Scientists step up work to find and contain 'the Ebolas of the future'

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Headlines about alarming new viruses have been hard to escape. In just the past few months, Dallas has confronted its first cases of Ebola, of the mosquito-borne virus chikungunya and of the respiratory disease enterovirus D68. Many other threats, such as Middle East Respiratory Syndrome and new strains of the flu, lurk a plane ride away.

In response, scientists are stepping up efforts to prevent the next pandemic.

Teams of researchers have fanned out across the globe, trapping bats in China, rats in Vietnam and monkeys in West Africa in an effort to identify dangerous viruses before they cross into humans. Others are working in labs, screening hundreds of thousands of compounds to disarm the pathogens.

"Instead of chasing the last epidemic, which is how we practiced historically, we want to be proactive, to get ahead of the curve," said Dr. Jonna Mazet, a veterinary epidemiologist at the University of California, Davis and director of PREDICT, a government-funded network of scientists who hunt viruses in disease hotspots around the world.

In the last five years, PREDICT researchers, who work in 20 countries in Africa, Asia and Latin America, have identified 800 new viruses.

"We have very little knowledge of what's in the wild, but that's where the

Ebolas of the future are going to come from," said Mark Woolhouse, professor of infectious disease epidemiology at the University of Edinburgh in Scotland.

Nearly two-thirds of all new or re-emerging diseases are zoonotic, meaning they originate in animals, reports the U.S. Agency for International Development, which funds PREDICT.

These diseases are the most dangerous to humans, because our immune systems have not previously encountered them and are slow to fight them off.

While humans and animals have always exchanged viruses, Woolhouse said the early 21st century is a "perfect storm" for emerging diseases.

As populations boom and humans proliferate, they encroach on forests and encounter new forms of wildlife. They also travel more widely and frequently, spreading the germs they pick up. Global warming may also make it easier for tropical diseases, such as dengue fever, to spread.

Primates, rodents and bats form some of the most important reservoirs for zoonotic viruses. Primates are closely related to humans, and the viruses that infect them hold the potential to infect us. Rodents and bats, said Mazet, adapt well to humans.

"They can live easily with us, and so we're more likely to have contact with them and their fluids and feces," she said.

Woolhouse and his colleagues have launched a large surveillance effort in Vietnam with funding from The Wellcome Trust, a United Kingdom nonprofit. Along with colleagues at Oxford University's Clinical Research Unit in Ho Chi Minh City, the Vietnam team recently found in children a new strain of stomach virus that probably came from pigs.

The group is now investigating whether a different cluster of illnesses may have originated in rats, which are sold as food in local markets.

Mazet's team earlier this year helped Bolivia control an outbreak of yellow fever that started in howler monkeys. It also helped Congo quash Ebola before it spread out of control.

More sophisticated ways of tracking viruses have improved surveillance efforts.

In the past, researchers needed a large amount of genetic material to identify a virus. Now, even small samples of DNA or RNA allow PREDICT scientists to figure out the family to which a virus belongs and then decipher its whole genome.

Mazet hopes more hospitals in the U.S. will begin using some of the less expensive sequencing techniques.

"We want to get to a new place where doctors don't have to rely simply on what they've been trained to recognize. They want to detect the new things, too," she said.

As epidemiologists hunt new viruses in the field, drug developers are working in labs to disable them.

Earlier this year, the National Institutes of Health invested $35 million over five years to establish the Antiviral Drug Discovery and Development Center at the University of Alabama at Birmingham. The center, in partnership with the pharmaceutical company Gilead Sciences, will develop drugs for influenza, dengue fever, West Nile virus, SARS, MERS and chikungunya.

While doctors have broad-spectrum antibiotics that can work for a

variety of bacterial infections, there are fewer drugs to fight viruses.

"The reason is we came to viruses very late," said Jean-Francois Rossignol, chief science officer of Romark, a pharmaceutical company in Tampa.

Until the arrival of Hepatitis C and HIV in the 1980s, said Rossignol, viral infections were perceived as self-limiting - likely to go away on their own.

Viruses are also difficult to treat because they hide inside human cells. Any potential therapy has to be nimble enough to kill the virus without damaging the tissue in which it resides. Viruses are also diverse and shape-shifting, making it difficult to develop a single medicine that can fight several types of infections.

But researchers are making headway. Richard Whitley, a professor of pediatric infectious diseases at Birmingham and the antiviral center's principal investigator, said his group has access to 1 million compounds. He and his colleagues will be searching for ones that disable viral polymerases, proteins that viruses use to reproduce.

Several broad-spectrum antivirals are already in late-stage clinical trials. One, called nitazoxanide, was approved years ago to fight parasitic diseases. Marketed by Rossignol's company, Romark, the drug has helped patients recover from the flu faster than placebo in early studies.

The company is now testing it in more than 2,000 patients with influenza in the United States, Canada, Australia and New Zealand, alone and in combination with other drugs. The hope is that it will also work against novel flu strains if and when they emerge.

In preliminary tests, the drug also helped children and adults recover

from severe gastrointestinal illnesses, and the company plans to test it against enterovirus D68. Because nitazoxanide has already been proven safe, it may go on the market for flu as early as next year.

While scientists have made progress in protecting us from infections, many say there is much more to be done. "The chance of an emerging infection happening where the surveillance is happening is low," said Woolhouse. "We are learning a lot, but it's not at a stage where we have a global surveillance program."

Others see the glass as half full. The fight between humans and diseases "is a constant struggle," said Dr. William Schaffner, chairman of the Department of Preventive Medicine at Vanderbilt University School of Medicine. "I'm an eternal optimist. I'm excited about the development of science and our ability to diagnose these infections earlier."