Measles outbreaks: a reminder that human diseases can move beyond human populations

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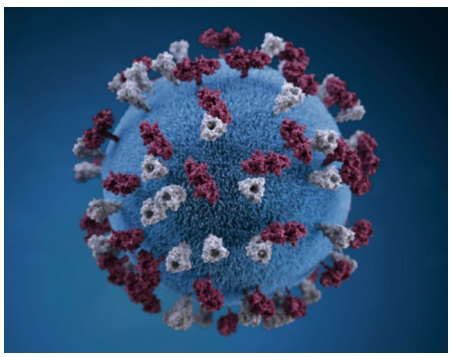
When zoonotic diseases make the headlines, it's usually because they are being passed *from* animals *to* humans. But some diseases can go the other direction. The recent outbreaks of measles in areas where experts had considered the disease to be eradicated are a reminder of the precautions needed to keep nonhuman populations protected too.

Measles is a highly contagious, airborne disease caused by *Measles morbillivirus*. The virus, which can linger in the air for up to two hours, is spread by coughing and sneezing and primarily affects unvaccinated children. It is a disease of humans, but it can spread beyond us: our close relatives, nonhuman primates, are also at risk of contracting measles. "It can go through a colony of nonhuman primates relatively quickly," says Gregory Timmel, the attending veterinarian at the Oregon National Primate Research Center (ONPRC) at the Oregon Health and Science University (OHSU) in Portland. Clinical symptoms in primates mirror those in humans: infected animals can experience measles' characteristic rash as well as dehydration, conjunctivitis, and fever; even after the disease has run its course, immunosuppression can linger for months. "With a viral infection like measles, you worry about susceptibility to secondary bacterial infections, and just the health and welfare of the animals," Timmel says.

There are no treatments for measles in any species beyond symptomatic care but like humans, nonhuman primates can be vaccinated. Animals at the UC Davis California National Primate Research Center (CNPRC) have been routinely vaccinated since the 1996 with the Vanguard Canine Distemper-Measles Vaccine (Vangard DM)[1,2], manufactured by Pfizer until 2007 and now available from Zoetis. The human Attenuvax vaccine produced by Merck has also been shown to be effective in nonhuman primates, as has MVac from the Serum Institute of India[3].

Vaccinating lab animal populations is not always feasible, depending on the kind of research for which they are being used. The nonhuman primates at the ONPRC for example are generally not vaccinated because they are often used in research that involves the immune system and immune responses, Timmel says. In some countries, vaccine availability can be a limitation. The CNPRC was considering the use of MVac while Vanguard DM was unavailable between 2007 and 2013 but realized the procedure for getting approval from the USDA to bring it into the country made it impractical, says JoAnn Yee, technical supervisor of the CNPRC Primate Assay Laboratory Core. In Israel, which saw over 1400 human measles cases in 2018, only combined vaccines for humans, such as the Measles-Mumps-Rubella (MMR) vaccine, are currently available. The animals don't necessarily need the 'Mumps' and 'Rubella' aspects, says Ady Eliav, a veterinarian who oversees the crab-eating macaques and African green monkeys at The Hebrew University of Jerusalem. They don't normally vaccinate their animals for measles, she says, but they have been considering whether or not to request special access to other options, such as the Canine Distemper-Measles vaccine, from government officials in Israel. While they wait for additional information about potential animal vaccines, they are taking extra precautions with the people who interact with the primates: anyone who didn't receive the full vaccination protocol (Israel only implemented a two-dose vaccination policy in the 1990s) or who has insufficient measles antibodies must be vaccinated, she says.



The measles virus. Credit: CDC/ Allison M. Maiuri

For the good of the herd

Whether animal vaccination is routine or not, prevention is key. Herd immunity is particularly important for nonhuman primates, just as it is for subsets of human populations who cannot be vaccinated, such as infants under 9 months of age. According to the World Health Organization (WHO), 90–95% vaccination of a population is considered the threshold for herd immunity against measles, but there are places where the rate is dropping. Across the river from Portland in Clark County, Washington, for example, rates have dropped to 78%, per the US Centers for Disease Control (CDC). Washington is one of 10 US states currently experiencing a measles outbreak according to the CDC as of February 2019. Measles cases throughout Europe are at record highs, and outbreaks are growing around the world after years of steady declines, according to WHO[4].

"The more people that are vaccinated, the less likely you're going to have a problem," says Timmel. The ONPRC addressed their policies a few years ago, he says, when they became aware of the growing number of people that were choosing not to vaccinate their children in the state. "We really changed our requirements for vaccination of staff," he says. Anyone working near the animals must vaccinated or show a positive titer against measles. In light of the recent outbreaks nearby, animal care staff as well as OHSU's Occupational Health and Safety Team and infectious disease specialists are considering if any additional steps might be taken to protect both their animals and their staff.

Proof of measles protection for human staff is routine at primate facilities, as is personal protective equipment like gowns, gloves, and facemasks. "The general consensus here is that we're covered," says Yee. "We had already put these precautions in place." Recent outbreaks of measles in California haven't prompted any additional considerations, but "it reinforces that it's important to do what we're doing and to make sure to periodically review our programs," she says.

"We need to really encourage everybody as much as possible to be vaccinating themselves and their kids," says Timmel. "That's protecting us as humans, and it's also protecting our research populations of nonhuman primates." ❐

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