Testimony

From SARS to 2019-Coronavirus (nCoV): U.S.-China Collaborations on Pandemic Response

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The RAND Corporation[2]

Before the Committee on Foreign Affairs
Subcommittee on Asia, the Pacific, and Nonproliferation
United States House of Representatives

February 5, 2020

Chairman Bera, Ranking Member Yoho, and members of the subcommittee, thank you for inviting me to testify about U.S.-China collaboration on pandemic response, especially in light of the recent novel coronavirus outbreak. First, I will describe the 2002–2003 outbreak of severe acute respiratory syndrome (SARS) and the global response. Next, I will discuss U.S.-China collaboration from 2003–2012, followed by developments in the years prior to the current coronavirus outbreak. Lastly, I will analyze the characteristics of 2019-nCoV and China's early responses, and offer policy recommendations.

2002–2003: SARS

Almost 17 years ago, a novel coronavirus was silently causing deadly pneumonia outbreaks—which later became known as SARS—in China. The index case of the SARS outbreak occurred in the city of Foshan in Guangdong Province, China, on November 16, 2002. Neither this case nor a few other cases in December attracted any notice from the public. A public health expert team from the province, which included a few representatives from the national Ministry of Health, went to one of the cities in Guangdong province in January 2003 to investigate. The team concluded that the atypical pneumonia diagnoses were probably caused by a virus. The team then suggested in a "top-secret" report that the provincial health bureau should establish a case-reporting system. This reasonable—although rather feeble—suggestion was expressed in a news bulletin for local health care professionals but fell on deaf ears during the Chinese New Year. The world did not find out for another two months that this was severe acute

[1] The opinions and conclusions expressed in this testimony are the author's alone and should not be interpreted as representing those of the RAND Corporation or any of the sponsors of its research.

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respiratory syndrome (SARS), a viral pneumonia that would infect more than 8,000 people globally and lead to 774 deaths.

At that time, China lacked a national center for disease control, which would have been responsible for maintaining a robust surveillance system for detecting emerging diseases. It also lacked a national case-reporting system. In addition, according to the *Implementing Regulations of the Law of the People's Republic of China on Guarding State Secrets* regarding the handling of public health-related information, any occurrence of infectious disease should be classified as a state secret before it is "announced by the Ministry of Health."[3] No physician or journalist can alert the public without breaking the law. With no information from government or media, the Chinese public was unaware of the outbreak until cell phone messages about a "deadly flu" started to circulate in early February 2003 in Guangzhou. A widespread panic caused residents to clear out antibiotics and flu medicines in pharmacies. Prompted by the public panic, the Guangdong health officials finally held a press conference on February 11 to announce the 305 atypical pneumonia cases in the province. China submitted the case report to the World Health Organization (WHO) as *atypical pneumonia*, probably caused by chlamydia or a virus around the same time. Afterward, information about the disease was reported on the news media, but the flow of information stopped on February 23. The news blackout from February 23 continued during the run-up to the National People's Congress in March, and the government shared little with the public until early April.[4]

Meanwhile, a "super-spreading" chain of transmission emerged at the end of the January and lasted until March, causing international attention on the outbreak: A patient with pneumonia in Guangdong was transferred between three different hospitals, ultimately infecting 200 people, including a doctor from Zhongshan Hospital. The doctor traveled to Hong Kong and infected 12 people in a hotel, and these 12 people then carried the virus to Singapore, Vietnam, Canada, Ireland, and the United States.[5]

By mid-March 2003, SARS clusters started to appear in Vietnam, Hong Kong, Singapore, and Canada. The WHO subsequently picked up the alerts from the Global Outbreak Alert and Response Network (GOARN) and issued a global alert about a new infectious disease of unknown origin. Between March 16 and March 21, the WHO started to suspect that the more than 300 cases from February—which China had labeled "atypical pneumonia" in its report—were actually SARS cases. At China's request, the WHO sent a team to China on March 23. On March 27, the WHO team concluded that the "atypical pneumonia" cases were same as SARS, and China announced 792 cases and 31 deaths.[6] Under intense international pressure to mobilize against the pandemic threat, the Chinese government publicly acknowledged the SARS outbreak

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[3] Yanzhong Huang, "The SARS Epidemic and Its Aftermath in China: A Political Perspective," in Stacey Knobler, Adel Mahmoud, Stanley Lemon, Alison Mack, Laura Sivitz, and Katherine Oberholtzer, eds., *Learning from SARS: Preparing for the Next Disease Outbreak: Workshop Summary*, Washington, D.C.: The National Academies Press, 2004

[4] Huang, 2004 ibid

[5] Institute of Medicine, "Summary and Assessment," in Stacey Knobler, Adel Mahmoud, Stanley Lemon, Alison Mack, Laura Sivitz, and Katherine Oberholtzer, eds., *Learning from SARS: Preparing for the Next Disease Outbreak: Workshop Summary*, Washington, D.C.: The National Academies Press, 2004.

