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The Lost Year Coronavirus Special Report



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What will this mean?

Coronavirus Special Report

The coronavirus that causes Covid-19 is a minute, studded wrecking ball that's not even truly alive. But in its machinelike way, it's defeating every effort to halt its spread. More than 100 nations had reported infections as of March 10, and almost 4,000 people had died, according to a Bloomberg tally. On March 11, the World Health Organization declared the outbreak a pandemic.

As Covid-19 inflicts its toll on the economy, business activity, profits, and stock prices have plunged. N95 masks have become rare and precious, and things that were once valued are in surplus—take crude oil, the price of which plunged as spigots opened in an impromptu geopolitical knife fight.

The most valuable commodity? Distance. There is security in the ability to stay more than a cough's distance away from others. You don't want to be a barista, a dentist, ►

◀ or a campaigning politician when Covid-19 comes to town.

Asymptomatic transmission makes Covid-19 an elusive enemy—and different from its older cousins, SARS and MERS. The bubonic plague that devastated London in 1665 was also an imperceptible killer. “It is impossible to know the infected people from the sound,” Daniel Defoe wrote in his book on that epidemic, *A Journal of the Plague Year*. “Their hands would infect the things they touched.”

Flummoxed authorities seem to be revising battle plans on the fly. Just look at President Trump, who proclaimed Covid-19 contained in the U.S. even as the number of cases was skyrocketing, before flip-flopping and promising to use the “full power of the federal government.” Elsewhere, China’s measures may have required a police state for enforcement, but that didn’t stop Italy from locking down the entire country.

How will we look back on all of this? It will depend on how bad it gets. Is your business changing plans? What about you, personally? The Lost Year, as we’re calling this special issue of the magazine, is less about GDP revisions than a major disturbance to our daily life.

There are still many questions about Covid-19. We have some answers.

We've organized this issue by order of scale, from macro to human to microbe:

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What will the the economy

● When Covid-19 strikes, the worst of the damage is done by the body's effort to fight off the disease. The immune system can overreact in what doctors call a cytokine storm. Immune cells attack not just the viral invader but healthy tissue as well. Victims gasp for breath as their lungs fill with fluid. The novel coronavirus, which scientists have christened SARS-CoV-2, tricks us into fighting it so hard that, in the most extreme cases, we kill ourselves.

As with the body's immune system, so with the defenses of the global economy. There's a virtual cytokine storm going on: The all-out effort to battle the disease is doing more harm to global growth than the disease itself. Quarantines, travel restrictions, business closings, and citizens' voluntary self-protection measures have frozen business while wreaking havoc on people's routines.

This will be the business story of 2020: Can the world modulate its immune response so as to fight Covid-19 in a way that saves lives without damaging everything else we care about? Or is this a lost year?

There's reason to worry that simultaneously defeating the virus and sustaining growth will be hard, if not impossible. New cases in China have declined sharply, which is wonderful news. But to make that happen the country's leaders imposed one of the most extensive quarantines in history, corralling close to 60 million people inside Hubei province, the epicenter of the outbreak. Governments in surrounding provinces also took steps to protect their populations, enacting travel bans and forcing factories to shut down. The economic toll has been high: Growth in the first quarter will be just 1.2%, according to projections by Bloomberg Economics—the slowest year-over-year rate since China started keeping records.

Despite Beijing's best efforts, there have been large outbreaks of Covid-19 across China as well as in South Korea, Iran, Italy, and elsewhere. And now that authorities outside of Hubei have begun easing

restrictions to limit the economic pain, there's a risk that the number of new cases in the country will begin to rise again as people go back to working, studying, and shopping. If the number of new cases in China does keep falling, it will show that an authoritarian state with a pliant population and high-tech surveillance capabilities can rein in Covid-19. But few—if any—other nations could employ China's strategy with the same strictness.

Forecasters have now turned their attention to the U.S., the only nation with a bigger economy than China's. The question is the same: How much will Covid-19 take off U.S. growth—and how much of the harm will come from efforts to fight the disease vs. the disease itself? There were 1,107 reported cases and 36 deaths in the U.S. through 4 p.m. Eastern time on March 11, according to data collected by Bloomberg. That number is expected to leap.

● How vulnerable is the U.S.?

Economists who were initially blasé about the potential hit to the U.S. have become increasingly concerned. Goldman Sachs Group Inc. revised its U.S. outlook downward in late February to reflect a drop in U.S. goods exports to China, fewer tourist arrivals from China, and modest supply chain disruptions for U.S. retailers. But that turned out to be not pessimistic enough. "Over the last week the situation has proven worse than we expected," the Goldman team wrote on March 1, citing increased economic weakness in China and further spread of the virus outside the country as key factors in the decision to downgrade full-year 2020 growth to 1.3%—a full percentage point below the previous forecast. A week later, Goldman lowered its forecast once more, to 1.2%, despite the Federal Reserve's half-percent rate cut. ▶

What I'm telling clients

Brendan MacMillan, CIO, QP Global Family Offices in New York, which manages family offices and their wealth

We believe the market hasn't discounted the full potential for an event as significant and symbolic as the temporary closure of the U.S. school system, or at least their statewide closures in California or New York. We don't see a high probability that the effects of Covid-19 will lead to a credit crisis yet, but just in case we get that wrong, we will look to hedge our equity positions by shorting stuff like HYG, the high-yield bond exchange-traded fund. —As told to Joel Weber

What's do to

Why?



▲ Wuhan resident Daniel Xie had been preparing to leave town to visit relatives for the Lunar New Year holiday when authorities locked down the city on Jan. 23 in an attempt to contain the spread of the coronavirus. Since then, the 33-year-old professional cameraman has been documenting life at the epicenter of the outbreak. "I witnessed a city of 11 million turn into a ghost town," says Xie, who snapped all the photos in the following pages of this section. "Sometimes I really want to find a stranger to chat with, but people are just staying away from each other."

● What about the wealth effect?

◀ The stock market's swoon is not just a symptom of the harm the virus is inflicting on the U.S. economy, but also one of its causes. Even U.S. households that don't directly own equities aren't immune to the so-called wealth effect of falling stock prices. Retail sales tend to decelerate sharply in the wake of market shocks because, rightly or wrongly, many Americans view stock indexes such as the S&P 500 as the most important indicator of the health of the economy. Business confidence experiences a similar impact, which usually translates into a decline in investment. And so it's self-fulfilling prophecy: If both U.S. consumers and companies dial down their spending because they think the outlook has worsened, then it almost certainly will.

A virus as contagious as SARS-CoV-2 is hard to tamp down as long as people continue to congregate and cough on one another. If the virus does spread widely in the U.S., a recession is likely to follow, says Moody's Analytics Inc. Chief Economist Mark Zandi. "We could be moving from a self-reinforcing positive cycle to a self-reinforcing negative cycle," he said on March 3.

State Street Associates, the research arm of

financial giant State Street Corp., puts the chance of a U.S. recession in the next six months at 75% based on early March stock prices. Actually, a Covid-19-induced recession may already have begun. Economic historians measure recessions from the peak of economic activity to the trough, and it's possible the U.S. economy peaked in February, when unemployment tied a 50-year low of 3.5%.

