[LINA MOSES:] We first started hearing these rumors about a mysterious hemorrhagic disease in Guinea. And honestly, I wasn't thinking Ebola at all. The biggest concern was that there was some evolutionary selection going on there. The virus could be changing into something really scary.

[PARDIS SABETI:] The Ebola outbreak in West Africa is believed to have started sometime in late 2013, with cases coming up in a village in Guinea.

[MOSES:] The epidemic started when a bat came in contact with a human, and the virus passed from that animal to the person.

Ebola spreads through direct contact with body fluids of someone that's infected with Ebola. They start to get a high fever, develop vomiting and diarrhea, bleeding. Blood pressure goes down. You go into a shock and systematic organ failure. And that's how people die.

[SABETI:] The virus in that time began to spread. It moved over into neighboring Liberia and Sierra Leone. Then before you know, there were 28,000 cases at least, with 11,000 reported deaths.

When outbreaks happen, we have to stop them right away because there is this possibility that the virus will accidentally have a change that could make that outbreak escalate.

I'm a computational geneticist, which is someone who uses computers to look at data from biology, from our genomes. The genome of a virus is so incredibly important to all aspects of its intervention, prevention, and understanding. It's basically a blueprint that every organism on Earth has, that defines it.

Every time a virus replicates, it just reproduces its genome. And when that happens, sometimes an accidental change can happen. A new mutation changes that genome sequence just a little bit. Most of those mutations either have no effect or a detrimental effect and get cleared out. Very rarely, it's possible they can pick up a change that somehow is beneficial to them.

One of the major drivers of evolution is natural selection. And in the context of viruses, you see that. That if a virus basically has some mutation that makes it spread more quickly or infect more people, then it will become more common in the population. And that's why it's a real issue when you're talking about an outbreak of something like Ebola that's not believed to happen in humans that often is you're giving it more and more opportunities in this new environment in human infection to mutate and change and to have a widespread impact.

[MOSES:] I'm a disease ecologist and epidemiologist. And my nightmare outbreak scenario actually happened. I got to live it last year. Sierra Leone and Liberia are just recovering from some very brutal, brutal civil wars. 85% of the health clinics in Sierra Leone were destroyed during the civil war. And West Africa has a very high population density. They have some very good roads. So if you take a health system that's in shambles and you add an Ebola outbreak and a rapidly moving population, then you have the perfect storm.

[SABETI:] When the outbreak hit Sierra Leone, Kenema Government Hospital was really the only hospital that was prepared to deal with patients with hemorrhagic fever. And Kenema was extraordinary and prepared for one or two or three cases. But before you knew it, there were hundreds. And at a certain point, everybody has their threshold, and they were overwhelmed. And what happened was that one of the nurses became infected, and then that spread through the clinical staff.

[MOSES:] One of the tragedies of Ebola is that it spreads through love and through people taking care of people that they care about.

[SABETI:] In this outbreak, we had 11,000 deaths. But what's really shocking is that 800 of those deaths are healthcare workers. It's estimated there was a 20-fold increased risk of a healthcare worker. My team also lost a number of our clinical care workers. All clinicians, all healthcare workers, all loved ones of individuals who are sick are putting themselves at risk every time they go to care for somebody who is ill like this.

The Ebola outbreak we saw in West Africa was by far the largest outbreak we've ever seen of Ebola. And so this is, as opposed to small numbers of cases, you're giving the virus many opportunities to replicate and to pass from human to human. And each of those is an opportunity for an accidental mutation to allow it to adapt.

And there is new evidence that there was a mutation that occurred early in the outbreak, a few months into the outbreak, that changed one of the important genes of the Ebola genome. And that mutation likely not only increased infectivity but did so in a way that was more specific to humans and primates. But the story to be told is not one that is answered by genomics, it's just answered by faster response. The more time you give it to change, the more chance it will.

[MOSES:] I do think that the world is not prepared for a long and sustained disease pandemic. The main reason why is because you see such disparities in health, quality of health. It's no accident that the epidemic happened the way it did in Sierra Leone. If Sierra Leone had the health system and the health infrastructure that we had in the US, you would have seen two cases like we saw in the US, instead of thousands and thousands of cases that we saw here. As long as there are countries that do not have proper health systems, everyone in the world is vulnerable.

[SABETI:] This outbreak did provide an opportunity to learn a lot more. But while there's tremendous new information that came to light, it didn't have to happen that way and it shouldn't have happened that way. We can get much, much better at picking up cases as they emerge and stopping these outbreaks from happening.

And so to me, actually, to think like a scientist is to be creative, to be open-minded, to be curious, to get ideas from all over, and then to identify ways of systematically proving out what you've done. You know, I love that, that balance between the creativity and the rigor. And I think as long as we're on this Earth, viruses will be too. And so, I think that's really why it's important to understand the biology, to appreciate it, to not assume that we need to completely eradicate them, but just to understand how to control them and how to respond when something gets out of control.