[6] World Health Organization, "Severe Acute Respiratory Syndrome (SARS) Multi-Country Outbreak – Update 10: Disease Outbreak Reported," news alert, March 26, 2003. As of February 3, 2020: https://www.who.int/csr/don/2003_03_26/en/

at the end of March and undertook a series of responsive actions in the following weeks, including

- establishment of new rules requiring all local health officials to report the number of cases daily, with severe penalties for noncompliance
- streamlining of interdepartmental communication and cooperation on the crisis
- creation of national and provincial interdepartmental SARS task forces
- dedication of over $1 billion to treating the patients and controlling the epidemic.[7]

In late April 2003, China's health minister and Beijing's mayor were fired one day after the Chinese Premier announced severe consequences for local officials who failed to report SARS cases in a timely and accurate manner. (That same day, the number of cases in Beijing jumped from 37 to 407.) By the end of May, more than 1,000 officials were fired or penalized for their "slack" responses to SARS.[8] The remaining officials, driven by political zeal, began to seal off villages, apartment complexes, and university campuses; quarantined tens of thousands of people; and set up checkpoints to take temperatures. A new hospital was built within 20 days in Beijing to accommodate and quarantine SARS patients. The epidemic started to subside in late May. By June 27, the WHO announced that China was "SARS-free." On August 16, the last two SARS patients were discharged from a Beijing hospital.

SARS revealed the state of China's unprepared public health system. It led the country to significantly rethink its approach to both domestic and global health. The government soon invested 6.8 billion renminbi (RMB) (850 million U.S. dollars [USD]) for the construction of a three-tiered network of disease control and prevention. The outbreak also spurred China to strengthen its relationships with the United States and the wider international community around issues of public health concerns. The change in China was welcomed and enthusiastically supported by governments and scientists around the world.

2003–2013: U.S.-China Collaborations and China's Public Health Restructuring and Capacity-Building

Increased U.S.-China collaboration on global health was an important result of the SARS response. In October 2003, three months after the conclusion of the SARS pandemic, U.S. Secretary of Health and Human Services Tommy Thompson visited China and signed a multiyear partnership with the Chinese Ministry of Health to develop a more robust public health infrastructure in China. Thompson also established an HHS health attaché at the U.S. embassy in Beijing. The following month, U.S. Secretary of State Colin Powell noted that

> It is upon such concrete forms of cooperation on issues of regional and global importance that a 21st century U.S.-China relationship will be built, issue by issue, experience by experience, challenge by challenge, initiative by initiative, program by program.[9]

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[7] Yanzhong Huang, "The SARS Epidemic and Its Aftermath in China: A Political Perspective," in Stacey Knobler, Adel Mahmoud, Stanley Lemon, Alison Mack, Laura Sivitz, and Katherine Oberholtzer, eds., *Learning from SARS: Preparing for the Next Disease Outbreak: Workshop Summary*, Washington, D.C.: The National Academies Press, 2004.

[8] Huang, 2004.

[9] Colin L. Powell, "Remarks at Conference on China-U.S. Relations," College Station, Tex., November 5, 2003.

H5N1: 2003–2009

Not long after the SARS pandemic, China and the international community confronted another complex challenge with the H5N1 influenza virus—commonly known as "avian flu" or "bird flu" because it infects and spreads largely through birds. Cases of bird-to-human transmission were discovered in Fujian Province in 2003. In 2004, the Chinese National Influenza Center and the U.S. Centers for Disease Control and Prevention (CDC) initiated cooperative agreements to build Chinese capacity in influenza surveillance. The two agencies collaborated on 1) developing technical expertise in virology and epidemiology in China; 2) developing a comprehensive influenza surveillance system by enhancing influenza-like illness reporting; 3) strengthening analysis, utilization, and dissemination of surveillance data; and 4) improving early response to influenza viruses with pandemic potential. In 2005, both governments inaugurated the Collaborative Program on Emerging and Re-emerging Infectious Diseases, which turned into the CDC's China Center. That same year, both countries established the U.S.-China Health Care Forum to address bilateral commercial, trade, and policy issues relating to health. Additionally, U.S. President George W. Bush announced the International Partnership on Avian and Pandemic Influenza—an ongoing framework for U.S.-China cooperation around the issue—in an address to the United Nations (UN).[10] In 2006, the U.S. Department of Health and Human Services (HHS) and China's Ministry of Health (MOH) further expanded their collaboration on biomedical research with a memorandum of understanding on research, technology, training, and personnel exchange.

