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## U.S. has only a fraction of the medical supplies it needs to combat coronavirus

*The country could require seven billion respirators and face masks over the course of the outbreak.*

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Three hundred million respirators and face masks. That's what the United States needs as soon as possible to protect health workers against the coronavirus threat. But the nation's emergency stockpile has less than 15 percent of these supplies.

Last week, U.S. Health and Human Services Secretary Alex Azar testified before the Senate that the Strategic National Stockpile has just 30 million surgical masks and 12

million respirators in reserves, which came as a surprise considering that the stockpile's inventory is generally not disclosed for national security reasons. Asked by National Geographic about the discrepancy, a senior official with the Strategic National Stockpile said the department intends to purchase as many as 500 million respirators and face masks over the next 18 months.

Even such a promised surge in production may not be enough—and it may not come soon enough. A widely overlooked study conducted five years ago by the U.S. Centers for Disease Control and Prevention found that the United States might need as many as seven billion respirators in the long run to combat a worst-case spread of a severe respiratory outbreak such as COVID-19.

The outbreak now has entered a new, more potent phase dictated by local or community transmission. It's no longer just being imported from China. Coronavirus has started spreading locally in 13 other countries, including South Korea, Japan, Singapore, Australia, Malaysia, Vietnam, Italy, Germany, France, United Kingdom, Croatia, San Marino, Iran, the United Arab Emirates, and the United States. On Tuesday, Tokyo hinted the Olympics might be postponed, as the global tally of confirmed cases and deaths rose to 90,800 and 3,100, respectively. (Here's how coronavirus spikes outside China show that travel bans aren't working.)

In the U.S., COVID-19 cases without clear ties to China began dotting the West Coast last week. At the same time, the nation saw an uptick in fatalities—six so far as of Tuesday—with most occurring at a nursing home in Kirkland, Washington. Besides confirming the threat posed to the elderly, these deaths, the community transmission, and genetic analysis suggest the virus has been spreading unnoticed in Washington since mid-January.

“We will have community spread,” New York Governor Andrew Cuomo said Monday at a news briefing about the state's first confirmed case. “That is inevitable.”

All of these events sparked a run on medical supplies over the weekend, a worrying prospect given the CDC has indicted there could be a global deficit of personal

protective equipment such as surgical masks, goggles, full-body coveralls, and N95 respirators, the only CDC-approved face guard, which are designed to filter 95 percent of airborne particles. What's more, even if U.S. medical centers obtain the necessary supplies, a second shortage of medical specialists may emerge if this respiratory outbreak spreads even more dramatically.

## TAKING STOCK

The panicked demand and lack of supplies was predictable. China manufactures roughly 50 percent more medical and pharmaceutical supplies than its nearest competitor, the U.S., according to data supplied to National Geographic by Euromonitor International. But the Asian country now needs those precious supplies for its tens of thousands of cases, at a time when manufacturing has slowed across the country.

“The fundamental point that's exposed in situations like that is that autarky—the idea of self-sufficiency—is lovely in theory, but it almost never actually works in practice, because we tend to not appreciate supply chains,” says Parag Khanna, a global strategy advisor and author of *Connectography* and *Technocracy in America*.

Much of the world has become accustomed to same-day delivery without thinking about the bundles of transactions that support such a system. Some global industries can circumvent major blockages or delays in supply chains caused by the coronavirus outbreak. But other supply chains and industries—like automobiles, travel, and medical supplies—are too tightly bound across borders in what Khanna calls a supply circuit.

“China's a manufacturer of intermediate products ... but what they're really

manufacturing on a wider scale is starting material for active pharmaceutical ingredients,” says Scott Gottlieb, a former U.S. FDA commissioner and resident fellow at the American Enterprise Institute. “These manufacturers have one to three months of supply, so they’re going to be able to continue to manufacture for a period of time, but eventually they’re going to run out.”

“The irony is that some of the other countries who could do these things very quickly, like Japan or South Korea, are also affected by the virus,” says Khanna, who has also noted that the coronavirus appears to be spreading along China’s “new silk road”—echoing what happened with the Black Death in the 1300s. He and other experts expect India, Thailand, Indonesia, and Vietnam to swoop in to capitalize on China’s deficit.

On Friday, the FDA announced the first drug shortage due to the coronavirus. And for nearly a month, the CDC has warned about the fragility of supply circuits for personal protective equipment, as manufacturers struggle to meet orders for face masks and N95 respirators. That’s possibly because the CDC conducted a thought experiment five years ago that offers a clear warning for the situation unfolding today. Back then, the public health agency wanted to predict how many resources the U.S. might need over the entire course of a hypothetical outbreak of a severe flu virus. (Learn about how coronavirus compares to flu, Ebola, and other major outbreaks.)

The result was a series of models built with parameters that bear an uncanny resemblance to what is currently happening with the coronavirus. From disease transmission rates down to the lack of specific antivirals or vaccines, the CDC papers offer a rough guide on what preparedness needs to look like to combat an emerging respiratory pandemic.

“In terms of the amount of masks, gowns, gloves, [and] respirators that would be needed, this influenza model is a good way to estimate that at this point,” says Eric Toner, a senior scientist at the Johns Hopkins Center for Health Security who wasn’t involved with the CDC papers. “I don’t see any reason to think that we would need a different number of those things than we do for a severe pandemic flu.”

