Potential Sales of an Avian H5N1 Vaccine

Summary

This summarizes my conclusions. Documentation with links is presented in the sections below for those who want to explore further.

While many avian H5N1 vaccines are being developed for a human pandemic, sales of a vaccine to animal markets are large enough to represent a profit opportunity for companies. Why focus on companies? The profit motive is a strong incentive in capitalist societies such as the United States, and there are companies that may wish to acquire and market a vaccine.

We should vaccinate targeted wild bird and mammal populations to develop immunity in them against the deadly and highly contagious avian H5N1. The first populations targeted should be animals that tend to congregate in large groups--for instance, seals resting on sand at the water's edge, and Antarctic penguins. By vaccinating these large groups, we will at least rescue large numbers of birds and mammals from death. This won't solve the problem of deadly and highly contagious avian H5N1 spreading throughout the globe but would be valuable and straightforward to do. Vaccination could slow avian H5N1 transmission to other animals and perhaps to humans.

Many animals die or are sickened by the avian H5N1 virus as it spreads globally. Deaths of feral cats, stray dogs, wild mammals, wild birds, commercial poultry, backyard poultry, and hobbyist bird flocks are reason enough to pursue vaccination of animals.

The role of veterinarians

In business speak, the product is avian H5N1 vaccine. The sellers are vaccine developers or veterinarians that buy the vaccine from developers to be resold to animal owners who own companion animals.

Veterinarians are likely the best expert group to supply avian H5N1 vaccine. Sales to veterinarians are by far the biggest potential market. Only sales to U.S. veterinarians will be quantified here as the data are readily available. The dollar amount of these sales is large enough to get the attention of companies to develop and supply vaccine.

The data for U.S. veterinarians comes from The American Veterinary Medical Association. Total number of U.S. veterinarians is 127,131, with 82,704 in clinical practice. 70.4% of U.S. veterinarians have companion animal practices, so 0.704 x 82,704 = 58,224 have companion animal practices. I assume that most of these veterinarians almost exclusively have patients that are cats and dogs, only occasionally exotic animals.

A company's market analysis involves two sequential steps, first finding the potential dollar market for product sales and then finding how much of the potential market a company would expect to capture, which is called market penetration. This first step, finding potential market is usually easy, but finding market penetration usually requires a big effort. Market penetration includes how many potential customers will buy the product and at what price. And are there competitors? Determining all the

variables in market penetration is not so important here because it is common knowledge that avian H5N1 is a big problem.

Cats

From 15 Cat Statistics & Facts All Cat Lovers Should Know, there are approximately 82 million pet cats in the U.S. An estimated 60–100 million cats in the U.S. live on the street without a home. So, there are about as many feral cats as there are pet cats. Here we consider only pet cats, although community public-health authorities might want to vaccinate feral cats and other wild animals against avian H5N1 . This is called "upside market potential" that would be difficult to quantify.

About 63% of pet cats, never go outside for many reasons. These include safety, mental and physical health, exposure to parasites or disease, and depredation of wildlife. Thus, the number of cats that go outside are (1-0.63) x 82 million = 30.3 million cats, which is the vaccine potential market.

To convert this potential market to dollar vaccine sales:

> "Routine vaccines are priced around $33-$49 depending on the city you're in and the type of vaccine your cat needs…Most vaccination rates include the visit cost, so you shouldn't have to pay more just to see the veterinarian or technician."

Very conservatively, assume cats receive only rabies ($33) and distemper combination ($47) vaccines once every three years, so the yearly prices are $11 and $15.67. Thus, the yearly price of cat vaccines is $26.67. Expressing as yearly dollars is the standard way of reporting data. Multiplying the price per outdoor cat by the number of outdoor cats is ($11 + $15.67) x 33.3 million cats = $888 million. Assuming that the avian H5N1 vaccine will be about the same price, the yearly dollar potential market is nearly a billion dollars.

As shown below, cats are the only animal for which enough data is available to quantify the dollar size of the potential market very conservatively. The rest of the markets discussed here are categorized as "upside market potential."

Dogs

With 90 million dogs, the U.S. has the highest number of pet dogs. But regarding stray dogs, there is no easy answer: "There are more than 200 million stray dogs worldwide, according to the World Health Organization. The American Society for the Prevention of Cruelty to Animals estimates about 3.3 million dogs enter U.S. animal shelters every year." Some of these 3.3 million dogs in the U.S. are stray dogs, and some are surrendered by their owners.

Assuming that most dogs are off leash at least some of the time to run around and to play with other dogs. These dogs could be exposed to avian H5N1 infected dogs.

Are Dogs at Risk for Bird Flu? The short answer is yes. H5N1 can infect dogs.

> "As the virus replicates, its genes may develop errors or mutations, causing changes in the virus' surface proteins. It's common for viruses to mutate as they move between host animals. Some mutations result in the virus becoming more transmissible or better at evading the immune system's natural defenses. Dogs are at risk for bird flu because

> H5N1 is a pretty good mutator, Dr. Attas says. However, dogs are not one of the mammals that are overly represented in cases of bird flu. The virus can spread among wildlife and cows, but there are extremely sporadic reports of dogs getting infected. So, while it helps to be aware of infectious disease outbreaks, dog owners don't need to be overly alarmed since there are so few cases of bird flu in dogs and people. That said, whenever you're dealing with an influenza virus that can mutate, you wouldn't want to risk exposing a beloved pet."