If extinguishing the virus is impossible, the next best thing is learning to live with it. Save extreme precautions for the most vulnerable, such as nursing-home residents, while dialing back economy-deadening measures in other spheres. For example, factories, offices, and schools should generally stay open, albeit with better procedures to limit contagion (hand-washing, social distancing, working from home where possible, paid sick leave). Governments can offset the economic damage with stimulative fiscal and monetary policies.

Walling off stricken cities, regions, or nations doesn't make sense if the disease is already spreading outside the containment area. "In a globalized world, there's a question about whether the horse may already have bolted," says Neil Shearing, Capital Economics' chief economist. That sounds defeatist. But given how damaging an overreactive immune system can be, it's simply realistic.

—Peter Coy

▼ Volunteers waiting to pick up people who've fallen ill in Wuhan's Jiang'an District

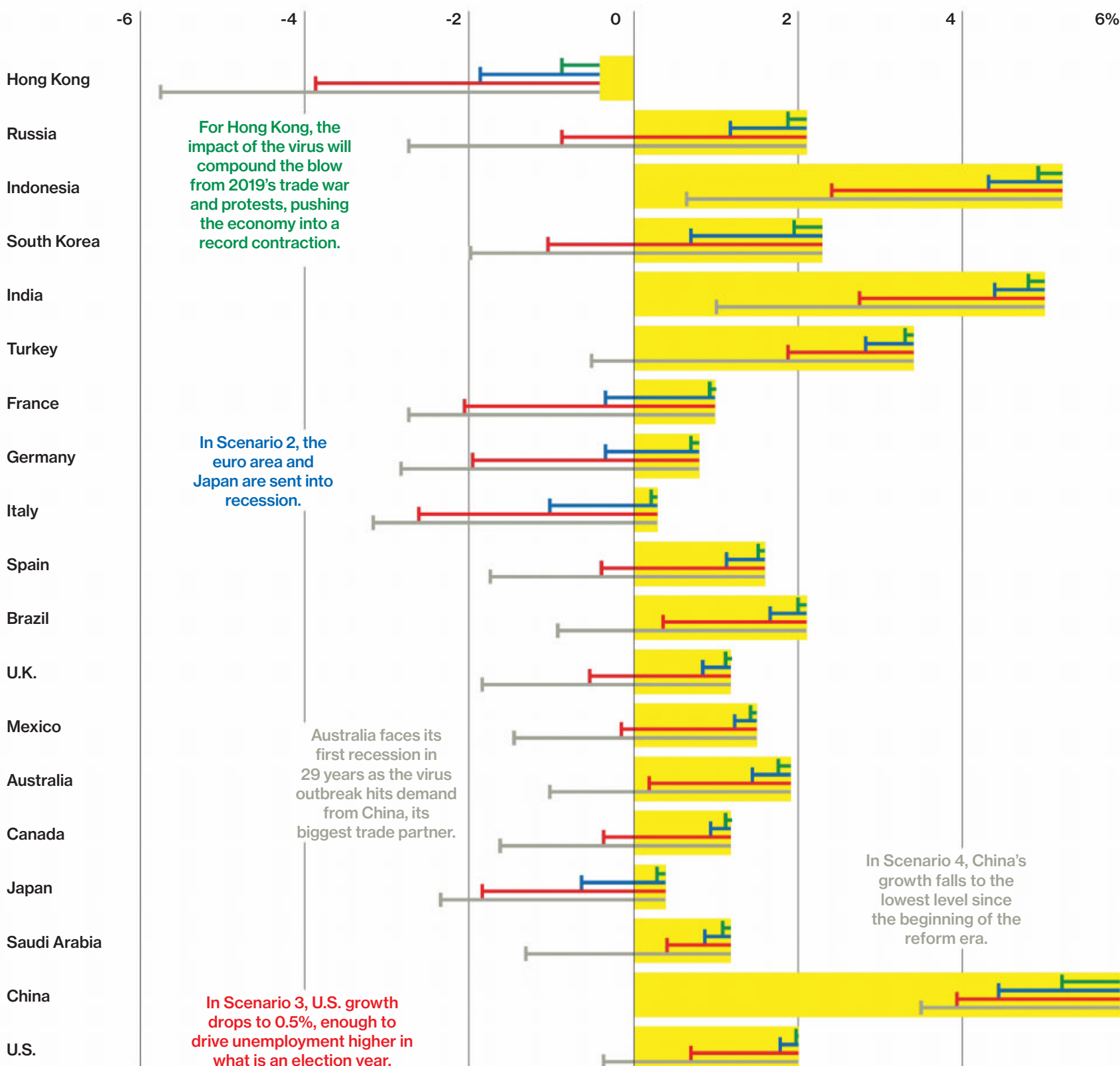


How much could this hurt GDP?

The coronavirus threatens to bring the world economy to a standstill. The fallout could include recessions in the U.S., euro area, and Japan; the slowest growth on record in China; and a total \$2.7 trillion in lost output—equivalent to the gross domestic product of the U.K. That's the most extreme of four scenarios developed by Bloomberg Economics. The outcome many had in mind a month ago—with a major outbreak confined to China and other countries suffering limited effects—is rapidly becoming too optimistic. The chances of the worst-case scenario—with all major economies suffering a significant shock—are rising by the day. The graphic below shows how they would fare under each scenario. —*Maeva Cousin, Jamie Rush, and Tom Orlik*

	Scenario 1 China shock	Scenario 2 More outbreaks	Scenario 3 Widespread contagion	Scenario 4 Global pandemic
Global 2020 GDP growth forecast ▶	2.9%	2.3%	1.2%	0.1%

■ Baseline 2020 GDP growth forecast ▬ Percentage-point change from baseline



SCENARIOS ARE BASED ON BLOOMBERG ECONOMICS' ESTIMATE OF THE SLOWDOWN EXPERIENCED IN CHINA, THE CASE COUNT IN OTHER COUNTRIES, CALCULATIONS OF SUPPLY CHAIN LINKAGES, AND A LARGE-SCALE MODEL OF THE GLOBAL ECONOMY. DATA: BLOOMBERG ECONOMICS, NIGEM, OECD IICIO

What happened to the bull market?

● The 11-year bull market in U.S. equities is over, at least by one measure. At the close of trading on March 11, the Dow Jones Industrial Average had recorded a 20% drop from its highest point. The S&P 500 closed 19% below its high, just outside of bear territory. But the events of recent days had already provided the sense of an ending—the world was anxious about much more than stock prices.

“The most unloved bull market” is the nickname this rally earned, and for good reason. While it was the longest in history, for much of its life it never quite felt like a boom for most people. It was born in the wake of the 2008 financial crisis and a massive, controversial effort by the U.S. government to rescue the nation’s banks. The rally was fueled for years by companies buying back their own shares, historically low interest rates, and the Federal Reserve purchasing massive amounts of bonds in what investors interpreted as an effort to keep the party going as long as possible.