Based on the models, U.S. health care workers would need two to seven billion respirators for the least- to most-severe possible scenarios. That’s up to 233 times more than what’s currently in the Strategic National Stockpile.

“The demand that would be required in a severe pandemic is so unlike the amount that’s used on a day-to-day basis,” says Lisa Koonin, an epidemiologist and founder of Health Preparedness Partners. She worked for the CDC for more than 30 years and is a co-author on these reports. “For the respirators and surgical masks, we’re talking orders of magnitude greater need for a severe pandemic.”

## SPECIAL STAFF

Along with the billions of respirators, the CDC predicted that U.S. patients and health care workers might need as many as 100 to 400 million surgical masks, as well as 7,000 to 11,000 mechanical ventilators. The latter are used during life support for the most severe cases of respiratory disease, after a patient’s lungs stop working on their own. A report published Friday in the *New England Journal of Medicine* states that about 2.3 percent of early coronavirus patients underwent mechanical ventilation.

But ventilators, respirators, and even basic masks are only helpful when used by expert hands—and that presents another potential shortfall for the U.S.



“In a severe pandemic, we certainly could run out of ventilators, but a hospital could just as soon run out of respiratory therapists who normally operate these devices,” says Toner. The Bureau of Labor Statistics estimates that the U.S. employs 134,000 respiratory specialists, or approximately 20 of these technicians for every hospital in America. (Will warming spring temperatures slow the coronavirus outbreak?)

“One of [the CDC’s] conclusions was, it’s not so much the number of ventilators as the number of people needed to operate the ventilators. That’s the choke point,” Toner adds.

Resource demands at a single hospital could also be substantial as coronavirus cases increase in the U.S. Three years ago, the Mayo Clinic—a prestigious medical system based in Rochester, Minnesota—asked Toner and his colleagues to assess what kind of individual stockpile might be required during a severe influenza pandemic.

Unlike the CDC papers, their model ran through 10,000 scenarios, each with slightly different settings for epidemiologic variables such as hospitalization rates, hospital length of patient stays, how much time patients spend on mechanical ventilation, and case fatality rate.

“A model like this can’t tell you the right thing to do. But it can tell you the range of possibilities,” Toner says.



*Concerned about the spread of COVID-19 in large gatherings, students from the University of North Carolina School of the Arts wear respiratory masks as they wait for Democratic presidential candidate Sen. Bernie Sanders (I-VT) to speak to supporters during a rally and march to early vote on February 27, 2020 at Winston-Salem State University in Winston-Salem, North Carolina.*

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For example, if the Mayo Clinic stockpiled 4.5 million gloves, 2.3 million N95 respirators, 5,000 doses of a potent antiviral, and 880 ventilators, those supplies would cover the clinic’s facilities for 95 percent of the likely outcomes—everything except the absolute worst-case scenarios for a respiratory pandemic.

“We go through a lot of gloves in health care, and the numbers can be staggering,” Toner says. “Particularly with a disease like this where some people are advocating double gloving, you’ll burn through gloves twice as fast.”

But he emphasizes that every hospital’s demands would be different. The Mayo Clinic is large, boasting more than 63,000 staff members that not only serve Minnesota, but accept specialty patients from around the world.

## RESILIENT CIRCUITS

The actual demand and supply for health care equipment during this outbreak will depend on myriad variables, one of which is an outbreak's attack rate. As of this moment, that is a mystery for COVID-19.

The attack rate is what percentage of a population catches an infectious disease overall. If a hundred people live in a city, and a virus' attack rate is 20 percent, then 20 citizens would be expected to get sick. Both the CDC papers and Toner's models rely on attack rates ranging from 20 to 30 percent, a standard estimate for severe pandemics. ([Learn about the swift, deadly history of the Spanish Flu pandemic.](#))

But the attack rate for COVID-19 is still unknown because it takes time to measure. Scientists must develop a test—[known as a serology assay](#)—that can detect whether a person caught the coronavirus even if they never reported symptoms.

“In terms of quantifying that specifically, it's still quite early days,” Maria Van Kerkhove, an infectious disease epidemiologist and the technical leader for WHO's Health Emergencies Program, said at a press briefing at the WHO headquarters in Geneva on Monday. Van Kerkhove added those serologic surveys must be conducted across large populations, so attack rates can be determined for individual age groups.

Because the attack rate reveals how much of a population is likely to catch a disease, it can be crucial in determining how to allocate resources locally, nationally, and globally. Van Kerkhove added that the necessary surveys are underway, and the World Health Organization hopes to see some preliminary results in the coming weeks.

In the meantime, Vice President Mike Pence, the Trump Administration's newly appointed coronavirus czar, on Saturday announced a deal with the Minnesota-based corporation 3M to produce 35 million masks a month. And the managers for the Strategic National Stockpile have asked companies to [submit data on their inventories of personal protective equipment](#), in case the coronavirus crisis escalates. They also hope their recent request for 500 million respirators and masks will promote the growth of local manufacturers.

“This purchase will encourage manufacturers to ramp up production of personal protective equipment now with the guarantee that they will not be left with excess supplies once the COVID-19 response subsides,” says Stephanie Bialek of the Strategic National Stockpile. “In an emergency, the SNS can send these products to areas in need as requested by state health officials.”