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Share the risks of Ebola vaccine development

Ebola vaccines have little in the way of commercial markets, so the risks should be shared between governments and industry, says **Seth Berkley**.

There are hundreds of infectious diseases out there that people could catch. More than 300 such conditions were discovered in the second half of the twentieth century alone. And how many of these diseases can scientists and clinicians protect against with a licenced vaccine? Fewer than 30.

Those are not always the biggest killers, or the most terrifying. Vaccine development is driven not by the risk that a pathogen poses to people, but by the economic pay-off. Given the difficulty of the science involved, how much money will it take to develop the vaccine? And given the size of the market, how much money can we make by selling it?

That helps to explain why, more than a year on from the first confirmed cases of the ongoing Ebola outbreak in West Africa, no vaccine is available, even though work started towards one more than a decade ago. Phase III trials for two vaccines have now been launched in Liberia and Guinea, and we have great hope for them, assuming that there are still enough cases developing to test the vaccines for efficacy. But for the more than 10,000 people who have lost their lives, and countless others who have suffered and will continue to suffer, these trials have come too late.

Our inability to protect people against Ebola is part of what makes the disease so frightening. In most cases, it is not what a disease is capable of that scares us, but that we can do so little about it.

But why is this the case for Ebola? We have known about the disease since 1976, and the first vaccine candidate was developed more than a decade ago. Ebola is not hypervariable like influenza or HIV, constantly changing and finding new ways to evade our immune systems, so we have had ample time to develop a vaccine or effective treatment during any one of the previous 23 outbreaks. Why were we caught by surprise this time?

The short answer is that we were not, but that the development of a vaccine was considered too financially risky. With a disease such as Ebola, which kills ferociously but occurs sporadically and usually in remote areas, there is simply no commercial market. Who would buy it? Outbreaks usually involve only a couple of hundred cases and occur every few years in poor rural communities in Africa. This leaves little in the way of incentives for manufacturers to invest the hundreds of millions of dollars it takes to develop a vaccine and get it clinically approved.

It is childish to blame the drug industry for failing to develop an Ebola vaccine — a product with no market. Instead, governments, public funders and private donors should be stepping up and investing.

We must work on a strategy that allows meaningful quantities of proven vaccines to be quickly produced and distributed when an outbreak occurs — of Ebola or other infectious diseases.

A first step is to identify the biggest threats, and that demands better disease surveillance. More and better-equipped laboratories, as well as trained epidemiologists, in developing countries would improve our ability to quickly detect and investigate outbreaks of commonly occurring diseases, as well new threats.

The vast amount of data produced by this kind of surveillance network would have an added bonus. With the right smart data-mining algorithms, the information could be used to radically increase our understanding of how pathogens travel and mutate, and then how our immune systems respond to these changes.

When an outbreak occurs and vaccines are needed, it would help significantly to have vectors ready to deliver them. With the right investment, these vectors, typically a harmless virus or bacterium, could be prepared and tested in advance. Crucially, they could be pressed into service to tackle a range of diseases. Four of the five Ebola vaccines currently going through clinical trials use vectors developed and tested for HIV.

Such generic vectors would, in effect, modularize the vaccine development process — conducting much of the safety testing and ironing out manufacturing processes for different vectors ready for the addition of a 'payload' antigen. By developing such mechanisms in advance, and pre-testing them for safety and dose, we can save significant amounts of money and time by having stockpiles frozen and ready for use or efficacy testing as soon as an outbreak occurs.

This is similar to the way in which technology developed using public funds through NASA has reduced the cost of placing scientific probes, telescopes and satellites into space. Same rocket, different payload.

It demands a different attitude to disease control. We need to stop waiting until we see evidence of a disease becoming a global threat before we treat it like one. Vaccine development is expensive, but the United States currently spends at least US$11 billion a year to keep fleets of nuclear-armed submarines patrolling the oceans to protect people from a threat that will almost certainly never happen. That is 60 times more than the World Health Organization puts into global disease preparedness.

Governments and donors need to invest in public-health capability, and they need to take on more of the risk of investing in vaccine development. We must view vaccines as the ultimate deterrent: make sure they are there, and pray that we never have to use them. ■

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