The rally added \$28 trillion in value to U.S. equities from March 9, 2009, to Feb. 19, 2020. Chalking all that up to financial engineering and a cooperative central bank is too easy, and it misses the point. The leading companies of this bull market were genuine innovators. Apple Inc. went from being a \$74 billion company in 2009 to a \$1.4 trillion company in 2020 not through financial engineering, but by old-fashioned engineering. (In fairness, there was some tax code engineering, too.) Amazon.com Inc. went from being a \$26 billion company to a \$1.1 trillion company by reinventing the retail industry. Google, Facebook, Nvidia... the list of companies that changed not only our investment portfolios but also our daily lives goes on.

● How did it hold up for so long?

The bull market seemed to withstand any challenge thrown its way: the European debt crisis, the loss of the U.S. government’s AAA rating at S&P in 2011, and the trade war. Maybe that explains the indestructible sense of optimism

priced into the market as 2020 got under way, with the U.S.-China trade war widely believed to be in the rearview mirror. At its last record in February, the S&P 500 was trading at more than 2.4 times the sales of its companies, the highest such ratio on record in 30 years of Bloomberg data. The price-earnings ratio was 22.3, in the top 25% most expensive valuations since 1990.

This all left the market especially vulnerable to a “black swan” event such as the novel coronavirus that is wreaking havoc on economies and corporations around the world—an event that central banks and the government can’t mitigate easily with their traditional toolkits.

The repricing has been sudden and violent. The S&P 500’s last record was three weeks ago. Perhaps, then, the recovery will be just as swift? Making such a prediction would be ill-advised in normal times and downright foolish when it comes to a situation as unpredictable as this one. While stock market history offers no past event exactly like this one, recovering from other bear markets has never been swift. The minimum time it’s taken for the market to return to its highs in previous episodes is 320 trading days, or roughly 15 months, according to Bloomberg strategist Cameron Crise. The median is two and a half years. Both the swiftness of the decline and the heady valuation of the market at the beginning could lengthen the recovery time.

What’s easy to predict is another bull market will come eventually. It could have a different character. The long 2000s bull was built on the legacy of the financial crisis. We may see the next rally as the one in which businesses and investors adjusted to the new rules of a world that’s lived through a public-health crisis. —*Michael P. Regan*

► Shoppers at a Walmart in Wuhan on Jan. 24, the day after authorities imposed travel restrictions

● Market value added to stocks during the long rally

\$28t

▼ “The panic arrived faster than I expected,” Xie says





How quickly will China bounce back?

● Across China, factories that produce everything from smartphones to sneakers have been dormant since the Lunar New Year holiday in late January as the nation battled to contain the spread of the new coronavirus. Now plants are slowly coming back online, prodded by President Xi Jinping and other top Chinese leaders who worry that an extended shutdown will jeopardize the government's lofty development targets for 2020.

Economists are tracking energy consumption, poring over pollution charts, and studying data on traffic movements to discern how quickly the world's second-largest economy can get back to business. Bloomberg Economics has estimated that the economy was operating at as much as 80% of normal capacity as of March 6.

Millions of migrant workers who were left stranded by restrictions on travel imposed after the start of the January holiday are being allowed back into the megacities along China's east coast. They have to endure quarantines when they get there, but back they are going. About 78 million have returned to work, which is about 60% of those who went home for the holiday, and almost all will have returned by early April, the government said in early March.

Given the extent of the virus controls, it will take time to get that many people back on the job. At one stage the cheap-and-cheerful long-distance buses that ply China's highways were allowed to travel only half full as part of an effort to prevent contagion.

Economists have long suspected that China fudges its statistics, and so they have become accustomed to tracking proxies for economic

activity, such as energy consumption. The use of coal burned to generate electricity has been steadily ticking up and is now approaching normal levels for this time of year.

But, as ever, some are trying to game the system. In Zhejiang, a province on the east coast that's a manufacturing powerhouse, at least three cities gave factories targets for power consumption because they're using the data to show a resurgence in production, according to people familiar with the matter. To comply, some plant managers turned on all the lights and ran machinery as if they were operating at full capacity.

Just as China's factories are beginning to get back on their feet, they face a second blow: the spread of the disease and the associated risk of a collapse in economic activity in the major developed economies that are their main customers.

● Can you trust the data?

Manufacturing companies across China told Bloomberg News that the emerging challenge is now demand, not supply. "We are actually more worried about the development of the epidemic in Europe and the U.S., which will affect their domestic consumption," says Mark Ma, owner of Seabay International Freight Forwarding Ltd., a company in Shenzhen. About a third of the goods it handles are sold on Amazon, he says.

David Ni runs a company in Nanjing that buys aluminum alloy car wheels from Chinese producers and exports them to retailers in the U.S. He was planning to showcase his products at the ►

What I'm telling investors

Karen Van Voorhis, director of financial planning, Daniel J. Galli & Associates, Norwell, Mass.

It's human nature to live and react in the here and now. The challenge is complicated by the fact that the solution to most of people's fears is to do nothing. It feels like an unsatisfying thing to tell people. People rarely remember that not everything they have is in the stock market. I'll say, "You're looking at what the Dow is doing, but you're not only invested in the Dow. You have holdings in bonds and international equities. And you have cash—remember how we put that aside in a money market fund?" This is a double whammy, because it's not only a market downturn but it's also a health scare. It's different than having a trade war. The stress level is higher because there are legitimate health concerns. —As told to Annie Massa

◀ Inspired Home Show in Chicago in mid-March. But the trade show, like so many others, has been canceled. “I’d booked hotel, flight ticket, and a booth—everything was ready,” says Ni, who’s based in Los Angeles. “But seeing the situation in the U.S., I began to feel afraid of going on business trips.”

There’s also a risk that the outbreak in China isn’t really under control. Although government statistics show a marked decline in the number of new infections registered daily both in Hubei province and in the rest of the country, there are suspicions that authorities are manipulating the data, as case numbers have been repeatedly revised through the course of the outbreak. Also, health specialists have warned that the country could experience

a resurgence in cases as factory staff return.

No matter how quickly life returns to normal, China is facing its first quarterly economic contraction in decades and the weakest year since the early 1990s. But though unemployment is likely to rise, it’s starting from a relatively low level of 5.2%, and there’s no evidence of widespread job losses yet. Consequently, there’s been little talk yet of a stimulus package on the scale of the one Beijing cobbled together in response to the 2008 global financial crisis, which equaled about 12% of the size of the economy. That may change as the machinery of government, also disrupted by the virus, resumes working. —*Jeff Black, Jinshan Hong, and James Mayger*

Could there be a financial contagion?

● The coronavirus is threatening to expose the Achilles heel of the U.S. economy: heavily leveraged companies. As the expansion stretched into a record 11th year and interest rates stayed at ultralow levels, business debt ballooned and now exceeds that of households for the first time since 1991.

What’s more, borrowing increasingly has been concentrated in riskier companies with fewer financial resources to ride out virus-driven difficulties. A wave of defaults would intensify the economic impact of the contagion. “It will add to recessionary pressures in the U.S.,” says Nariman Behraves, chief economist at consultant IHS Markit Ltd.