While dogs may become infected with avian bird flu, not many do get infected. But from the point of view of veterinarians, it might be wise to vaccinate dogs in geographical areas where bird flu infections are widespread. But it would be difficult to quantify this, so again it will be categorized as upside market potential.

There are many species that are potentially susceptible to highly pathogenic avian influenza (HPAI). In addition to dogs, H5N1 viruses have been detected in many species of mammals (see Figure 1 in the "All mammals" section below). Infection may lead to illness, including severe disease and death in some cases.

All mammals

Figure 1 shows the number of mammals that have become infected with H5N1 since 2022 in different states. Points on the graph may represent multiple detections.

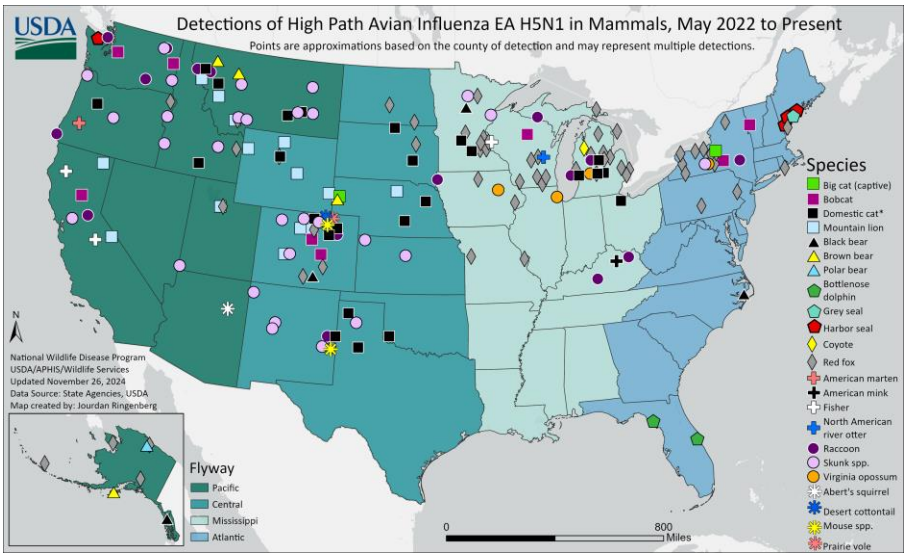

Figure 1. *Detections of Highly Pathogenic Avian Influenza in Mammals.*
Points are based on the county of detection and may represent multiple detections. Note that no infected dogs have been detected according to this map.

For commercial poultry facilities, backyard poultry and hobbyist bird flocks

https://www.cdc.gov/bird-flu/situation-summary/data-map-commercial.html#cdc_generic_section_1-summary

> Highly pathogenic avian influenza (HPAI) A(H5) viruses have been detected in U.S. wild aquatic birds, commercial poultry and backyard or hobbyist flocks beginning in January 2022. Preliminary genetic sequencing and RT-PCR testing on some virus specimens shows these viruses are HPAI A(H5N1) viruses from clade 2.3.4.4

These are the first detections of HPAI A(H5) viruses in the U.S. since 2016. There have been 111,176,176 birds affected in 49 states, that is, in all but one state. And within the states there are 547 counties affected with 1,238 reported outbreaks.

While it was possible to quantify the vaccine sales data for cats but categorized as "upside market potential" for vaccine are the other categories examined here that are dogs; several other mammal species; and commercial poultry facilities, backyard poultry and hobbyist bird flocks. Dollar potential market for H5N1 vaccine is so large that it is not an exaggeration for me to say that it outweighs by a considerable amount the estimated billion-dollar potential market for H5N1 vaccine for cats.

The reason for this long-winded discussion is to attract companies to what I believe is a business opportunity in procuring and marketing avian H5N1 vaccine. Of course, government organizations, NGOs, and other entities should be attracted to the large numbers of animals involved. Vaccination of animals against avian H5N1 may have several benefits, the most likely of which is slowing the spread of this deadly and contagious virus thus saving animals from death and slowing infections of humans. With a bit of luck, perhaps preventing a human pandemic by providing more time for the virus to mutate to a variation that is not fatal to humans. It has happened before.

> Before the year 2015, avian H5N1 killed nearly 60% of poultry workers and others who became infected through close contact with infected poultry. Fortunately, the virus was rarely transmissible among humans. From 2015 to 2020 avian H5N1 fatalities in humans had almost disappeared, since the strains from nature that appeared in poultry markets were no longer deadly to humans. They were, so to speak, "defanged." We thought we were finished with H5N1 avian flu virus. We thought we were in a good place.

Some avian H5N1 vaccine developers might not want their vaccine wasted on animals. I hope that I have convinced them that vaccinating animals may reduce the risk of a human pandemic.