Pandemic could mark ‘turning point’ for Chinese science

Despite missteps and government control, early findings guided other countries’ fight against the coronavirus

By Dennis Normile, in Wuhan, China

On 2 January 2020, a group of clinician-researchers at the Jinyintan Hospital here, along with colleagues at other institutions, launched a study of 41 patients suffering from a new, atypical pneumonia. The team assembled clinical data, laboratory results, and chest x-rays; tracked the production of immune system molecules called cytokines; and noted the use of antivirals, antibiotics, and corticosteroids. Thirteen of the patients required intensive care, and six died.

The group’s observations, published online by The Lancet on 24 January 2020, were the first dispatch from the clinical front lines of the COVID-19 pandemic and gave clinicians around the world a detailed picture of what to brace for as the virus, then called 2019-nCoV, began to race across the globe. The paper also contained a clear warning: “We are concerned that 2019-nCoV could have acquired the ability for efficient human transmission,” Chaolin Huang, a Jinyintan medical doctor, and colleagues wrote. They “strongly recommended” that health care workers use personal protective equipment.

China’s initial handling of the pandemic, and the way it has shared information, has come under intense criticism. The government only reported the discovery of a novel coronavirus after The Wall Street Journal broke the news. It punished Chinese doctors who spoke out about the disease’s early spread and a researcher who published the first sequence of the virus. It took until 20 January for China to confirm the potential for human-to-human transmission, which had been clear for weeks, and the country still strictly controls how scientists speak with media.

Yet at the pandemic’s first anniversary, Chinese scientists can boast that they made major contributions to the science of SARS-CoV-2, as the virus was christened in February 2020, and taught the world vital lessons about how the outbreak might be contained.

The 10 most cited COVID-19 papers of the first 6 months of 2020, based on data from Elsevier’s Scopus database, all came from China, according to an August study in Scientometrics by Jaime Teixeira da Silva, a Japan-based independent researcher, and colleagues. The Lancet paper topped the list. That’s a sharp contrast to what happened during the global outbreak of severe acute respiratory syndrome (SARS) in 2003, when researchers here made few contributions. For SARS, “China’s scientists were not so well prepared,” says Wang Weibing, an epidemiologist at Fudan University. “This time was different.”

Early on, the National Natural Science Foundation of China (NSFC) awarded more than 200 million yuan ($31 million) to some 100 projects under two rapid call programs. China has dragged its feet in some areas—most notably the origins of the virus, a politically explosive issue subject to conspiracy theories both in China and abroad. And research slowed down after March, for a happy reason: China ran out of cases.

Still, the response overall is a testament to China’s rapid scientific development, says Edward Holmes, a virologist and evolutionary biologist at the University of Sydney who with Chinese colleagues published the first genome of the virus on 10 January 2020. “COVID-19 is perhaps a turning point for Chinese science: the point when their work really had global reach and they saw the value of sharing,” Holmes says.

Much of the initial data came from Wuhan, by far the hardest hit city. Researchers at Huazhong University of Science and Technology published well over 400 COVID-19 articles and reviews from January through June. The bulk came from the university’s Tongji Medical College, home to four authors of the Lancet paper, and its large clinical network. The studies covered clinical observations and outcomes, epidemiology, convalescent plasma therapy, blood glucose control for COVID-19 patients with diabetes, and the use of statins to reduce mortality. “Our doctors and nurses worked at the front line fighting against the epidemic,” says Chen Jian-Guo, a pharmacologist and dean of the college, but they also felt a responsibility “to share their experiences and treatment plans with colleagues.”

Existing international ties proved helpful. Tongji’s Chaolong Wang teamed up with Xi-hong Lin, a biostatistician at Harvard University’s T.H. Chan School of Public Health, where Wang had done a postdoc from 2012 to 2014. With others, they detailed how Wuhan’s increasingly strict countermeasures—sealing the city, halting local travel, and quarantines—affected the course of the outbreak. They posted a paper on the impact of such “non-pharmaceutical interventions” on medRxiv on 6 March, in hopes “that our findings and experience could help other countries tailor their intervention strategies,” Chaolong Wang now says.

A report released 1 week earlier by a joint mission of WHO and China had confirmed that countermeasures adopted in Wuhan and throughout the country were on the cusp of stopping the virus in its tracks—a feat many outside China found hard to believe. But the report presented epidemiological evidence for the cutover.
logic curves showing new cases peaked in late January and rapidly tapered off after isolation of cases, quarantining of contacts, and harsh lockdowns in several cities. “We in New Zealand learnt that this pandemic virus could be successfully controlled,” says Nick Wilson, a public health scientist at the University of Otago. Despite political tensions, China and the United States collaborated more frequently on COVID-19–related papers than they had on papers in general in the previous 5 years, Jenny Lee and John Haupt of the University of Arizona reported in The Journal of Higher Education in November. “For scientists, advancing knowledge and improving the human condition, in this case, overcoming COVID-19, appears to be the greater goal,” Lee says. A Chinese property development company bankrolled a $115 million COVID-19 research collaboration between researchers in Boston and China.

