Pandemic prep needs 'smart surveillance' to predict viral spillovers

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"Smart surveillance" for viral spillover from animals to humans, targeted preparedness and drug and vaccine research, and worldwide cooperation on surveillance and stopping disease spread are required to reduce deaths and lessen the economic consequences of the next pandemic, according to an international team of scientists.

In a perspective article published this week in *Proceedings of the National Academy of Sciences*, the 14 experts cite virus pandemics dating from 1918 to the COVID-19 crisis as examples of how "the world has largely failed to meet the challenge to be better prepared to prevent or respond to the next outbreak."

Future outbreaks are inevitable. The team says the best way to lower chances for widespread disease outbreaks and pandemics and improve prospects for mounting a rapid response is to adopt a One Health approach to diminish these threats—working across disciplines and administrative barriers at all levels to understand and address links between animal and human health and the environment.

Ohio State University virologist and immunologist Linda Saif, co-lead author of the paper, has been sounding the alarm about viruses that affect food animals, wildlife and humans for decades—and provided expertise very early in the pandemic about the dangers of SARS-CoV-2. In 1995, her lab was the first to document a coronavirus's leap from wild animals to cattle and from cattle to poultry. The recognition of interspecies transmission of coronaviruses from deer to cattle was prescient: In 2021, Saif was part of an Ohio State research team that showed that SARS-CoV-2 could spill over to deer. All these years later, the scientific community is still learning about how the wily pathogens work.

"SARS-CoV-2 taught us that viruses do not respect borders, walls, demographics or politics—nor do they respect species barriers," said Saif, a Distinguished University Professor in Ohio State's Center for Food Animal Health with faculty appointments in the departments of animal sciences and veterinary preventive medicine.

"Emerging and re-emerging RNA viruses—including coronaviruses—are a major cause of the transmission of disease from animals to humans

and back again to animals, and that spillover between species enables viruses to establish new hosts in which they can mutate and persist. The most effective way to fight back is to work as a global community and apply One Health practices for prevention and preparedness."

The researchers from the United States, Africa, Asia, Australia and Europe convened in 2021 as the Independent Task Force on COVID-19 and Other Pandemics: Origins, Prevention and Response. The task force was chaired by Gerald Keusch of the National Emerging Infectious Diseases Laboratory and Center for Emerging Infectious Diseases Policy and Research at Boston University, who is co-lead author of the *PNAS* article.

Recommendations are based on their findings from an expansive review of major RNA virus outbreaks over the last 50 years and research results before and during the COVID-19 pandemic. They paid particular attention to identifying places and times when targeted interventions in the past could have blocked cross-species transmission to inform their proposed solutions for the future.

Evidence strongly suggests that the two SARS coronavirus outbreaks, in 2003 and 2019, can be traced to coronaviruses in bats that most likely spilled over to intermediate animal hosts in wildlife farms or markets before infecting people—in the case of COVID-19, at the Huanan Seafood Market in Wuhan, China. The task force found the risk for a pandemic increases when people and animals interact closely in altered settings driven by land use and climate change, environmental degradation, the wildlife trade, population growth and economic pressure.

Addressing the risk factors of these types of conditions is one focus of the group's recommendations, which include:

- Conducting early-warning surveillance in locations where people, wildlife and domestic animals intermingle to detect high-threat potential zoonotic pathogens and inform development of potential broad spectrum vaccines and therapeutics.
- Investing in research and development of diagnostics, antivirals and vaccines for priority pathogens, and streamlining avenues to enable rapid clinical testing and manufacturing of medical countermeasures.
- Reducing drivers for spillover risk and spread, in part by minimizing high-risk human-wildlife contact, on the front lines of disease emergence from the community to country level.
- Countering misinformation and disinformation about the prevention and control of emerging diseases based on research focused on fostering public trust in and understanding of science and expert advice, and providing trusted resources and outlets for accurate information.
- Establishing an inclusive, transparent One Health governance framework at all levels for pandemic preparedness and response, and providing stable funding for all related global efforts.

"It's not an overstatement to say that this requires worldwide collaboration and coordination to come up with measures enabling us to predict, prevent, mitigate and control future pandemics," Saif said. "We know where opportunities have been missed in the past. We know what research questions need to be answered most urgently. We just have to seize the opportunity and have the resolve to act on what we know to improve human, animal and our ecosystem health."

This look toward a better future comes at a time when SARS-CoV-2 is still causing infections worldwide and still has potential to circulate as viral variants that would pose new threats to human health, and as spillovers continue, potentially to animal health, the researchers noted.

"The time to energize these processes is now," the task force concludes, "when the tragedy of COVID-19 continues to confront the public and politicians."

More information: Keusch, Gerald T. et al, Pandemic origins and a One Health approach to preparedness and prevention: Solutions based on SARS-CoV-2 and other RNA viruses, *Proceedings of the National Academy of Sciences* (2022). DOI: 10.1073/pnas.2202871119. doi.org/10.1073/pnas.2202871119

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