The bird flu outbreak has taken an ominous turn

It's moved to mammals; now the poultry industry needs new measures to stop its spread.

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This week, Argentina and Uruguay declared national health emergencies following outbreaks of highly pathogenic avian influenza H5N1, the fast-moving virus that destroys poultry flocks and wild birds and for decades has been feared as a possible spark for a pandemic among people. That makes 10 South American countries that have recently marked their first-ever encounter with the virus, including Peru—where more than 50,000 wild birds died last fall, and more than 600 sea lions in January. Combine the sea-lion infections with the revelation that H5N1 flu invaded a mink farm in Spain in October, and health authorities must now confront the possibility that the unpredictable virus may have adapted to threaten other species.

To be clear, this does not yet include people. Although past decades have witnessed bird flu outbreaks that spread to humans, only two cases have been identified in the past 12 months: a Colorado adult last May, and a 9-year-old girl in Ecuador in January. (Neither died.) And there's no evidence yet that the virus has been able to jump from newly infected mammals to people. But the fact that it was transmitted from birds to mammals, and then spread among them, indicates a disquieting trend.

According to the World Organization for Animal Health, at least 60 countries have recently experienced outbreaks of H5N1, which is named for two proteins found on the virus's surface. That includes the US, where 43 million laying hens were either killed by avian flu last year or slaughtered to prevent the disease from spreading. Those losses took out almost a third of the national flock of laying hens; according to the

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US Department of Agriculture, they cut into egg supplies so much that prices at the end of the year were 210 percent higher than at the end of 2021. Overall, the USDA estimates just under 58 million birds—mostly layers, turkeys, and backyard poultry—died or were killed in 2022, and another half-million so far this year.

The poultry industry is enormous. Just the US portion comprises more than 9 billion meat chickens and 216 million turkeys grown each year, plus 325 million laying hens; chicken is the most-consumed meat worldwide. That scale makes it difficult to put the losses from bird flu into context. But the ongoing epidemic has become the worst animal-disease outbreak in US history, as well as the largest poultry outbreak ever recorded in the UK, Europe, and Japan. And though surveillance is difficult, wildlife biologists say the damage to wild birds has been disastrous.

There may be little that can be done to protect wild birds; avian flu is spread by seasonally migrating waterfowl, which carry the virus without being harmed by it. But the poultry industry relies on a complex set of behaviors and building features, broadly called biosecurity, that it developed or reinforced after a catastrophic outbreak killed more than 50 million birds in 2015. Given the virus's relentless advance, people who study the industry are beginning to ask whether biosecurity can ever be hardened enough to exclude avian flu—and if not, what has to change to keep birds and humans safe.

"We know that biosecurity can work and does work, but it's a heroic effort, and it may not be sustainable given current building styles and current workforce," says Carol Cardona, a veterinarian and professor of avian health at the University of Minnesota College of Veterinary Medicine. "The reason I say it can work is that companies that had [highly pathogenic avian flu] in 2015 had fewer cases in 2022. So they learned some lessons and changed some things—but very few of them kept it out completely."

The relentless attack of H5N1 is important not just for its impact on poultry or wildlife, but for what it portends for people. Avian flu was long considered the animal disease most likely to break out into a global human pandemic, and even after the onslaught of SARS-CoV-2, many scientists still feel that way.

The H5N1 subtype first spilled from birds to humans in 1997 in Hong Kong. It sickened 18 people and killed six of them—small numbers, but a disturbing 33 percent mortality rate. Since then, variants of H5N1 have periodically infected people, causing 868 human cases through 2022 according to the World Health Organization, and 457 deaths. Those numbers represent a 52 percent mortality rate—but at the same time, an indication that the virus had not adapted enough to spread easily from person to person and ignite large outbreaks.

Still, scientists are always watching for the virus to find situations that would encourage those adaptations. For instance: Spanish and Italian scientists disclosed last month that in October 2022, an H5N1 variant infected minks on a fur farm in Northwest Spain. The virus might have been passed to a single mink by a wild bird, or via chicken carcasses used for feed. But once on the farm, it made minute adaptations that allowed it to spread from one mink to another. To stop the outbreak, all the farm's minks—almost 52,000—were killed.