H1N1: 2009

The capacity-building and infrastructure put into place to monitor the continuing threat from avian flu served China and the United States well when another novel influenza strain—H1N1, commonly known as "swine flu"—emerged in 2009. The epicenter was in the United States and Mexico, but the flu soon spread across the globe. American and Chinese health authorities shared information and technology to facilitate national monitoring of H1N1's spread and to develop a vaccine; China subsequently became the first country to mass-produce an H1N1 vaccine. During the summer lull in the 2009 pandemic, the two countries strengthened their bilateral health communications through the U.S.-China Strategic Economic Dialogue. As then–U.S. President Barack Obama visited China in November 2009 in the midst of the H1N1 outbreak, the two countries addressed global public health in a joint statement, pledging to "deepen cooperation on global public health issues, including Influenza A (H1N1) prevention, surveillance, reporting and control, and on avian influenza, HIV/AIDS, tuberculosis, and malaria."[11]

China's National Influenza Center Expansion: 2010–2014

From 2010 to 2014, China expanded the Chinese National Influenza Center (CNIC) to include 408 laboratories and 554 sentinel hospitals, and it trained 2,500 public health staff. CNIC became the fifth WHO Collaborating Centre for Reference and Research on Influenza. CNIC

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[10] George W. Bush, statement delivered to the 2005 World Summit of the United Nations, High Level Plenary Meeting, New York, September 14, 2005. As of February 3, 2020: http://www.un.org/webcast/summit2005/statements/usa050914.pdf

[11] The White House, Office of the Press Secretary, "U.S.-China Joint Statement," statement by U.S. President Barack Obama and Chinese President Hu Jintao, November 17, 2009. As of February 3, 2020: https://obamawhitehouse.archives.gov/realitycheck/the-press-office/us-china-joint-statement

established viral drug resistance surveillance and platforms for gene sequencing, reverse genetics, serological detection, and development of vaccine strains. CNIC also built a bioinformatics platform to strengthen data analysis, publishing weekly online influenza surveillance reports in English and Chinese. The surveillance system now collects between 200,000 and 400,000 specimens and tests more than 20,000 influenza viruses annually, which provide valuable information for WHO influenza vaccine strain recommendations. CNIC now provides training for other countries to improve global capacity for influenza control.[12]

H7N9: 2013

CNIC was fully functional when another novel strain of avian influenza, H7N9, emerged in eastern China in 2013. This form of avian influenza has a high fatality rate, of 30 percent (similar to Middle East Respiratory System [MERS]), but human-to-human transmission proved extremely rare, allowing the outbreak to remain in check with effective public health measures. This time, China quickly reported the new viral strain to the WHO after only three cases were detected, and it also posted the full viral genome sequences of these cases in a public international database to facilitate research around the world. The outbreak plateaued in June at around 130 confirmed cases with more than 40 confirmed deaths, but, as expected, the virus reemerged the following winter, with more than 100 confirmed cases and 20 deaths in China in January 2014 alone.

China's domestic response to the H7N9 outbreak prevented the virus from spreading beyond mainland China, save for a handful of cases in Hong Kong, Taiwan, and Malaysia. Chinese scientific cooperation with the international community also allowed other countries to prepare for further spread of the virus. Chinese scientists developed a vaccine in October 2013—the first influenza vaccine developed entirely in China—and shared their method with the world, facilitating vaccine development efforts by the U.S. CDC and private pharmaceutical companies. The Chinese and American CDCs collaborated throughout the H7N9 outbreak by sharing epidemiological data and engaging in joint research on the virus. The Chinese efforts to manage the outbreak of H7N9 were widely praised by governments and scientists around the world.[13] In the United States, the CDC partially activated its Emergency Operations Center to conduct epidemiological and vaccine research, provide assistance to the Chinese, and develop and distribute test kits capable of detecting the virus worldwide.[14]

HIV/AIDS: 2003–2014

Besides preparing for and responding to influenza epidemics, the United States also helped China in its campaign against HIV/AIDs. In 2002, the U.S. National Institutes of Health (NIH) gave the Chinese CDC a five-year, $14.8 million grant to develop infrastructure to improve

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[12] Yuelong Shu, Ying Song, Dayan Wang, Carolyn M. Greene, Ann Moen, C. K. Lee, Yongkun Chen, Xiyan Xu, Jeffrey McFarland, Li Xin, Joseph Bresee, Suizan Zhou, Tao Chen, Ran Zhang, and Nancy Cox, "A Ten-Year China-US Laboratory Collaboration: Improving Response to Influenza Threats in China and the World, 2004–2014," BMC Public Health, Vol. 19, No. 520, 2019.

[13] Carina Perkins, "OIE Meeting Congratulates China on Bird Flu Response," GlobalMeatNews, June 4, 2013; Mara Hvistendahl, "A Decade After SARS, China's Flu Response Wins Cautious Praise," *Science*, Vol. 340, No. 6129, April 12, 2013, p. 130; Dobri Genchev, "H7N9 Response Discussed During World Health Assembly," news release, World Health Organization, November 9, 2018.