Energy companies are especially vulnerable because of a collapse in oil prices. But they’re not alone. Debt tied to travel companies such as American Airlines Group Inc. and Hertz Global Holdings Inc. has been hit hard in the fixed-income markets, as have the obligations of movie theaters and casinos.

Federal Reserve Chair Jerome Powell has dismissed comparisons of the business borrowing binge to the precrisis housing debt bubble, arguing that the financial system is now better able to handle credit losses. But he has acknowledged that some debt-laden businesses could face severe strains if the economy deteriorates and that they could amplify any downturn by laying off workers and cutting back on investment.

The Fed is trying to cushion the economy—and the corporate sector—from the blow of the coronavirus by cutting interest rates and pumping money into the financial system. Behraves says Congress and the White House will also have to act. “We’re going to need them to set up a bailout fund, then decide where to distribute it,” he says.

On March 9, stock markets posted their worst losses in more than a decade. President Trump told reporters later in the day that he’d seek a payroll tax cut and “very substantial relief” for industries

“It will add to recessionary pressures in the U.S.”





that have been hit by the virus, reversing course on the need for economic stimulus.

There are about \$1.3 trillion in high-yield bonds outstanding, up from \$786 billion a decade ago. The investment-grade credit market has more than doubled, to \$6 trillion, in the same period. Almost half the investment-grade bond market is now rated BBB, which means it could be downgraded to junk levels if the economy falters. Should that happen, many investors would need to sell the debt to comply with restrictions on the quality of their holdings.

● Who's at risk this time?

In the \$1.15 trillion leveraged loan market—where companies already carrying a lot of debt accumulate more—borrowers have used adjustments to their earnings to reduce their apparent level of indebtedness. A downturn could expose their weakness. Analysts at Barclays Plc estimate that buyers of U.S. leveraged loans will be able to

recover only 55¢ to 60¢ on the dollar, compared with 67¢ historically, because of companies' dubious earnings math and rising debt loads.

With broad financing markets shut for now, desperate companies are turning their attention to the \$812 billion private-credit market. In times of stress, these lenders—private equity firms and others—often step in to provide financing to borrowers that would otherwise have to go without, at a cost.

But that might not be a cure-all. A slowdown in consumer and business spending could be particularly damaging for broadly syndicated loans and private credit, much of which is debt rated B and below, according to UBS Group AG credit strategist Matthew Mish. That debt is among the riskiest in the high-yield market because downgrades can put it in CCC, the lowest tier.

“Companies with vulnerable balance sheets—meaning little cash, high maturing debt—are going to have difficulty refunding themselves,” Mohamed El-Erian, chief economic adviser at Allianz SE, told Bloomberg Radio on March 9. “There is going to be an increase in credit defaults.” —*Rich Miller and Claire Boston, with Kelsey Butler and Davide Scigliuzzo*

▲ Wuchang train station on Feb. 5



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▲ Walking the desolate streets of Wuhan's Jiangnan District on March 7



◀ Opening hours at a mall in Qingshan District on March 5

What I'm telling clients

Mark Haefele, CIO at UBS Wealth Management, Zurich

Taking a look at the overall coronavirus picture, we think it's going to accelerate a lot of larger trends. One is genetic therapies. We've seen the rapid sequencing of the virus to see how it's mutating. Another one is the digital consumer. The trend toward use of facial-recognition software—that trend is accelerating. And the future of food, not just moving to plant-based foods but also microfarming and the provenance of food.

While markets are good at pricing slowdowns in growth, they're bad at pricing just how fast a recovery can take. People adapt. There are some pent-up sales. What makes this such an interesting period is if our baseline view holds that this gets settled in the first half of the year, we're in a situation with low interest rates and high global stimulus applied. With a global economy that went into this in decent shape, that is a highly stimulative environment. We could see a very sharp recovery in the back of the year. —As told to Joanna Ossinger

Who wins the oil price war?

● Saudi Arabia and Russia have long been at odds over how to cope with falling oil prices. It took the coronavirus to bring the conflict out into the open and set off a price war that sent crude down as low as \$31 a barrel in early March.

For Russian President Vladimir Putin and Saudi Crown Prince Mohammed bin Salman, oil is the lifeblood of their economies—and their political power. Saudi Arabia depends on oil for almost 70% of government income, according to the International Monetary Fund. For Russia it's 40%, including gas.

On March 6, Putin refused to go along with MBS's plan to cut production among the oil-rich countries to put a floor under prices. Riyadh then declared a massive production increase for April, which Moscow matched. Prices went into free fall.

Russia and Saudi Arabia have a common enemy: the U.S. and its shale oil drillers, which have grabbed an increasing share of the world's oil market. At first glance, the U.S. should be the loser in the price war. Drilling in the Permian Basin of West Texas and New Mexico is far more expensive than in Siberia or the Saudi desert. Permian shale producers need an average of \$40 to \$50 a barrel to break even, according to Rystad Energy. Producers have already been weakened by lenders reluctant to finance their drilling and by falling demand because of the coronavirus.

But much depends on the economic resilience

of the other combatants. If the price war persists for months, Saudi Arabia appears to be in a weaker position. Riyadh needs oil prices of more than \$80 a barrel to balance its budget, higher than at almost any other time in the past 20 years. If it's forced to tap the piggy bank, the kingdom's cash reserves are \$500 billion—down a third from their peak in 2014.

Russia has spent the past five years resetting its economy to a lower oil price and rebuilding cash reserves to \$570 billion. Following a price slump and U.S. sanctions in 2014, Moscow has lowered the price at which its budget breaks even, to about \$50 a barrel from \$115 in 2013. And Russian companies can turn a profit at a much lower oil price.

President Trump cheered on the fall in prices, tweeting it was "good for the consumer." He may feel the domestic impact politically, however. The oil industry's pain could hurt his popularity in Texas. And the price plunge is ricocheting across U.S. financial markets—his personal gauge of success. To avoid disrupting his own presidency, Trump may have to intervene to keep Moscow and Riyadh from escalating further. The U.S. president called the Saudi prince on March 9, according to two people familiar with the situation. "It's no longer about economics," says Chris Weafer, chief executive officer of Macro Advisory, a Moscow-based consulting firm. "All three of them are hurting at this price." —Javier Blas and Jack Farchy

How is government responding?



● As the new coronavirus spread around the world, sickening tens of thousands of people, President Donald Trump suggested that warm weather would kill the virus and said the number of U.S. cases of Covid-19 was “going very substantially down, not up.” He predicted the imminent availability of a vaccine and blamed the Obama administration for the slow rollout of test kits.

With the number of cases in the U.S. now in four figures, public-health experts have harsh criticism for how the White House has responded. “This is an unmitigated disaster that the administration has brought upon the population, and I don’t say this lightly,” says Ashish Jha, director of the Harvard Global Health Institute. “We have had a much worse response than Iran, than Italy, than China and South Korea.” Financial executives are just as concerned: “Where is the U.S. leadership, which was one of the defining features of the crisis in 2008?” BlackRock Inc. Vice Chairman Philipp Hildebrand said on Bloomberg TV on March 10.

