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Pigs are big business in China, where many farms are being ravaged by African swine fever.

INFECTIOUS DISEASE

Spread of deadly pig virus in China hastens vaccine work

The virus is not harmful to humans, but pig culls are taking a huge economic toll.

BY SMRITI MALLAPATY

A highly contagious disease that kills infected pigs has swept across China and is moving through neighbouring countries. Scientists in China are ramping up efforts to study the virus that causes African swine fever, and produce a vaccine. But researchers elsewhere fear that political pressure to make a vaccine quickly could lead to unacceptable adverse reactions in some pigs.

Although the haemorrhagic disease was first recorded in Kenya in 1921, China's first case was detected only last August, in the northeastern city of Shenyang. Since then, the government has reported more than 120 outbreaks across some 30 provinces, autonomous regions and municipalities.

Officials had long feared the arrival of African swine fever in China, which is the world's largest pig producer. The virus is not harmful to humans, and virologists say the risk of it

mutating to become infectious to people is low, but the economic cost of an epidemic is huge.

With no vaccine or treatment, more than one million pigs have so far been culled in the country to try to contain the outbreaks. A study¹ published in October, two months after the virus was first detected there, reports that the death of some 100,000 pigs — just 10% of the latest figure — had cost the Chinese economy US\$20 million. A shortage of pigs could also jeopardize worldwide availability of ▶

► the blood-thinner heparin, warns Paulo Mourão, a molecular biologist at the Federal University of Rio de Janeiro in Brazil.

The drug's active ingredient is extracted from the mucous membrane of pig intestines, and used to treat heart attacks, among other things; China accounts for almost 80% of worldwide production². Swine fever “has the potential to cause an unprecedented shortage of heparin's raw material, which may jeopardize the global supply”, says Mourão.

The Chinese government says the outbreaks are under control, but some researchers are sceptical. There is little information about how the disease is spreading in China, or how effective the control measures have been, says Linda Dixon, a virologist at the Pirbright Institute, UK. She suspects that some cases might have gone undetected.

China has roughly 440 million pigs, and unofficial estimates of the proportion currently infected with the virus vary from 10% to 40%, says Dirk Pfeiffer, an epidemiologist at the City University of Hong Kong.

The government is prioritizing research on the virus, setting aside about 100 million yuan (US\$15 million) for projects, says George Gao, vice-president of the National Natural Science Foundation of China in Beijing.

The work will help to fill the many gaps in scientists' understanding of the virus, including its detailed structure and how it transmits to hosts and evades their immune systems. “We know almost nothing about this virus,” says Gao.

Before the outbreaks, researchers in China were banned from studying the live virus in case it escaped from a lab and infected pigs. Now that the infection has entered the country, scientists at the second-highest-level biosafety laboratories can study it in cells, and those at the most secure biosafety laboratory can work with it in animals, says Gao. “Within a couple of months, I expect to see Chinese scientists contributing a lot to the field.”

VACCINE DEVELOPMENT

The Harbin Veterinary Research Institute (HVRI), part of the Chinese Academy of Agricultural Sciences, is among the few institutions in the country with permission to handle the live virus in cell culture, and the only facility qualified to test the infection in pigs, which is essential for vaccine development, says Bu Zhigao, who heads the institute.

Researchers at the HVRI are investigating what, if any, natural immunity pigs have to swine fever, with a view to making drugs and developing new diagnostic techniques. But the priorities are learning how quickly the virus spreads and developing vaccines, says Zhigao, although he declined to comment on the details of the research.

At a symposium on swine fever in Beijing on 9 April, Pfeiffer says, HVRI scientists presented research on a potential vaccine that triggers an immune response using a less harmful strain of the pathogen — known as an attenuated vaccine — instead of an inactivated

strain. Attenuated vaccines tend to produce a stronger and longer-lasting immune response than inactive vaccines, says Dixon.

But Pfeiffer and Dixon are concerned about the intense political pressure in the country to come up with a vaccine quickly.

With live-attenuated vaccines, there is a risk that the microorganism could persist and spread through pigs, and cause unacceptable adverse reactions, Pfeiffer says. “It is a bit like playing with fire.”

One thing to monitor is whether a vaccine prevents replication of the deadly form of the virus in a host, notes Dixon. If it doesn't, vaccinated pigs, which might show no symptoms, could infect unvaccinated animals. A vaccine is probably still some years off, says Dixon.

Groups in China are also studying how the virus survives in the host. In February, researchers at the HVRI reported that a strain extracted from the spleen of an infected pig was extremely virulent, resulting in certain death, and efficient at passing from pig to pig³.

These results will help to improve measures to prevent and control the disease, says Zhigao, the HVRI paper's lead author. “We must control this disease, no matter how big a cost it is,” he says. ■

1. Bao, J. *et al.* *Transbound. Emerg. Dis.* <https://doi.org/10.1111/tbed.13124> (2019).
2. Vilanova, E., Tovar, A. M. F. & Mourão, P. A. S. *J. Thromb. Haemost.* **17**, 254–256 (2018).
3. Zhao, D. *et al.* *Emerg. Microbes Infect.* **8**, 438–447 (2019).

PUBLIC HEALTH

Malaria vaccine rolled out in Africa, but doubts linger

The RTS,S vaccine is up to 40% effective at preventing malaria in young children.

BY AMY MAXMEN

When health workers in Malawi began rolling out the first vaccine proven to protect against malaria, it was a moment 32 years — and more than US\$700 million — in the making.

The country began giving the vaccine, called RTS,S, to children under the age of two on 23 April. Ghana and Kenya will soon join in, as part of a large-scale pilot programme backed by the World Health Organization (WHO). The effort could immunize more than one million children by 2023 — a welcome boost in the fight against malaria, which kills an average of 1,200 people worldwide per day. The vast majority are children in Africa.

“We are excited and support this vaccine since there is nothing else,” says Michael Kayange, a programme manager at Malawi's National Malaria Control Programme in Lilongwe.

But the plan is not without controversy. The RTS,S vaccine prevents only 4 in 10 malaria cases, and must be given as 4 injections over 18 months. Some malaria researchers question the wisdom of spending time and money on the pilot programme, given that a handful of more effective vaccines are in clinical trials and could be available by the time RTS,S is ready for regular use. They say that the decades-long effort to roll out RTS,S exemplifies the plodding progress on vaccines for diseases that affect the world's poor, and highlights the need

for a more efficient path forward.

“We need to rethink this whole process,” says James Tibenderana, global technical director at the Malaria Consortium in London. “We can't expect pharma to spend another 30 years making a vaccine that will then be piloted for 3–4 years before people make their mind up about that result.”

Officials at GlaxoSmithKline (GSK), the London-based pharmaceutical firm that manufactures the vaccine, agree. “We are incredibly proud to see it rolled out,” says Thomas Breuer, the company's chief medical officer for vaccines. But, he adds, “This kind of endeavour can't be repeated, from GSK's point of view — we have to find other ways.”

When scientists at the Walter Reed