[14] Centers for Disease Control and Prevention, "Asian Lineage Asian Influenza A(H7N9) Virus" December 7, 2018. As of February 3, 2020: https://www.cdc.gov/flu/avianflu/h7n9-virus.htm

research and better monitor the spread of the disease in the country. Beijing also partnered with the U.S. CDC to establish the CDC's Global AIDS Program (GAP) in China in early 2003. GAP quickly developed and implemented a comprehensive HIV prevention and mitigation plan across 15 Chinese provinces to promote increased surveillance of high-risk populations. The CDC, in partnership with China's National Center for AIDS/STD Control and Prevention, has assisted with capacity-building, including the improvement of the quality and geographical reach of laboratory testing capabilities, the development of an epidemiological surveillance system, and the expansion of treatment options. The U.S. CDC has assisted Chinese health authorities with the establishment of three HIV/AIDS clinical training centers in rural areas, which have educated more than 300 graduates who are now providing antiretroviral therapy for 50,000 patients in 16 provinces.[15]

2013–2019: The Years Leading Up to the 2019 Coronavirus

Ebola

In 2014, the Chinese government launched an unprecedented response to the Ebola epidemic in West Africa in 2014.[16] China's State Council dispatched one of its largest medical teams of about 1,200 clinicians, public health experts, and military medical officers after the WHO declared a Public Health Emergency of International Concern (PHEIC). The Chinese team opened a 100-bed treatment unit and established three field demonstration sites in Sierra Leone while providing free treatment. Within six months, China also built a biosafety level 3 laboratory, transporting all construction materials into the laboratory in only 87 days.[17]

The United States took similar actions but on a larger scale, with aid exceeding $1 billion. In some cases, U.S. and Chinese teams collaborated on the ground in Africa. On the international stage, the United States and China worked together at the UN Security Council, jointly declaring the Ebola outbreak a "threat to international peace and security," and called on governments around the world to respond to the crisis.[18] In June 2015, at the U.S.-China Symposium on Ebola, Research, and Global Health Security hosted by the NIH, both countries renewed their commitment to building systems to detect, prevent, and respond to global health threats.

Indeed, these collaborations between U.S. and Chinese public health agencies are the ones that the 2016 U.S.-China Strategic and Economic Dialogue highlighted as venues for deeper cooperation moving forward: "The United States and China are committed to strengthening cooperation to improve global health security," both sides agreed. They pledged to further "strengthen their partnership to build capacity to prevent, detect and respond to infectious disease

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[15] Bulterys M. (2020) The US CDC Global AIDS Program in China. In: Wu Z., Wang Y., Detels R., Bulterys M., McGoogan J. (eds) HIV/AIDS in China. Springer, Singapore

[16] Yanzhong Huang, "China's Response to the 2014 Ebola Outbreak in West Africa," *Global Challenges*, Vol. 1, No. 2, February 27, 2017.

[17] Kun Tang, Zhihui Li, Wenkai Li, and Lincoln Chen, "China's Silk Road and Global Health," *The Lancet*, Vol. 390, No. 10112, December 2017, pp. 2595–2601.

[18] "Ebola 'Threat to World Security'-UN Security Council," BBC News, September 19, 2014. As of February 3, 2020:
http://www.bbc.com/news/world-africa-29262968

threats including but not limited to influenza, malaria, laboratory capacity, and antimicrobial resistance."[19]

However, a big change in the U.S.-China relationship was on the way. Afraid of western influences, China enacted new legislative restrictions on foreign nongovernmental organization (NGO) activity on January 1, 2017; the law requires foreign-based researchers in China to have a government partner who will report their activities to central and local security agencies. Then, in 2018, due to a U.S.-China trade war, such diplomacy dialogues as the strategic and Economic Dialogue and bilateral diplomatic and security dialogues halted. Subsequently, the United States closed the National Science Foundation office in Beijing in 2018 (along with its offices in Tokyo and Brussels) and the GAP program. Currently NIH and the CDC both reduced their staff in the Beijing office.

In summary, in the 18 years since SARS, with help from the international community and through the commitment of the Chinese government, China has invested in a nationwide network of its own centers for disease control at the national, provincial, prefecture, and county levels; they are connected by a real-time, web-based reporting system for emerging public health events. The workforce for China's CDCs is large, relative to the 15,000 employees at the U.S. CDC, consisting of 3,481 units and 877,000 public health professional positions at all levels of government. China also has a world-class National Influenza Center. However, the question on the minds of global health organizations around the world is, is China truly ready for the next pandemic?

A report in late 2018 from China's CDC casts some doubts.[20] The challenges, as the authors highlighted, are multifaceted. First, the growing public health needs (and the voids after the departure of international funders) have stretched still-limited investments in China's public health and its preparedness and response. In the past decade, many Chinese agencies have prioritized innovation in technology, including biomedical research. They have also invested in restructuring the health system for the population of 1.4 billion. Public health, in comparison, was relatively underfunded due to these competing priorities. At the local level, local CDCs are supported by provincial governments. In places where the local government's resources are less robust or declining, local public health resources, including personnel, can also suffer from insufficient funding. Low salaries are a significant barrier to the recruitment and retention of high-quality professionals, and local Chinese CDC staffing has declined at all levels. Secondly, suboptimal multisector coordination, such as inadequate communication and inconsistent data sharing between health and veterinarian sectors, between clinicians and public health professionals, can delay early detection of emerging diseases. Insufficient health care surge capacity was also identified as a potential barrier for providing sufficient response to pandemics, as well as the lack of an official technical framework to communicate an epidemic's intensity, severity, and risks to public.