● Why didn’t the U.S. move faster?

The federal government’s role in the crisis began in earnest on Jan. 31, when Trump forbade most foreign nationals from entering the U.S. if they had recently traveled to China. “I give Trump credit for the travel restrictions—and he has taken that credit,” says Ian Bremmer, president of Eurasia Group, a political risk consulting firm.

But the few weeks of time the U.S. bought with the travel restriction were frittered away, experts say. What other countries have done, and what the U.S. didn’t do, is immediate and widespread testing for the virus, which Jha says is the single most important step in containing the spread of disease. The administration decided against a test already in use by the



Xi Jinping, China

After his government initially suppressed warnings about the outbreak’s severity, Xi claimed credit for locking down Hubei province and replaced local leaders. His success will depend largely on whether there’s a second wave of infections.

◀ When the going gets tough, go golfing



Hassan Rouhani, Iran

At the outbreak’s start, Iranian authorities made a show of solidarity with China and were slow to restrict international and domestic travel. Religious authorities in Qom, a pilgrimage site that was the epicenter of the Iranian outbreak, declined to restrict access to shrines. Iran’s missteps are reflected in the high number of government officials who have been infected, including about one-tenth of the nation’s 290-member parliament.



Moon Jae-in, South Korea

The government’s refusal to completely bar Chinese visitors sparked anger. Moon recovered by declaring “war” on the virus and instituting an aggressive and effective testing campaign. Some 210,000 tests (as of March 11) have left the country with one of the largest case totals—but also one of the lowest fatality rates.

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World Health Organization and instead developed its own version, even though “you could see the tsunami coming,” Jha says.

The U.S.’s resulting coronavirus test contained a faulty component that led to many inconclusive results. It took several

weeks to fix that. Initial U.S. guidelines for testing were also narrow, instructing hospitals and doctors to screen only people who had respiratory symptoms and had either traveled in China recently or come into close contact with someone who had been infected. In California, Oregon, and Washington state, the epicenter of the U.S. outbreak, those limits may have left undetected the virus’s spread to people who had done neither.

The White House’s messaging in January and into late February continued to be that the virus had been contained. “You would literally not know what to do to protect yourself if you were only listening to” the Trump administration, says Bremmer.

While states and public-health departments are largely responsible for their own preparedness and delivery of health care, the administration didn’t make sure hospitals and health departments had the funds, equipment, and training needed to respond to local outbreaks, say epidemiologists and other experts. That left facilities underprepared.

On Feb. 25, the president told reporters traveling with him in India that the virus was “very well under control in our country” and that the U.S. was “in very good shape.” Hours later, federal health officials warned that the spread of the virus was inevitable and advised businesses to arrange for employees to work from home and consider scrapping meetings and conferences.

“It’s not so much of a question of if this will happen anymore, but rather more of a question of exactly when this will happen,” Nancy Messonnier, director of the National Center for Immunization and Respiratory Diseases, part of the Centers for Disease Control and Prevention, told reporters. “We are asking the American public to work with us to prepare, in the expectation that this could be bad.”

Trump’s response, upon returning to the U.S., was to contradict that advice, saying he didn’t believe the virus’s spread was inevitable. “We have it so well under control,” he said. “We really have done a very

good job.” As criticism of the U.S.’s slow response grew, Trump on Feb. 26 named Vice President Mike Pence as his coronavirus coordinator. Even then, the president pronounced, “The risk to the American people remains very low.”

The next day, Trump named Deborah Birx as the official in charge of scientific and medical efforts against the virus. Birx, a medical doctor and retired Army colonel, had been the U.S. State Department’s highly respected global ambassador for AIDS prevention and treatment. Experts were pleased by her appointment but put off by what the White House did next—ordering all public communications to go through Pence. Jim Thomas, an epidemiology professor at the University of North Carolina, says previous health scares have typically had a scientist as the public face of the response and complained that this time scientific voices “have had to contend with the confusion introduced by the political voices.” On March 6, Trump signed an \$8.3 billion spending measure to speed federal funds for vaccine development and help state and local governments buy masks and other equipment, hire staff, supply laboratories, and assist community health centers. Just after arriving in West Palm Beach, Fla., where he spent the weekend playing golf and hosting a lavish birthday party for his son Donald Jr.’s girlfriend, Trump tweeted, “We have a perfectly coordinated and fine tuned plan at the White House for our attack on CoronaVirus.”

But all over the country, front-line medical workers were telling a different story by warning of supply shortages, and hospitals were uncertain when they’d be able to test suspected cases without relying on government labs. Lawmakers said the federal government would fall far short of being able to test 1 million people within days, as promised. Hospitals were getting fewer than half the high-quality respirator masks they were ordering, said Chaun Powell, a vice president at Premier Inc., which helps hospitals purchase supplies.

If Trump’s goal had been to minimize the threat to keep markets calm, his misstatements and delays may have had the opposite effect: On March 9 the stock market saw its biggest rout since the 2008 financial crisis, sending shares down about 19% from their Feb. 19 all-time high. The U.S. dollar, normally strong in times of crisis as investors seek a haven, has lost value, which may reflect a lack of confidence by markets in the administration’s response.

“The federal government is the only game in ►



Lee Hsien Loong, Singapore

Cases in the city-state surged to among the highest outside China in the early weeks of the outbreak. Prime Minister Lee’s communications struck a reassuring tone. The government laid out steps people could take to help prevent the spread of the virus and detailed the risks associated with infection. Singapore has taken stringent measures, including setting up quarantine facilities and contact-tracing cases.



Shinzo Abe, Japan

Not only could the virus tank Japan’s economy, it’s raising questions about whether the Summer Olympics will be canceled. As cases of Covid-19 mounted, Abe lurched from a relatively relaxed approach to restricting travel from China and South Korea and shutting down schools for a month.



Giuseppe Conte, Italy

Conte has drawn fire for his handling of the biggest coronavirus outbreak in Europe. In early March he bungled the announcement of a series of increasingly drastic measures to halt the virus. Ultimately, the government placed all of Italy under lockdown. The efficacy of these measures is still unclear, but they will tip an already weak economy into recession.

—Benjamin Harvey, Kanga Kong, Philip Heijmans, Peter Martin, Alessandro Speciale, and John Follain

TRUMP: ANDY BUCHANAN/GETTY IMAGES; XI: XIE HUANCHI/ALAMY; ROUHANI: JASON ALDEN/BLOOMBERG; MOON: SOUTH KOREAN PRESIDENTIAL BLUE HOUSE/GETTY IMAGES; LEE: NICKY LOH/GETTY IMAGES; ABE: TOMOHIRO OHSUMI/GETTY IMAGES; CONTE: FILIPPO MONTEFORTE/GETTY IMAGES

Why did containment fail?

town,” wrote Stephen Stanley, chief economist at Amherst Pierpont, in a note to clients, in which he also warned against thinking that additional Federal Reserve easing or fiscal stimulus could do much good. “I would argue that the most important front right now is the public health response,” he wrote, which has “been underwhelming.”

