passed 1,000 and is still rising, according to the World Health Organization. Fear of the virus and concerns about its spread beyond Liberia, Guinea, Sierra Leone and Nigeria are also soaring.

Hospitals in the United States, including Harvard affiliates in Boston, are reminding their staffs of standard infection-control procedures in case someone infected with Ebola comes through their emergency department doors.

Sean Whelan, HMS professor of microbiology and immunobiology and an expert in virology who studies Ebola and other pathogens, talked to Harvard Medicine News about the small chance of infection in North America, the very real humanitarian crisis in West Africa and progress

being made toward therapies against the deadly disease.

Here are his answers to seven questions about Ebola.

HMN: What is Ebola?

SW: The Ebola virus was discovered in 1976. It is an RNA virus with what we call a negative-sense genome, and that virus, when it infects a cell, makes more virus particles. An infection of humans by this virus causes hemorrhagic fever and massive damage to the internal organs. Basically the body goes into shock.

HMN: What can be done to prevent or treat it?

SW: There is no current vaccine or antiviral drug that is approved to treat Ebola virus infection.

Ebola certainly has been well studied by the research community, but developing a therapeutic is not something that is a priority for most pharmaceutical companies, for example.

Until the current outbreak, the total number of deaths from Ebola virus that we knew of since 1976 was about 2,000. Whilst there's active research to study Ebola virus infection, there are a number of other infectious agents that are responsible for many more deaths per year on a global scale than Ebola.

Also, because it's a biosafety level four virus, you can work with the complete virus only in very specialized containment facilities, including the one that's about to finally open at Boston University.

The U.S. government, through the National Institutes of Health and through the Centers for Disease Control and Prevention, has funded lots

of research on Ebola.

HMN: Should people in the U.S. be concerned?

SW: I don't see Ebola virus becoming a significant public health problem in the U.S. Ebola is a horrible disease but you're obviously much more likely to be exposed to Ebola virus in Africa than you are in North America. I think the challenges of being infected with a virus like Ebola are compounded because of the living conditions in West Africa versus here.

I think it's right for people in the U.S. to be concerned about Ebola virus infection, but I think we should be concerned from a humanitarian perspective, to help combat the outbreak in West Africa. I don't see that Ebola is going to become a public health problem in North America.

There was a story in the news about a patient at Mt. Sinai Hospital in New York who presented with vomiting and diarrhea and had just returned from West Africa and was being checked to see if they had Ebola virus. Well, it's much more likely that they just have food poisoning of some description.

It's an important disease and we should be vigilant and continue our efforts to try and develop therapies to combat this disease.

HMS: What might be in the pipeline?

SW: There's a candidate vaccine that has been generated by Heinz Feldmann [chief of the laboratory of virology at the National Institute of Allergy and Infectious Disease Rocky Mountain Laboratories] that's based on vesicular stomatitis virus (VSV).

He replaced the envelope protein of VSV with that of Ebola virus and

has demonstrated that that virus will protect monkeys against a challenge with infectious Ebola. If given 48 hours post-infection along with a lethal dose of Ebola, it will protect those monkeys against disease so they recover.

There are also a number of interesting candidate antiviral therapeutics in various stages of development that treat the infection. Jim Cunningham [HMS associate professor of medicine (Microbiology and Molecular Genetics) at Brigham and Women's Hospital] has been working on one in cell culture that remains to be proven in the context of an infectious scenario in large animal models of disease.

There is an inhibitor against the polymerase of Ebola virus that was published earlier this year by Sina Bavari's group at USAMRIID [U.S. Army Medical Research Institute of Infectious Diseases]. That polymerase inhibitor was able to treat monkeys that were experimentally infected with Ebola. They recovered from that infection. But the toxicity of that compound isn't fully clear.

So there are things that are in stages of development, but there's nothing that is currently approved as a drug and has made it through a set of trials.

HMN: What about ZMapp, the experimental serum?

SW: It's an anti-serum that is basically an antibody against Ebola virus. We've known for years that passive immunotherapy can protect against many diseases, so long as you get it early enough in the process of infection. This experimental antibody is apparently what the people brought back to the United States had been given. But again, this antibody hasn't yet been approved as a licensed therapeutic.

This is one of the challenges with these types of diseases.

How do you get approval for doing a human clinical trial for an infectious agent like this?

Under these conditions where you have an infectious agent whose lethality varies, depending on the outbreak, from 50 percent up to 90 percent, then if your chance of surviving an infection is one in two, you're probably going to be willing to take whatever you can.

HMN: Why do Ebola outbreaks flare and subside?

SW: It's very difficult to absolutely pin down why an outbreak starts. One source of transmission to people is eating or butchering contaminated monkeys. But as to how the virus is really transmitted in nature, what's the real reservoir for the virus? Some people argue that it's bats.

And then the reason that the outbreaks subside is often because of the isolation of the people who are infected. People who are infected are very sick and it's only very close contacts of these people who usually get infected by the virus. So it sort of naturally dies out.

HMN: What's next?

SW: I'm optimistic based on the currently available data that one day there will be an effective treatment.

Then the question becomes, how do you make that available to the people most in need of this treatment? You know, the ZMapp antibody, for example, if it's going to be an effective therapy, there has to be a way to get it to people and keep it cold and then there has to be a way to inject those people with it. And antibody-based therapies are very expensive.

From a humanitarian perspective, I think there is the will to do this.

The U.S. has invested a lot of money in trying to develop therapies and vaccines to treat this disease. There are a lot of people working on this problem and a lot has been learned in the past decade or so in particular. I think the fact that there are certain experimental therapies and a candidate vaccine already in progress is a testament to that work.

Provided by Harvard Medical School