These underlying issues with the Chinese CDC—especially its dwindling funding and lack of effective communication with public and other sectors—may explain the different fate of the two main surveillance systems in China for detecting and monitoring emerging pathogens. One is China's national sentinel surveillance system for influenza-like illness (ILI), as mentioned

[19] U.S. Department of State, Office of the Spokesperson, "U.S.-China Strategic & Economic Dialogue Outcomes of the Strategic Track," Washington, D.C.: June 7, 2016. As of February 3, 2020: https://2009-2017.state.gov/r/pa/prs/ps/2016/06/258146.htm

[20] One hundred years of Influenza since the 1918 Pandemic -Is China prepared today? CCDC weekly; 2018:1 (4) 56-61.

earlier, anchored by more than 500 sentinel hospitals in 31 provinces.[21] The other is the national pneumonia surveillance system, which was built and has been maintained by China's CDC since 2004. The latter is designed to monitor pneumonia of unknown etiology (PUE) and facilitate timely detection of novel respiratory pathogens, such as SARS or the 2019 coronavirus. The ILI system is able to use the hospital information system for case recording and outpatient monitoring since the network is hospital-based. The PUE surveillance system, on the other hand, belongs to the CDC system, and has not been used consistently. One study found that 29 percent of community-acquired pneumonia cases that met the PUE criteria were not reported to the PUE system in 2009.[22] Only 1,016 PUE cases in all of China were reported during a nine-year period. A study showed that the number of cases surged when an outbreak occurred, either during the SARS outbreak or during A(H5N1) outbreaks. This surge may reflect enhanced administrative requirements from health authorities or enhanced clinician awareness of respiratory viruses.[23] This illustrated that the hospital system (a system paralleled to the CDC system) is in better fiscal condition to maintain a surveillance system compared with the CDC system, which is underused and not sensitive unless it is triggered by an established outbreak.

But a more fundamental question is, what role will China's CDC take in an outbreak response? From what I have witnessed in SARS and 2019-nCoV, the CDC's role is mostly that of consultation rather than decisionmaking.

2019–2020: Is 2019-nCoV Another SARS?

As millions of Chinese prepared to celebrate the 2020 Chinese New Year, the country was seized by anxiety over the emergence of a rapidly evolving epidemic of pneumonia associated with a new coronavirus, 2019-nCoV. At the time of this writing, more than 17,000 confirmed cases and more than 20,000 probable cases have spread throughout China and 23 other countries, causing more than 360 deaths. After person-to-person transmission was reported in four of the 23 countries known to be experiencing cases of the virus, the WHO declared a Public Health Emergency for International Concerns (PHEIC) on January 29, signaling global consensus on deeming the 2019-nCoV outbreak as an extraordinary public health risk. Therefore, to address the question, "Is this another SARS?" I will provide my thoughts from two angles: (1) Will the 2019-nCoV epidemic be similar to that of SARS? (2) What can we learn from comparing China's current response with that of SARS 18 years ago?

[21] Dennis KM Ip, Qiaohong Liao, Peng Wu, Zhancheng Gao, Bin Cao, Luzhao Feng, Xiaoling Xu, Hui Jiang, Ming Li, Jing Bao, Jiandong Zheng, Qian Zhang, Zhaorui Chang, Yu Li, Jianxing Yu, Fengfeng Liu, Michael Y. Ni, Joseph T. Wu, Benjamin J. Cowling, Weizhong Yang, Gabriel M. Leung, and Honjie Yu, "Detection of Mild to Moderate Influenza A/H7N9 Infection by China's National Sentinel Surveillance System for Influenza-Like Illness: Case Series," *The BMJ*, Vol. 346, June 24, 2013.

[22] Nijuan Xiang, Fiona Havers, Tao Chen, Ying Song, Wenxiao Tu, Leilei Li, Yang Cao, Bo Liu, Lei Zhou, Ling Meng, Zhiheng Hong, Rui Wang, Yan Niu, Jianyi Yao, Kaiju Liao, Lianmei Jin, Yanping Zhang, Qun Li, Marc-Alain Widdowson, and Zijian Feng, "Use of National Pneumonia Surveillance to Describe Influenza A(H7N9) Virus Epidemiology, China, 2004-2013," *Emerging Infectious Diseases*, Vol. 19, No. 11, 2013, pp. 1784–1790.

