CHINA'S COVID VACCINE SHOWS MILITARY'S ROLE IN MEDICAL RESEARCH

The People's Liberation Army is investing in medical research as part of a modernization strategy.

By Dyani Lewis

The largest armed force in the world, China's People's Liberation Army (PLA), is not known for its cutting-edge medical research. But since 2015, it has ramped up recruitment of scientists and investment in the field as part of its strategy to modernize its military. Now, the coronavirus pandemic is showcasing the PLA's growing expertise in medical research, indicated, among other things, by its major role in developing the coronavirus vaccine that was the first in the world to be approved for restricted use.

"China is definitely trying to leverage the crisis from a PR perspective," says Abigail Coplin, who studies China's biotechnology industry at Vassar College in Poughkeepsie, New York.

Medical researcher Major General Chen Wei at the Beijing Institute of Biotechnology — part of the Academy of Military Medical Sciences — led the team that developed the vaccine, which included collaborators from government agencies, universities and the Tianjin-based pharmaceutical company CanSino Biologics.

In July, the team became one of the first in the world to publish results in a peer-reviewed journal that showed a coronavirus vaccine to be safe and capable of eliciting an immune response (F.-C. Zhu *et al. Lancet* **396**, 479–488; 2020). By then, the Chinese government had already approved the vaccine, called Ad5-nCoV, for limited use in military personnel, before large-scale testing to prove its efficacy. Chen and members of her team were among the first — of thousands in the military so far — to receive the vaccine. She and the Beijing Institute of Biotechnology did not respond to *Nature*'s request for comment about the vaccine work.

Should the vaccine win approval for more widespread use before efforts backed by other countries, especially the United States, "it will be a pretty big propaganda victory" for Beijing, says Adam Ni, a China analyst at the Australian National University in Canberra.

As well as its contributions to the development of a coronavirus vaccine, the PLA has also taken a high-profile role in controlling the pandemic in China, has sent assistance with pandemic response to a host of countries and has used the vaccine to forge new links abroad.

Other militaries, including that of the United States, work on vaccines and conduct medical research. But the sheer size of the PLA and the speed at which reforms are taking place make its scientific transformation noteworthy and, for some, a cause for concern, especially given the growing political tensions between the United States and China, Ni says.

In the past few months, US security officials have revealed that China has tried to spy on and steal information from US pharmaceutical companies and university research groups working on coronavirus vaccines. Scientists have also raised concerns about the ethics of approving military use of a vaccine that is still being trialled.

Science a priority

In 2015, Chinese President Xi Jinping announced reforms that made science and innovation key elements of modernizing its armed forces, says Elsa Kania, who analyses Chinese military strategy at the Center for a New American Security in Washington DC.

The PLA established branches for electronic, cyber and space warfare alongside its more conventional army, navy and air force. And in 2016, a Science and Technology Commission, which decides what research is funded, became one of 15 newly formed military 'sections'. "It's gone from a fairly backward military in the 70s and 80s — large but certainly not professional and not technologically advanced — to a much more formidable military," says Ni.

The reforms also brought the Academy of Military Medical Sciences — which helped develop the Ad5-nCoV vaccine — under the umbrella of the Academy of Military Sciences, the PLA's main military strategy body, which oversees nine other research institutions.

Before the reforms, the PLA recruited scientists either internally or from military universities, partly because civilian scientists didn't find research positions in the military attractive, says Ni. Working conditions were less flexible than in civilian institutions, he says.

But since 2018, the PLA has been recruiting more civilian-trained scientists,making research positions more appealing — and has upped its recruitment of medical scientists.

The Academy of Military Medical Sciences has recruited 213 civilians for scientific research positions since 2018, making it the second-highest recruiter of scientific talent among the Academy of Military Science's 10 research institutions, according to an analysis posted online by Kai Lin Tay at the International Institute for Strategic Studies in London.

The military is also increasing its ties to civilian universities in China, as part of a policy known as military–civil fusion, which the Chinese government also announced in 2015. The strategy highlights biology as a priority research area. The PLA has also been bolstering its scientific expertise by sending researchers abroad.

CHINE NOUVELLE/SIPA/SHUTTERSTOCK

The People's Liberation Army has been central to China's ability to control the coronavirus.

And partnerships between the PLA and the medical-science companies have accelerated since the pandemic, according to Tay's report. As well as collaborating with CanSino Biologics to develop the Ad5-nCoV vaccine, the PLA has worked with Beijing Chieftain, which makes medical equipment, since March.

The pandemic has provided China with an opportunity to highlight its military's scientific achievements on the domestic and international stage. PLA epidemiologists and medical workers have had an important role in treating the sick, monitoring the outbreak and overseeing distribution of medical supplies in Wuhan. The military has also assisted with the pandemic responses in Pakistan, Iran, Iraq, Lebanon, Vietnam, Laos, Myanmar, Cambodia and Italy, by deploying units and supplies.