Yet China’s remarkable success at taming its outbreak meant the focus of research there began to shift after a few months. “There are almost no cases, so it’s very difficult for us to start a good cohort study,” says Zhang Wenhong, an infectious disease specialist at Fudan University’s Huashan Hospital.

Now, Zhang and others are trying to understand why COVID-19 has such a disproportional impact on the elderly and how long immunity, triggered by either natural infection or vaccination, lasts. Several groups are looking at the psychological impact of infection and the lockdown. Other studies focus on the long-term consequences of infection. Huang co-authored a study published online by The Lancet last week on the health status of 1733 COVID-19 patients discharged from Wuhan’s Jinyintan Hospital between January and May 2020. Fatigue or muscle weakness affected 63% of the former patients; 26% had sleep difficulties, and 23% suffered from anxiety or depression.

Research on the origins of the virus and how it crossed into the human population has lagged, however. Early widespread speculation on social media both within and beyond China claimed the virus escaped from a laboratory, with the Chinese Academy of Sciences’s Wuhan Institute of Virology (WIV) being the prime suspect, a notion that U.S. President Donald Trump and some other Western politicians have repeated. China, for its part, is claiming the virus originated elsewhere and was brought here by visiting U.S. servicemen or on frozen food shipments. The scientific consensus is that the virus probably evolved in nature, possibly from a bat-borne virus. Shi Zhengli, a WIV virologist who has collected more than 2000 viral genetic sequence samples from bats in the wild, told Science in July that many groups in China are trying to pin down the origin of the virus (Science, 31 July 2020, p. 487). But few data have been released. And China has waffled on letting members of a long-awaited joint WHO-Chinese mission enter the country. As Science went to press, the mission was scheduled to begin on 14 January.

China expects to have a major impact this year with its vaccines, which were the first to work in monkey experiments and to enter human trials. Because the country has so few cases, they are being tested in more than a dozen countries in Central and South America, Southeast Asia, and the Middle East. On 30 December 2020, an affiliate of pharma giant Sinopharm said a phase III trial had shown its vaccine to have a 70% efficacy, although details are scant. China’s drug regulator granted conditional marketing authorization the next day and Beijing initiated mass inoculation of priority groups on 1 January.

The United Arab Emirates and Bahrain had already approved the use of the vaccine earlier in December, based on studies in those countries, and Indonesia authorized the emergency use of another Chinese vaccine, produced by Sinovac Biotech, on 11 January. Both vaccines are based on inactivating the entire virus, a classic approach not used for leading candidate vaccines in the West. China plans to offer millions of doses to developing countries at a “fair and reasonable” price in what some are calling “vaccine diplomacy” (Science, 11 December 2020, p. 1263).

The pandemic has also highlighted opportunities for strengthening China’s public health research. In particular, disease modeling needs an upgrade, Wang Weihong says. China’s modeling groups are made up of a few people, in contrast to the dozens on teams overseas. And the country has no undergraduate-level training in disease modeling. Another slug of funding for COVID-19 research is on its way through NSFC. And after demonstrating that “they are committed and talented team members of the international scientific community,” Lin says, China’s researchers seem unlikely to give up the momentum of the past year.

### Ground zero for science


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Q: When you look at how vaccination is being marketed now, what do you see?
A: I see public health officials approaching it in a very straightforward way that says, “All we need to do is educate people about why this is a good idea.” But there’s more nuance to the hesitancy than we realize. Someone says, “Hey, I know how pharmaceutical products are developed and tested, this went way too fast.” Another person says, “You know, science is not the answer, we trust too much in science.” So the communications towards these different groups have to be well targeted.

Q: How does a provider do that?
A: People are more compelled by stories than they are by statistics. If your patient says to you, “Hey, the lady down the street from me said her niece had a bad reaction. I’m the same age as her niece. I’m really worried about this.” It’s important not to say, “Well, let me show you a chart that will explain exactly how rare this is.” It’s more important to say, “I have a patient exactly your age who was in here last week, and they were one of the first people to get the vaccine, and they did great.”

Q: Some people have a really big megaphone, like Anthony Fauci. What would you tell him?
A: People don’t like to be lumped in with the average. You may say the average person is going to have no reaction. Well, how dare you imply I’m an average person, I am very special. I can see very clearly that someone who’s unlike Dr. Fauci by age, or people of color, might say, “Well, look, that may be true for you, but for people in my situation...” He needs a couple of Fauci surrogates who meet these other communities a little closer.

Q: You suggest a visible marker that you’ve been vaccinated, like a Livestrong bracelet.
A: The gist of the strategy is that it’s a visible sign of in-group/out-group. That’s one that works really well for people who are in the “probables”: I probably will get it or I probably won’t. I don’t know if observables would ever change someone who’s in the hardcore “definitely, no.”
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