Study finds Wuhan market as likely origin of COVID-19 pandemic

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Robert Garry, professor of microbiology and immunology at Tulane University School of Medicine, explains how a team of leading virologists traced the origins of COVID-19. Video by Roman Vaulin.

The global COVID-19 pandemic likely started in the Huanan Seafood Wholesale Market in Wuhan, China, according to a new study that looks at the distribution of the earliest known cases of SARS-CoV-2.

The study was published simultaneously in the journal *Science* along with a genetic analysis that finds the virus likely jumped from host animals to people twice before sparking the pandemic. Tulane University virologist Robert Garry is a co-author on both studies along with several of the world's leading scientists that investigate the origins of outbreaks.

“This is the largest in-depth study of the origin of SARS-CoV-2 that we've been able to do yet,” said Garry, professor of microbiology and immunology at Tulane University School of Medicine. “This gives us a very granular, very detailed idea about those early days…basically December of 2019, where we can actually pinpoint the location of where this virus emerged into the human population.”

Using data from the World Health Organization and China, the team examined the first 174 cases in the Hubei province in December 2019. They mapped out proximity to the market for 155 of the cases where they had information about where the first patients lived.

“We actually found that most of those early cases were clustered very tightly around the market,” Garry said. “Wuhan is a very large city. It's got 10 million people. That's bigger than New York City. And the area we're looking at is a very tiny area about the size of a football field, in that very large city where most of those cases were clustered.”

One of the key findings in the study is that early COVID-19 patients who were “unlinked” to the market — meaning they didn’t work there, didn’t know someone who worked there and had not recently visited there — lived closer to the market than patients with a direct link to the market. Researchers suspect that these patients were exposed as the outbreak migrated into the surrounding neighborhood.

Health officials collected samples from animal cages, vendor stalls and other surface areas throughout the market and performed PCR testing on the samples. Using this information along with images from Google Maps and other sources, researchers created a detailed map of where the virus was found throughout the market. Spatial analysis showed that SARS-CoV-2-positive environmental samples were associated with the southwest corner of the market, which is the same section where vendors were selling live mammals, including red foxes, raccoon dogs and other species known to be susceptible to SARS-related coronaviruses.

“We don't know precisely which animal it was,” Garry said. “There were several animals that we know can be infected pretty efficiently with SARS-CoV-2 and that, in the wild, they could have picked up this infection. Then they were caught and brought to the market to be sold.”

The study was led by University of Arizona virus evolution expert Michael Worobey and Kristian Andersen at Scripps Research Institute in San Diego, California.

The second study examined how the virus emerged into the human population from two distinct lineages. The first lineage was closer to the original SARS viruses circulating in bats. It likely then jumped over to another animal host and then ultimately infected humans. However, the study showed that the second SARS strain emerged in people first and both were likely circulating in animals at the market.

That study was co-led by Jonathan Pekar and Joel Wertheim at the University of California, San Diego and Marc Suchard of the University of California Los Angeles.

To reduce the risk of future pandemics, it is crucial to understand how these viruses evolved and made the leap from animals to people, Garry said.

“We need to identify those pathways and figure out how we can regulate them better, so that we don't have pandemics like SARS-CoV-2 happening every decade or so,” Garry said.