That outbreak was unnerving, twice over. Not only had the virus begun adapting to mammals, but to a particular mammal that might have direct relevance for people. Minks belong to the same family as ferrets, which are already used by scientists for flu research because they develop symptoms in the same progression that humans do.

But there's a third reason why the mink outbreak was notable, something that is so normal in animal agriculture that it mostly goes unnoticed. The Spanish farm was not a property where minks gamboled freely while they grew their fur. Instead, it was an intensive farm where the animals were confined in cages. Most of the poultry farms affected in the US have been intensive confinement farms also, though what that means differs by bird species: large metal barns for broilers, barns and sometimes interior cages for layers, and mesh-curtained sheds for turkeys.

Operating in confinement doesn't necessarily make a farm more vulnerable to infection, but once a virus penetrates the premises, confinement ensures that very many animals are exposed at once. That puts a lot of animals at risk—some of the egg farms wiped out by flu last year lost more than 5 million birds—and it also gives the virus a plethora of hosts to mutate in. This drives people outside the poultry industry to suggest that if very large farms pose a risk of amplifying a virus, maybe making them smaller should be part of viral defense.

"When there's public discussion of addressing zoonotic disease, it almost immediately turns to vaccination, preparedness, biosecurity—but no one discusses addressing the root cause," says Jan Dutkiewicz, a political economist and visiting fellow at Harvard Law School's Brooks McCormick Jr. Animal Law and Policy Clinic. "We would never have a debate about preventing cancer from tobacco products without talking about stopping smoking. Yet when it comes to zoonotic disease risk, there is a huge reticence to discuss curbing animal production."

That might be an unthinkable proposal, given that Americans ate an estimated 1.45 billion wings during the Superbowl last Sunday—and that as a culture, we're not inclined to ask many questions about how our food arrives at our plates. "Industrial animal production operates and maybe even depends on a distance between the consumer and the realities and violence of industrial animal production," says Adam Sheingate, a professor of political science at Johns Hopkins University who studies food and agriculture policy. "Most people really prefer not to know how their food is produced." Still, he points out, when disease risks from food become clear, other nations respond rapidly—such as

when the UK changed cattle-farming practices after Creutzfeldt-Jakob disease, the human variant of bovine spongiform encephalopathy, or "mad cow disease," killed 178 people in the mid-1990s.

"This is not to say we get rid of poultry," says Andrew deCoriolis, executive director of Farm Forward, a nonprofit that works to improve farm animal welfare. "It's to say: We have to understand what are the factors that are the biggest risk drivers, and perhaps legislate changes to them. That could be moving farms out of flyways, it could be reducing the number of barns on a particular location, it could be reducing animal density within the barns."

Dreadful though it is, it's possible to construe the current outbreak as an opportunity to begin gathering big data about what makes poultry production so vulnerable. Precisely because the disease has spread so widely, data could reveal patterns that haven't been visible before—whether affected farms use certain feed or water systems, for instance, or buy just-hatched birds from specific breeding lines, or are sited in particular landscape features or lie under the migration routes of identifiable birds. "There isn't a lot of research to show what are absolute best practices, because viruses are stochastic—you don't know exactly when you're going to get an introduction," says Meghan Davis, a veterinarian and epidemiologist and associate professor at the Johns Hopkins Bloomberg School of Public Health.

After the 2015 outbreak, which up to that point was the worst poultry producers could imagine, the industry focused on identifying the human networks that made its farms vulnerable. Companies tried to control how visitors might unknowingly expose them to the virus: through sharing housing with workers from another property, or driving a truck from an infected farm onto a clean one, or carrying mail or even a cell phone that might have been contaminated. The extraordinary expansion of H5N1 flu into wild birds now may mean that producers also have to think about how the environment itself invites exposure. Wetlands attract ducks. Copses shelter raptors that pursue rodents that scavenge spilled grain. It's an approach that concedes that biosecurity can never be perfect, and that a production system can never fully seal itself off from the world.

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