The PLA-developed vaccine could give China additional geopolitical influence, with favoured countries being given priority access to the vaccine, says Ian McCaslin, a China military analyst affiliated with Air University's China Aerospace Studies Institute in Washington DC. CanSino Biologics already has agreements to conduct phase III trials in Russia, Mexico, Saudi Arabia and Pakistan.

Because analysts who study the Chinese military have not previously focused on the medical research conducted by the PLA, its true impact remains unknown, says Kania. "We're still trying to get a handle on how to understand the scope and scale of their activities, as well as the quality and competitiveness of their research," she says.

Some research is similar to that conducted by other military forces. The US military, for instance, is developing its own coronavirus vaccine and conducts basic research into trauma and infectious diseases.

It's important to bear in mind that the PLA's scientific efforts represent only "a small minority of work being done in biotechnology, both within China and globally", adds Coplin.

Still, some China experts and foreign governments are concerned about the participation of PLA researchers in medical research.

In July, the US Justice Department indicted two Chinese nationals for spying on three US-based entities involved in medical research to fight the coronavirus. "Tech transfer is clearly a policy and priority of the Chinese government at the highest levels and has involved fairly egregious instances of hacking, for purposes of data theft," says Kania.

Scientists are also concerned about China's lack of safeguards to ensure that research on people is conducted ethically, says Kania. It is unclear whether military personnel were given a choice about whether to receive the PLA-backed coronavirus vaccine, she says.

These are legitimate concerns, says Coplin, but she cautions the United States against using them as a reason to stymie otherwise productive collaborations with China.

L. BRIAN STAUFFER/UNIV. ILLINOIS

Q&A

'We didn't model that people would go to a party if they tested positive'

As universities around the globe struggle with how to keep their doors open amid the COVID-19 pandemic, some have developed their own rapid coronavirus diagnostics to test students multiple times per week. The University of Illinois at Urbana–Champaign (UIUC) has a mass testing programme that has been touted as a model system. But the institute saw a spike in infections last month — on 31 August, it reported a 291% increase over the daily total a week earlier. Martin Burke (pictured), a chemist at UIUC who helped to develop the university's RNA-based saliva test, spoke to *Nature* about the lessons learned.

How did you get involved in developing this test?
At the end of April, UIUC provost Andreas Cangellaris called me and asked if I would lead a team to build up and deploy scalable testing as part of our campus's effort to reopen as safely as possible. We decided to take a comprehensive approach: we got a lot of data scientists to help us figure out how to model the epidemic on campus. We realized that we would need to test everybody on campus twice a week. Over the course of about six weeks, we discovered that we could use saliva samples and cut out almost all the bottlenecks associated with standard COVID-19 tests. We're now doing more than 10,000 — sometimes 15,000 — tests per day.

What's innovative about the test compared with standard RNA-based tests?
Three things. We use saliva instead of a nasal swab. We skip RNA isolation, which saves a very expensive and slow step. And as soon as the sample tube comes into the lab, it gets heated in a water bath at 95 °C for 30 minutes, which inactivates the virus and protects the workers, but also breaks the virus open and exposes its RNA.

Walk us through what happens when people take the test on campus.
You swipe your ID card, and walk into a big open-air tent over to a square that's 6 feet [2 metres] apart from all the other squares, and you just dribble into a tube. You put the tube in a rack, and once the rack is filled, [workers] seal it up and drive it on a golf cart down to the lab, where it gets straight into the water bath. The test itself takes 90 minutes; the results come back in less than 24 hours. The data go straight to an app on your phone. To get into any building, you have to scan your data to show that you are compliant with testing twice a week.

UIUC reported a spike in campus infections last month. What happened?
When we put the whole programme in place, we did a bunch of modelling to try to understand how student socialization was going to integrate with the fast, recurrent testing. We modelled that they were going to go to parties and that they probably weren't going to wear masks, and it would lead to some level of transmission. What we didn't model for is that people would choose to go to a party if they knew that they were positive. The overwhelming majority of our students have done a great job, but unfortunately, a small number of students chose to make very bad decisions.

Does this call into question the idea that mass testing can keep campuses safe?
The answer is definitely no. We caught this early, we made changes, and now we're watching our numbers fall. [On 8 September, UIUC reported a total of 81 new COVID-19 infections in one day, a 65% decrease since the spike.]

What protocol changes did UIUC make?
People who made those bad choices have been suspended. We've started testing more frequently [in the fraternity houses and dormitories] where there were problems. Because some of the students were avoiding phone calls from public-health authorities, we built our own internal team, whose goal is to get everyone [who tests positive] safely isolated within 30 minutes.

What lessons have you learnt?
It's not just a matter of getting the test done fast; it's a matter of acting on the results as fast as possible.

Interview by Giorgia Guglielmi
This interview has been edited for length and clarity.