For a president who often measures his success by how well stocks are faring, the market plunge was enough to reverse course on the need for economic stimulus. Trump announced he would meet with congressional officials soon to work on a measure to provide “substantial relief,” including to industries that have been hit by the virus.

● What can we do to catch up?

Comparisons with other countries’ responses highlight the U.S.’s lack of central coordination. Singapore is the standout, says Eurasia’s Bremmer. The country responded quickly and transparently, giving the public a wealth of information about how to protect itself. For example, the government created an app to inform users where people with the virus had visited so others could avoid those places. South Korea is a close second, Bremmer says: It created drive-thru testing centers, among other measures.

The U.S. effort is moving toward what those countries have done, belatedly. The CDC is advising high-risk people to stock up on medicine, food, and household necessities and to avoid crowds and contact with people who are sick. Conferences, festivals, sporting events, college classes, and business travel are being sharply curtailed. Under pressure from governors, several large health insurance companies said they’d waive patients’ costs for coronavirus tests. Labs in every state are now capable of testing for the virus. But Illinois Governor J.B. Pritzker said on March 10 he was “frustrated” by the federal government’s lack of assistance with testing.

For now, the Pollyanna-ish tone at the top has died down. On Feb. 27, CDC Director Robert Redfield downplayed Messonnier’s warning that the virus would spread beyond those who had traveled to China or come into contact with an infected person. By March 10, he conceded to House lawmakers that the U.S. is past a containment-only approach and must now try to limit the virus’s impact: “In some areas, we’re in high mitigation.” —Margaret Newkirk and Paula Dwyer, with Justin Sink, Mario Parker, Jennifer Jacobs, John Tozzi, and Steve Matthews

● Patient zero for the new coronavirus outbreak in the U.S. appeared to do everything right. He arrived on Jan. 19 at an urgent-care clinic in a suburb north of Seattle with a slightly elevated temperature and a cough he’d developed soon after returning four days earlier from a visit with family in Wuhan, China. The 35-year-old had seen a U.S. Centers for Disease Control and Prevention alert about the virus and decided to get checked. He put on a mask in the waiting room. After learning about his travel, the clinic drew blood and swabbed his nose and throat, then called state and county health officials, who hustled the sample onto an overnight flight to the CDC lab in Atlanta. The patient was told to stay in isolation at home, and health officials checked on him the next morning.

The test came back positive that afternoon, Jan. 20, the first confirmed case in the U.S. By 11 p.m., the patient was in a plastic-enclosed isolation gurney on his way to a biocontainment ward at Providence Regional Medical Center in Everett, Wash., a two-bed unit developed for the Ebola virus. As his condition worsened, then improved over the next several days, staff wore protective garb that included helmets and face masks. Few entered the room; a robot equipped with a stethoscope took vitals and had a video screen for doctors to talk to him from afar. County health officials located more than 60 people who’d come into contact with him, and none developed the virus in the following weeks. By Feb. 21 he was deemed fully recovered.

Somehow, someone was missed. All the careful medical detective work, it’s now clear, wasn’t enough. In February firefighters in Kirkland, Wash., began making frequent visits to a nursing home where residents complained of respiratory problems—evidence of continuing transmission that burst into public view on Feb. 29 when officials announced the first sicknesses, and later multiple deaths, of people at the facility from Covid-19, the disease caused by the virus.

The Seattle area, which had 260 infections and 23 deaths as of March 10, is, for now, the center of the most severe U.S. outbreak. That may change soon.



“We are past the point of containment and broad mitigation strategies—the next few weeks will change the complexion in this country,” Scott Gottlieb, a former Food and Drug Administration commissioner, said on March 8 on CBS’s *Face the Nation*.

This reconstruction of how the virus spread around Seattle, based on interviews with health-care providers, first responders, relatives of patients, and academic researchers, offers lessons to places such as Florida and California that are reporting their first deaths. There were excruciating missed opportunities, especially at the nursing home. One shortcoming was a lack of testing in a critical six-week window when the virus spread undetected. Even recently, some patients say, hospitals weren’t taking enough precautions to protect staff and others from infection.

Governments are bowing to the reality of unprecedented, economy-killing measures seen as drastic just weeks ago. Italian Prime Minister Giuseppe Conte on March 9 ordered nationwide closures of public places including schools, gyms, and theaters and asked everyone to stay home after hospitalizations strained its health-care system.

Although a lockdown of a U.S. city such as Seattle is hard to imagine, something similar might happen, Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases, told Fox News. “You don’t want to alarm people, but given the spread

we see, you know, anything is possible,” he said.

On Jan. 15, when the traveler to Wuhan who became the first known U.S. case returned to Seattle-Tacoma International Airport, he took group transportation from the airport with other passengers, county officials said. At the time, 41 people in Wuhan had been diagnosed with the new coronavirus, and Chinese officials said the threat of human-to-human transmission was low. A CDC notice advised Americans who’d been in Wuhan and felt sick to seek care. On Jan. 17 the U.S. began checks of passengers from Wuhan at airports in Los Angeles, New York, and San Francisco. Two days later the recent arrival from Wuhan visited the urgent-care clinic in Snohomish County, and the intensive response began.

In retrospect, it was already too late. Some researchers who’ve traced the viral genomes of patients around the world now say someone else in the area might have picked it up between Jan. 15 and Jan. 19, before the traveler went to the hospital. He might have sneezed in the airport shuttle or on some surface. “This virus is more contagious than the flu, so any sort of exposures before he got to the hospital would be certainly of high concern,” says George Diaz, who leads the infectious disease department at Providence, where the patient was treated. By Jan. 30 the patient’s symptoms had resolved, according to a *New England Journal* ▶

▼ A deserted Pike Place Market in Seattle



◀ of *Medicine* paper. Snohomish County officials allowed him to leave home isolation three weeks later.

● **What slowed testing down?**

Early in February the CDC began shipping test kits to laboratories around the country as news out of Wuhan grew alarming—tens of thousands more sickened and a virtual lockdown imposed to keep people in their homes. Outbreaks hit Iran, Italy, and South Korea. More cases around the U.S. were reported, suggesting other travelers may have brought the virus home with them. For every dozen cases the U.S. caught, it probably missed 20 or 25, estimates Marc Lipsitch, an epidemiology professor at the Harvard T.H. Chan School of Public Health. “It may be, for

example, that Seattle got unlucky and had an early introduction that did take off into a chain of transmission, and other places that did nothing different might have had better luck,” he says. “It’s quite possible that we’ll see some places with lots of cases once we start testing.”

Testing around the U.S. was hampered when local officials reported flaws in the kits the CDC sent. Replacements didn’t come until weeks later, which left most hospitals and clinics short of tests. Shifting guidelines for who should get the few tests available also confused hospitals, Diaz says. At the time, there still had been only the single case reported in Seattle.

Trevor Bedford, a Harvard-trained researcher and viral genome expert at Seattle’s Fred Hutchinson Cancer Research Center, wondered why. He had

Are American workers ready?