[23] Xiaorong Guo, Dong Yang, Ruchun Liu, Yaman Li, Qingqing Hu, Xinrui Ma, Yelan Li, Heng Zhang, Xixing Zhang, Benhua Zhao, and Tianmu Chen, "Detecting Influenza and Emerging Avian Influenza Virus by Influenza and Pneumonia Surveillance Systems in a Large City in China, 2005 to 2016," *BMC Infectious Diseases*, Vol. 19, No. 825, September 18, 2019.

Agent, Host, Environment, and Transmission

2019-nCoV is the latest member of the coronavirus family. This type of virus is commonly found in humans and other mammals, such as bats, civet cats, and camels. In humans, coronavirus has four strains that cause mild clinical symptoms, usually referred as the common cold. Two other strains are more lethal: SARS and MERS. Currently, I do not know whether the new virus will cause clinical symptoms similar to the strains that cause the common cold or to the two strains of coronavirus that caused large-scale epidemics and fatalities. We do know that it shares a high degree of genomic similarity to coronavirus in bats, and to SARS-CoV in humans.[24] It is as contagious as SARS, but so far, the reported statistics indicate a lower proportion of case fatalities (around 2–3 percent) compared with SARS (10–14 percent) and MERS (35 percent).[25] The severe symptoms and fatalities seem to be associated with individuals with medical complications. These estimates can change if the virus continues to mutate or the data are, in reality, different from what we know. For now, the moderately high infectivity, mild clinical symptoms, and wide-ranging incubation period may mean that the novel virus is less harmful to individuals but may coexist with humans and become endemic. In this sense, 2019-nCoV has the potential to cause a pandemic.

The physical and social environments of 2020 are also very different from those in 2002. China is wealthier and more globalized today. Today, there are 739 international air travel routes originating from China—three times the number of routes (233) available in 2002. On average, 51 million people travel between China and another country per year, a number many times higher than the 3 million back in 2002. The epicenter of the outbreak, Wuhan, is a major transportation hub in central China, sometimes known as "Chicago of China." On an average day, 30,000 people fly out of the city, and many more use the bullet trains from three railway stations in the city. The outbreak began right before the Chinese New Year, a time during which more than three billion trips typically occur under normal circumstances. January is also the time when students from overseas colleges to return to school after the winter break and students from Chinese universities start the winter break. The environmental difference between the 2019-nCoV epidemic and SARS is the scale of mobility, which makes the global spreading of the disease much easier than that for SARS.

Prevention and treatment methods are similar between SARS and 2019-nCoV. In both cases, vaccine development takes months to a year and can hardly be helpful in stopping the outbreak. Quarantines, travel bans, and case-tracing can slow down the disease transmission and buy precious time for countries to plan their responses, but they are not perfect prevention methods.[26] Quarantine will only be effective if it can guarantee stopping people's mobility, which is hard to do for a city of 11 million people. Early detection is conducted using proper reverse transcription

[24] Peng Zhou, Xing-Lou Yang, Xian-Guang Wang, Ben Hu, Lei Zhang, Wei Zhang, Hao-Rui Si, Yan Zhu, Bei Li, Chao-Lin Huang, Hui-Dong Chen, Jing Chen, Yun Luo, Hua Guo, Ren-Di Jiang, Mei-Qin Liu, Ying Chen, Zu-Rui Shen, Xi Wang, Xiao-Shuang Zheng, Kai Zhao, Quan-Jiao Chen, Fei Deng, Lin-Lin Liu, Bing Yan, Fa-Xian Zhan, Yan-Yi Wang, Gengfu Xiao, and Zheng-Li Shi, "Discovery of a Novel Coronavirus Associated with the Recent Pneumonia Outbreak in Humans and Its Potential Bat Origin," bioRxiv, January 23, 2020.

[25] Chen Wang, Peter W. Horby, Frederick G. Hayden, and George F. Gao, "A Novel Coronavirus Outbreak of Global Health Concern," *The Lancet*, January 24, 2020.

[26] Jennifer B. Nuzzo, "Past Epidemics Prove Fighting Coronavirus with Travel Bans Is a Mistake," *Washington Post*, February 2, 2020.

polymerase chain reaction (RT-PCR) testing kits, thanks to the Chinese scientists who have isolated the novel virus, conducted genomic sequencing, and shared the data with the world in an astonishingly short amount of time. This has helped to identify the virus and has enabled China and other countries to develop effective testing kits for early detection. The treatment of 2019-nCoV mostly focuses on supportive therapy, but a few antiviral medicines are being used experimentally.

The Chinese Government's Response to 2019-nCoV

The Chinese government's response to 2019-nCoV has followed a similar pattern to that of the SARS outbreak and is characterized by three common features: (1) delaying public acknowledgement of a public threat, (2) downplaying the severity of the outbreak in its early days, and (3) relying on quarantine, social control, and large-scale health care system mobilization to stop the outbreak. The current response also has a few major differences, including the use of social media, better research, and technology, which have helped mitigate some of the negative effects.

