Heading Off the Next Pandemic

Scientists fear another virus will leap from wildlife into humans, one that is far more lethal but spreads as easily as SARS-CoV-2.

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As the COVID-19 pandemic heads for a showdown with vaccines it's expected to lose, many experts in the field of emerging infectious diseases are already focused on preventing the next one.

They fear another virus will leap from wildlife into humans, one that is far more lethal but spreads as easily as SARS-CoV-2, the strain of coronavirus that causes COVID-19. A virus like that could change the trajectory of life on the planet, experts say.

"What keeps me up at night is that another coronavirus like MERS, which has a much, much higher mortality rate, becomes as transmissible as COVID," said Christian Walzer, executive director of health at the Wildlife Conservation Society. "The logistics and the psychological trauma of that would be unbearable."

SARS-CoV-2 has an average mortality rate of less than 1%, while the mortality rate for Middle East respiratory syndrome, or MERS — which spread from camels into humans — is 35%. Other viruses that have leapt the species barrier to humans, such as bat-borne Nipah, have a mortality rate as high as 75%.

"There is a huge diversity of viruses in nature, and there is the possibility that one has the Goldilocks characteristics of pre-symptomatic transmission with a high fatality rate," said Raina Plowright, a virus researcher at the Bozeman Disease Ecology Lab in Montana. (COVID-19 is highly transmissible before the onset of symptoms but fortunately is far less lethal than several other known viruses.) "It would change civilization."

That's why in November the German Federal Foreign Office and the Wildlife Conservation Society held a virtual conference called One Planet, One Health, One Future, aimed at heading off the next pandemic by helping world leaders understand that killer viruses like SARS-CoV-2 — and many other less deadly pathogens — are unleashed on the world by the destruction of nature.

With the world's attention gripped by the spread of the coronavirus, infectious disease experts are redoubling their efforts to show the robust connection between the health of nature, wildlife and humans. It is a concept known as One Health.

While the idea is widely accepted by health officials, many governments have not factored it into policies. So the conference was timed to coincide with the meeting of the world's economic superpowers, the G20, to urge them to recognize the threat that wildlife-borne pandemics pose, not only to people but also to the global economy.

The Wildlife Conservation Society — America's oldest conservation organization, founded in 1895 — has joined with 20 other leading conservation groups to ask government leaders "to prioritize protection of highly intact forests and other ecosystems, and work in particular to end commercial wildlife trade and markets for human consumption as well as all illegal and unsustainable wildlife trade," they said in a recent press release.

Experts predict it would cost about $700 billion to institute these and other measures, according to the Wildlife Conservation Society. On the other hand, it's estimated that COVID-19 has cost $26 trillion in economic damage. Moreover, the solution offered by those campaigning for One Health goals would also mitigate the effects of climate change and the loss of biodiversity.

The growing invasion of natural environments as the global population soars makes another deadly pandemic a matter of when, not if, experts say — and it could be far worse than COVID. The spillover of animal, or zoonotic, viruses into humans causes some 75% of emerging infectious diseases.

But multitudes of unknown viruses, some possibly highly pathogenic, dwell in wildlife around the world. Infectious disease experts estimate there are 1.67 million viruses in nature; only about 4,000 have been identified.

SARS-CoV-2 likely originated in horseshoe bats in China and then passed to humans, perhaps through an intermediary host, such as the pangolin — a scaly animal that is widely hunted and eaten.

While the source of SARS-CoV-2 is uncertain, the animal-to-human pathway for other viral epidemics, including Ebola, Nipah and MERS, is known. Viruses that have been circulating among and mutating in wildlife, especially bats, which are numerous around the world and highly mobile, jump into humans, where they find a receptive immune system and spark a deadly infectious disease outbreak.

"We've penetrated deeper into eco-zones we've not occupied before," said Dennis Carroll, a veteran emerging infectious disease expert with the U.S. Agency for International Development. He is setting up the Global Virome Project to catalog viruses in wildlife in order to predict which ones might ignite the next pandemic. "The poster child for that is the extractive industry — oil and gas and minerals, and the expansion of agriculture, especially cattle. That's the biggest predictor of where you'll see spillover."

When these things happened a century ago, he said, the person who contracted the disease likely died there. "Now an infected person can be on a plane to Paris or New York before they know they have it," he said.

Meat consumption is also growing, and that has meant either more domestic livestock raised in cleared forest or “bush meat” — wild animals. Both can lead to spillover. The AIDS virus, it’s believed, came from wild chimpanzees in central Africa that were hunted for food.

One case study for how viruses emerge from nature to become an epidemic is the Nipah virus.

Nipah is named after the village in Malaysia where it was first identified in the late 1990s. The symptoms are brain swelling, headaches, a stiff neck, vomiting, dizziness and coma. It is extremely deadly, with as much as a 75% mortality rate in humans, compared with less than 1% for SARS-CoV-2. Because the virus never became highly transmissible among humans, it has killed just 300 people in some 60 outbreaks.

One critical characteristic kept Nipah from becoming widespread. “The viral load of Nipah, the amount of virus someone has in their body, increases over time” and is most infectious at the time of death, said the Bozeman lab’s Plowright, who has studied Nipah and Hendra. (They are not coronaviruses, but henipaviruses.) “With SARS-CoV-2, your viral load peaks before you develop symptoms, so you are going to work and interacting with your family before you know you are sick.”

If an unknown virus as deadly as Nipah but as transmissible as SARS-CoV-2 before an infection was known were to leap from an animal into humans, the results would be devastating.

Plowright has also studied the physiology and immunology of viruses in bats and the causes of spillover. “We see spillover events because of stresses placed on the bats from loss of habitat and climatic change,” she said. “That’s when they get drawn into human areas.” In the case of Nipah, fruit bats drawn to orchards near pig farms passed the virus on to the pigs and then humans.

“It’s associated with a lack of food,” she said. “If bats were feeding in native forests and able to nomadically move across the landscape to source the foods they need, away from humans, we wouldn’t see spillover.”

A growing understanding of ecological changes as the source of many illnesses is behind the campaign to raise awareness of One Health.

One Health policies are expanding in places where there are likely human pathogens in wildlife or domestic animals. Doctors, veterinarians, anthropologists, wildlife biologists and others are being trained and training others to provide sentinel capabilities to recognize these diseases if they emerge.

The scale of preventive efforts is far smaller than the threat posed by these pathogens, though, experts say. They need buy-in from governments to recognize the problem and to factor the cost of possible epidemics or pandemics into development.

“A road will facilitate a transport of goods and people and create economic incentive,” said Walzer, of the Wildlife Conservation Society. “But it will also provide an interface where people interact

and there's a higher chance of spillover. These kinds of costs have never been considered in the past. And that needs to change."

The One Health approach also advocates for the large-scale protection of nature in areas of high biodiversity where spillover is a risk.

Joshua Rosenthal, an expert in global health with the Fogarty International Center at the National Institutes of Health, said that while these ideas are conceptually sound, it is an extremely difficult task. "These things are all managed by different agencies and ministries in different countries with different interests, and getting them on the same page is challenging," he said.

Researchers say the clock is ticking. "We have high human population densities, high livestock densities, high rates of deforestation — and these things are bringing bats and people into closer contact," Plowright said. "We are rolling the dice faster and faster and more and more often. It's really quite simple."

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