18

Many working Americans lack health benefits, while more workers than ever are in industries where they have to show up to get paid, including health care and restaurants. Older workers, who are particularly vulnerable to Covid-19, make up an increasing portion of the U.S. labor force. Here’s a look at how various risk factors vary by income level and industry. —*Dorothy Gambrell*

What benefits do workers enjoy in different industries?

Percentage of workers with / Access to paid leave / Health benefits / Ability to work from home



◀ Highest weekly wages

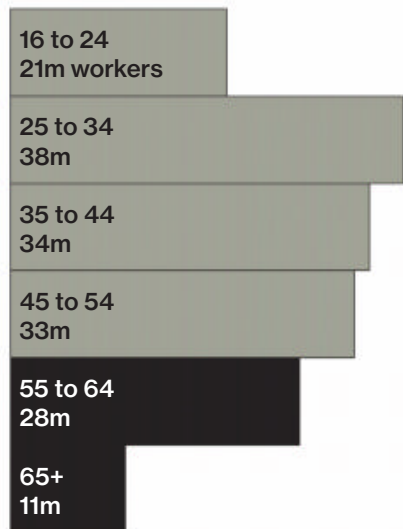
spent weeks analyzing genomes of patients from around the world, tracing minor mutations to deduce how Covid-19 emerged and spread. The early work found that infections were doubling roughly every six days, and that for every three to four rounds of transmission—or once every 20 to 30 days—one minor mutation was occurring, Bedford said in an interview on Feb. 13. “We are watching very carefully for more local transmission,” he said. They soon found it: a teenager with mild symptoms who attended a high school about 15 miles from where the first case was identified—someone who wouldn’t have been tested because he didn’t meet the criteria. But the results showed up in the Seattle Flu Study, a project on which Bedford is a lead scientist.

The new case, announced on Feb. 28, was

genetically identical to the original except for three minor mutations in the virus. And it contained a key genetic variant that was present in only two of 59 viral samples from China. This type of circumstantial evidence stops just short of proving a chain of transmission. It’s possible the Washington cluster didn’t derive from the known patient zero, but from another case that came into Washington at the same time and went undetected. Still, Bedford calculated a 97% probability the new case was a direct descendant—one that hadn’t been spotted because of the narrow testing at that time, he wrote in a blog post on March 2. “This lack of testing was a critical error and allowed an outbreak in Snohomish County and surroundings to grow to a sizable problem before it was even detected,” he wrote.

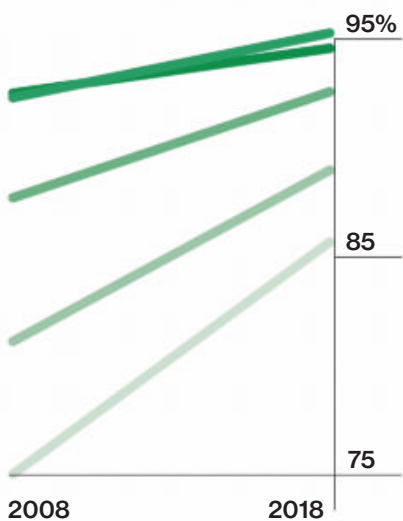
How old are they?

■ A more than 20% increase in workers from 2008-18

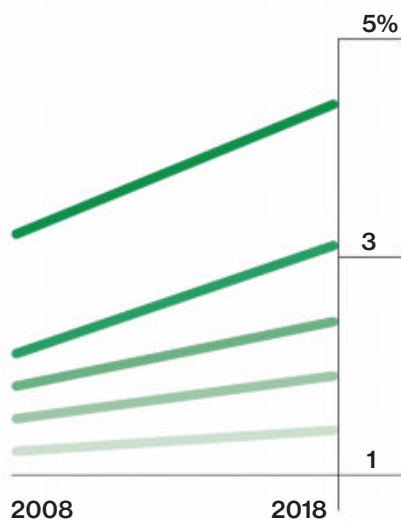


Do they have health benefits?

Income bracket: / Lowest / Second / Third / Fourth / Highest

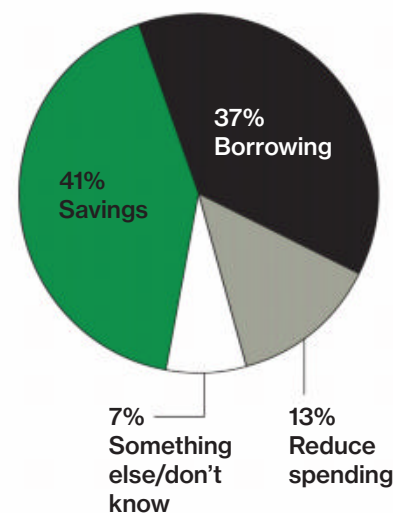


Do they work from home?

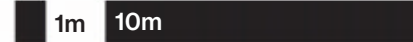


Can they handle a financial emergency?

How Americans would cover an unexpected \$1,000 expense



Box width = number of workers



Education and health services

Other services

Retail trade*

Leisure and hospitality



Lowest weekly wages ▶

*TRANSPORTATION IS CATEGORIZED WITH UTILITIES AND WHOLESALE TRADE IS CATEGORIZED WITH RETAIL TRADE FOR WORK-AT-HOME AND PAID LEAVE DATA RELEASED BY THE BUREAU OF LABOR STATISTICS. DATA: BUREAU OF LABOR STATISTICS, AMERICAN COMMUNITY SURVEY, BANKRATE JANUARY 2020 FINANCIAL SECURITY INDEX

● How did the area handle the rapidly growing number of cases?

The consequences were deadly for residents of Life Care Center, a nursing home in the Seattle suburb of Kirkland that houses elderly and often very sick patients. February was an unusually busy period for 911 calls to the home, says Evan Hurley, a Kirkland firefighter and union representative. The number went from seven in January to 33 for February and the first few days of March, he says, citing call logs later used to track which staffers needed to be quarantined. Firefighters weren't always wearing masks; sometimes the calls were for a nosebleed or some other problem, Hurley says. But by late February, he recalls, a lieutenant remarked about the number of recent visits to Life Care for breathing issues and fever. A captain shared the concern with the county. Then, on Feb. 28, came word that a patient transferred from the home had Covid-19. The fire department declared the facility a "hot zone" requiring full protective gear. An initial group of 17 firefighters was quarantined. The next day, state officials announced the first death in the U.S. attributed to the new coronavirus and said that more than 50 people associated with Life Care were sick and being tested.

The facility's low-slung building in a nondescript part of town dotted with condos became the center of an unfolding crisis. Authorities dramatically increased public warnings—while, families contended, doing little to save people in the home. "They are being left to be picked off one by one by this disease," Kevin Connolly, a relative, told television reporters outside.

King County officials quickly moved to purchase a motel and set up modular housing to isolate patients, a jarring escalation. Within days of the first deaths, they advised people older than 60 to stay away from public places, while avoiding a total ban on big events. A comic-book convention planned for downtown Seattle held out until March 6 before canceling. "We are determined to protect those who are most vulnerable—our older residents, those with compromised immune systems—and, in doing those things, we also want to protect our economy," King County Executive Dow Constantine told reporters.