The first common feature response of SARS and 2019-nCoV is the delay in acknowledging the initial case cluster to be a public health threat. If we recognize that stability is what the Chinese political system values most, and an acute public health threat, such as an epidemic, is precisely the "black swan" that can threaten such stability, then it is not too difficult to understand the Chinese government's reluctance toward acknowledging an epidemic. China's law prohibits anyone from talking about a public health threat before an official government announcement. For the government to make an announcement on an epidemic, a full process of upward reporting and verifying at every political level has to be accomplished. Once the verified report reaches the Ministry level, a special expert group is often sent to investigate. Following such a process, a timely acknowledgement of an epidemic to the public is almost impossible. The exception has been when social stability itself is being threatened. For example, we saw Guangdong government officials breaking the silence three months after the first SARS case only when the public panicked after seeing phone messages regarding a deadly flu in February 2003. We also saw Wuhan health officials announcing the 27 cases of 2019-nCoV on December 31, 2019 after a few doctors in Wuhan sent WeChat messages warning their acquaintances about a "SARS-like" pneumonia. (The informants were later publicly reprimanded by the government.) In this case, wide use of social media, no matter how closely monitored, helped the local officials significantly shorten the waiting period that is usually required for an official announcement.

The second characteristic of the government's response is the downplaying of the severity of the threat at the beginning of an epidemic. For SARS, the results from the first investigation did not alarm the Ministry—and therefore, there was no public announcement—in January 2003. For the next two months, the government continued downplaying the severity of SARS to the public until the Minister of Health was fired in April. In this recent response to 2019-nCoV, the first expert team went to Wuhan in January 2020 and concluded that there was no person-to-person transmission and the outbreak was well controlled after the closing of the seafood market where many cases (not all) were identified. For days, the local health officials assured the public that there were no new cases in Wuhan and no cases outside Wuhan. This inaccurate portrayal of the disease may have allowed sufficient time for the virus to be spread widely in Wuhan, to other cities in China, and to the world. It was not until the 2019-nCoV cases were confirmed in Thailand and Japan in patients who had had no exposure to the seafood market that the MOH sent a second expert group to Wuhan on January 19. This time, person-to-person transmission was immediately confirmed, and the national case reporting system was triggered on January 20. Although the downplaying of the severity of the epidemic did occur, this time it only lasted 20 days, compared with the 2.5 months during the SARS outbreak. This was due to better biomedical and research capacity of the Chinese researchers in 2019. Chinese scientists were able to quickly culture the virus and share the genomic sequencing data with international researchers by January 11. The genetic sequencing data helped many countries quickly develop testing kits for early detection of the disease. When cases showed up in Thailand and Japan, international genomic researchers were able to quickly identify the matching genomic patterns and confirm the presence of 2019-nCoV. This success helped provide the evidence for understanding the greater geographic spread of the epidemic and the role of person-to-person transmission. During the SARS epidemic, however, because of the lack of virus identification, China's pneumonia outbreaks were not linked to those in Hong Kong and Vietnam until four months after the index case happened.

Finally, during SARS, once the government finally geared up to stop the outbreak, they swiftly initiated a quarantine policy. With 2019-nCoV, the decision on quarantine was made three days after the government accepted the fact that the outbreak was fueled by person-to-person transmission. This time, the scale of the quarantine was unprecedented. The mayor of Wuhan announced that the government would shut down all public transportation, including airports and railways, in Wuhan—a city of 11 million people—on January 23, two days before the Chinese New Year. The national government also employed social policing to enforce self-quarantine, canceled public events, and prohibited crowd gatherings across the country.

Without a vaccine, a quarantine is one of the few effective ways to prevent disease transmission. China's decision on a city lockdown has been praised by the WHO and probably buys precious time for many other countries to activate their public health responses. However, there are debates on the effectiveness of the lockdown over such a large area. First, some would argue that by issuing a lockdown only two days before the Chinese New Year, the government missed many people who had left earlier, since new year travel usually starts a week before the new year. The lockdown also took effect a day after the announcement, and many people from Wuhan rushed to get out of Wuhan before it started. As the mayor of Wuhan mentioned in a news conference on January 27, about five million people had left Wuhan by then.[27] Second, the lockdown of a city of 11 million people made it harder to implement the typical door-to-door or community-by-community screening, assessment, and provision of supportive care that usually happens after a quarantine is established. Quarantine may also bring heightened fear and stigma among the affected population, accelerate the shortage of medical supplies and health care resources, and provide a false picture that the epidemic is under control. In addition, the economic impact of the quarantine can be large.

SARS cost the world 40 billion USD and China 1 percent of its GDP in 2003. China may suffer more economic loss this year due to the 2019-nCoV, given that quarantine was initiated before the Chinese new year and at a relatively early stage of the epidemic. (Quarantine may last longer than two months.) In 2003, the industries hurt most were tourism, retail, and entertainment, which was 43 percent of China's GDP. Today, these industries account for

[27] Gerry Shih, "Coronavirus Prompts CDC to Expand Travel Warning to All of China; Top U.S. Health Official Urges Beijing to Admit Disease Experts," *Washington Post*, January 27, 2020.

