Nguyen-Viet says the team identified ten stalls selling wildlife, either wild or farmed, that could have carried the virus into the market from farms in southern China. Some wild animals sold for meat, such as rabbits and ferret-badgers, are susceptible to SARS-CoV-2.

WHO team member Peter Daszak, president of the non-profit research organization Ecohealth Alliance in New York City, says that the farms should be investigated to see whether there were infections in the animals or among workers. When the team interviewed the first person known to have COVID-19, he mentioned that his parents had visited a local community wet market, says Daszak.

Did frozen wild-animal meat have a role in the early spread of the virus?

The WHO team concluded that it's most likely the virus jumped from live animals to people, but Ben Embarek says it is possible that the virus entered the Huanan market through infected frozen wild animals from farms in southern China, and then sparked an outbreak.

Although researchers in China have isolated viral RNA from the packaging of imported frozen fish[4], Ben Embarek says the WHO team concluded that these goods were not likely to be the route of the virus's first arrival in Wuhan.

Lipkin says there is no evidence that the virus entered the market through infected frozen wild animals. It could have just as easily been brought in by infected people who had handled wild animals, he says.

Was the virus circulating in animals in China before the pandemic?

To establish which animal passed the virus to people, researchers need to find evidence of the virus in that species. Researchers in China tested some 30,000 wild, farmed and domestic animals in 2019 and 2020 but found no evidence of active or past SARS-CoV-2 infection, except in some cats in Wuhan in March 2020[5].

However, Ben Embarek says that these surveys were not representative of China's overall animal population, and that many more animals need to be tested for traces of infection, particularly on wildlife farms. "The amount of testing that's been done is not sufficient to say, in any way, that wildlife farms were not carrying the virus," says Daszak.

The explosive way in which the outbreak took off in Wuhan in December suggests that the virus was probably introduced once, through the wildlife trade, says Daszak. He says future testing should focus on farmed wild animals.

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Deducing which pandemic policies work best

Since the start of the COVID-19 pandemic, thousands of scientists and volunteers have been tracking the interventions that governments have adopted to curb viral spread — from closing restaurants to mandating face masks. They hope to deduce which policies are most effective. At a conference this month, scientists involved in 50 tracking databases discussed their efforts. Peter Klimek, a mathematical physicist at the Complexity Science Hub (CSH) Vienna and the Medical University of Vienna, who is involved in the CSH's tracking project, explains the challenge.

How much work has gone into these trackers?

In our tracker, more than 40 volunteers and scientists have been involved in assigning codes to more than 11,000 measures in 57 countries. Other efforts, such as the CoronaNet consortium and the government response tracker run by the University of Oxford, UK, each have hundreds of volunteers and researchers. Some tracking efforts have received funding, but most are struggling owing to a lack of money, and some have had to stop. It's also a challenge to keep volunteers motivated.

How have the trackers been used?

We advise the Austrian government on policy measures to contain the spread of coronavirus and avoid health-system overload. When we're asked questions, such as why some countries have much lower case numbers than others, the first places we look are the databases tracking government interventions. We still don't know what is the best way to plug the data from the tracking systems into mathematical models. But the trackers are a unique treasure trove that we can use to make epidemiological modelling a data-driven science and to prepare for the next pandemic.

What have they told us so far?

When many countries applied various control measures simultaneously, we knew very little about the effects of government interventions. When more data became available, we found that curfews, cancellations of small gatherings, and closures of schools, shops and restaurants were among the most effective policies (N. Haug *et al. Nature Human Behav.* **4**, 1303–1312; 2020).

But there is less agreement, when analysing different trackers, on how to rank these measures. For example, it is not certain that highly restrictive measures are automatically more effective than a smart mix of comparatively modest restrictions implemented with better timing.

Why is it hard to estimate the effects of interventions?

It is difficult to untangle the effects of any given measure from those of other policy interventions. There are many statistical approaches to disentangling relationships in complex systems, but none of them is perfect. And sociocultural factors can make social distancing more effective in one country than in another.

The effects of interventions also change over time. The situation has become more complicated as government interventions have become more diverse, and as people adhere less willingly to restrictions.

Why not combine the trackers?

Each tracker has its own perspectives. Some do integrate data from different databases, including one maintained by the World Health Organization. But this comes at the expense of some of the granularity that the original databases might have had. From the perspective of data quality and reproducibility of results, merging trackers into a super-database isn't a good idea.

How might this sort of work change in the future?

There is growing societal and political pressure to understand hypothetical scenarios: how not having implemented a certain measure might have changed the course of the pandemic. For example, was it really necessary to close schools? Or will the social and economic costs turn out to have outweighed the health-related benefits? Without reliable tracker data, there will be no solid evidence to answer such questions.

Interview by Quirin Schiermeier
This interview has been edited for length and clarity.