54 percent of the GDP.[28] China now contributes 17 percent of world's economy, compared with 4.3 percent in 2003, when the SARS epidemic was unfolding. China's current stature in the world economy means that the impact of 2019-nCoV outbreak is likely to substantially exceed that of SARS.

Currently, the national case report system is in use, and the case numbers have surged in the last weeks. However, given that many hospitals in China are overwhelmed by the large volume of people with cold-like symptoms coming for testing and treatment because of the fear of the epidemic, patients are often being turned away, and delayed diagnosis and deaths that are not counted (when infected people die before the diagnosis or at home) are both possible. The two new 1,000-bed hospitals that China built in two weeks may help relieve the severe shortage of hospital beds and improve health care for many infected people. It may also help improve the accuracy of the epidemic's statistics.

In summary, the 2019-nCoV is the third of its type, after SARS and MERS, to cause a global outbreak. The Chinese government's response to 2019-nCoV has been similar to that of SARS; however, the initial delay and the "downplay" time were much shorter this time due to the widespread use of social media and the much-improved local research capacity. The unfolding battle against this new pandemic, meanwhile, highlights the importance of transparency and open collaboration among scientists globally. It is a reminder that all nations should prioritize and protect global health research, capacity building, and cooperation.

Recommendations

Given that my fellow panelists both have more experience on leading pandemic preparedness programs in the United States, I will focus my recommendations on the China-related issues. I have short-term, medium-term, and long-term suggestions.

Short Term

First, China is on the front line of a full-fledged battle with the new coronavirus. Health care workers are exhausted, and testing kits and personal protection, such as face masks, goggles, and gloves, are all in short supply and have been rationed.[29] At this time when many Chinese people are suffering from illness, anxiety, and uncertainty, it is important and opportune for U.S. public health and health care professionals to reach out to China and provide humanitarian and technical aid. Such support will boost the morale of their Chinese colleagues, serve as an international witness to the health care professionals' work at the front line of the epidemic, and help provide technical support on trials of the latest antiviral medicines. I am quite encouraged to hear that the U.S. CDC office in Beijing will be hosting a medical team in the near term.

Secondly, any efforts by the U.S. government to reduce stigma and unfriendly gestures toward people from China and Wuhan at this tense and sensitive moment will increase the soft

[28] Bloomberg News, "Coronavirus Is More Dangerous for the Global Economy than SARS," January 31, 2020. As of February 3, 2020:
https://www.bloomberg.com/news/articles/2020-01-31/the-coronavirus-is-more-dangerous-for-the-economy-than-sars

[29] Rosie Perper, "As the Wuhan Virus Spreads, Doctors in the City Say They Face a 'Flooding' of Patients and Not Enough Protective Gear," Business Insider, January 24, 2020. As of February 3, 2020:
https://www.businessinsider.com/wuhan-coronavirus-doctors-wuhan-patients-protective-gear-2020-1

power of the United States and bring more goodwill from Chinese people toward the United States. Conversely, stigma, prejudice, and any punitive remarks will preclude any sense of goodwill and will also more likely undermine the level of transparency the Chinese government is willing to allow now.

Finally, given that the WHO has declared 2019-nCoV a PHEIC, there are concerns regarding developing countries that do not have a health care system capable of stopping the spread of the virus. In the worst-case scenario, the epidemic may affect more people in these countries when the epidemic subsides in China and the United States. The U.S. CDC may consider working with China's CDC and the China International Development Cooperation Agency (CIDCA) to map out potential collaborations to help these countries in distress.

Medium Term

Once the epidemic is under control, studies on the country response systems and global pandemic management will begin. It might be valuable for the United States to help lead the evaluations with government officials and scholars from China and other countries. There will be several questions for China to contemplate: What can China do in the future to improve communication about new public health threats? What can be done to increase the transparency about the occurrences and the severity of the outbreak? To what extent are quarantines effective, and how should they be implemented? How can China make its CDC more sustainable and improve multi-sector communications? The lessons learned will benefit not only China, but also other countries that encounter similar issues.

To take such a leadership role, I hope the U.S. government can build a realistic and consistent policy about future U.S.-China collaboration on global health and seek consensus with China on what data to share and what rules to follow.

Long Term

As I mentioned earlier in my testimony, during most of the years between SARS and 2019-nCoV, the United States and China were working side by side to confront the challenges of epidemics. In doing so, both countries have benefited from capacity building for their current and future public health workforces. In our current situation, as the first phase of the trade war is resolved, this could be an opportune time to restart the U.S.-China dialogues on economy, diplomacy, and security. I hope U.S.-China collaboration on global health and pandemic preparedness will benefit from these future talks between the two countries.