Amazon.com Inc., Microsoft Corp., and other companies told Seattle-area staff to work from home if possible, and the University of Washington shifted to online classes for the rest of the quarter ending March 20. As of March 8, King County reported 83 cases and 17 deaths, all but one tied to the nursing home. The challenge for the health system is that in the vast majority of cases, symptoms remain mild—but some percentage of people require hospitalization.

At Providence in Everett, where patient zero was treated, bed space could become an issue. The hospital has started a program to discharge stable patients, Diaz says. They're sent home with a thermometer and an oximeter, a measurer of respiratory health. Readings are transmitted to Providence, and if the patient's condition worsens, he or she can quickly be returned to the hospital. Ten patients were in the program on March 8, Diaz says.

Still, some people complain that area hospitals aren't consistently following protocols to isolate possible cases. On a doctor's orders, Alicia Hansen on March 3 took her mother, who's had cancer multiple times, to the Swedish Hospital First Hill emergency room after she developed fever and breathing difficulties. She and her mother lived together not far from the nursing home in Kirkland. According to Hansen, some hospital staff were in and out of her mother's room without masks in their first 45 minutes at the facility. Hansen herself, who could have been exposed to the virus, was mixed with the general population in a waiting room while her mother was treated and tested for Covid-19. The test came back negative, but her mother died on March 7. A spokesman says the hospital is following WHO's guidelines for dealing with potential Covid-19 patients.

At Life Care on March 6, 15 more people were hospitalized within 24 hours. Within days, infections began turning up in other homes. The facility also serves as a short-term rehabilitation center, and firefighter Hurley says some of those patients were discharged to other places in the weeks before the spread of the virus was known. (Life Care says the first patient later diagnosed was picked up from the home on Feb. 19. Hurley says it may have been as early as Jan. 22, based on call logs.) "We don't think we're anywhere near the end of this," Hurley says. "This spread is not limited to Life Care."

On March 6, a nursing home in Issaquah, a suburb east of Seattle, said a resident tested positive for Covid-19. Four days later, county health officials said 10 long-term care facilities had positive cases. All told, 31 Kirkland firefighters have been quarantined—almost a third of the department—in addition to 10 from other communities, as well as some relatives.

Bedford, the genome expert, is working with researchers from the University of Washington to understand the extent of the spread. In early March the university started using its own virus test, a modified version of one the World Health Organization created. When a positive result is found in a sample, the researchers perform a second round of tests to sequence the viral genome. Pavitra Roychoudhury, a university researcher in charge of sequencing, says technicians have been working late into the night

● Number of cases in King County as of March 8

83

■ COVID-19 / GOVERNMENT

to complete as many samples and sequences as possible. She puts her toddler to bed and then logs back on to her computer.

On a call with reporters on March 9, Nancy Messonnier, director of the CDC's National Center for Immunization and Respiratory Diseases, called Bedford's theory that the original U.S. coronavirus patient in January was the source of the outbreak in the state "interesting," but said other possibilities won't be ruled out. "There are alternate explanations of the same findings," she said. There may have been a "secondary seeding," as more recent cases in Washington match viral sequences posted in China. So far, Bedford has reported, sequencing still suggests the transmission is related to the original patient. What's more, the state's early cases may have seeded infections spreading on the cruise ship *Grand Princess* (now docked in Oakland), he tweeted on March 6. On March 10, he tweeted that the accumulating data "points to a growing outbreak of #COVID19 in the greater Seattle area" and that if people don't heed the social-distancing warnings of health authorities, "I fully expect cases to keep climbing." —*Peter Robison, Dina Bass, and Robert Langreth, with Emma Court and Michelle Fay Cortez*



How did South Korea get ahead?

South Korea is experiencing one of the largest coronavirus outbreaks outside China, where the pneumonia-causing pathogen SARS-CoV-2 first took root late last year. But unlike China, which locked down a province of more than 60 million people to try to stop the illness from spreading, Korea hasn't put any curbs on internal movement in place, instead testing hundreds of thousands of people everywhere from clinics to drive-thru stations.

The testing blitz appears to be paying off in a lower-than-average mortality rate. The outbreak also shows signs of being largely contained in Daegu, the city about 150 miles south of Seoul where most of the country's more than 7,700 infections have emerged.



▲ Medical staff get samples at a drive-thru clinic testing people for the coronavirus in Goyang, north of Seoul, on Feb. 28

◀ People arrive in their cars at the Goyang center, where testing takes about 10 minutes

It's an approach born of bitter experience. An outbreak of Middle East respiratory syndrome in 2015 killed 38 people in South Korea. Because of a lack of kits to test for the MERS pathogen, infected patients went from hospital to hospital seeking help, spreading the virus widely. Afterward, the country created a system to allow rapid approval of testing kits for viruses that have the potential to cause pandemics.

When the novel coronavirus emerged, that system allowed regulators to collaborate quickly with local biotech companies and researchers to develop testing kits based on a genetic sequence of the virus released by China in mid-January. Companies were then granted accreditation to make and sell the kits within weeks—a process that usually takes a year.

South Korea has managed to test more than 210,000 people for the coronavirus, using kits with sensitivity rates of more than 95%, according to the director of the Korean Society for Laboratory Medicine. That's in stark contrast to China, where unreliable and inadequate testing resulted in thousands of infected patients not being quarantined until it was too late. A similar scenario may be playing out in Japan and the U.S.

Testing widely has meant South Korea knows where its infections are centered, and so far it's been able to keep them largely contained, with outbreaks beyond Daegu in the minority. The country reported many consecutive days of slowing infections until ►

"We are testing people on the biggest scale, at the fastest pace in the world"

◀ March 11, when a new cluster of cases was tied to a call center in Seoul.

The emphasis on diagnosis is also being credited with helping patients get treatment early, bringing the mortality rate from the coronavirus to less than 1%—below every other affected country save Singapore, where the outbreak is on a much smaller scale. “The coronavirus is highly contagious, and even those without symptoms can transmit the virus, which makes it hard to stop infection among communities,” says Lee Hyukmin, director at the Korean Society for Laboratory Medicine and a professor at Yonsei Severance Hospital. “Without enough testing capabilities, the death rate will be high, as the delay worsens the damage in the lungs.”

By late February, when South Korea’s outbreak began to accelerate, four local companies had approval to sell kits to test for the virus. The country is now

able to test more than 10,000 people a day. In neighboring Japan, a total of only 9,600 people had been tested as of March 10.

The tests can deliver results within hours and are relatively easy to administer. Officials in Seoul have started operating drive-thru stations in three districts where people can get tested without leaving their cars.

The country is also exporting its testing kits, including to China, Europe, and Pakistan, according to the manufacturers. “We are testing people on the biggest scale, at the fastest pace in the world, and disclosing the results transparently and instantly to the public,” said President Moon Jae-in in a speech on March 3. “We believe this is the best thing we can do for now in order to prevent further spread in local communities.” —*Heejin Kim, Sohee Kim, and Claire Che, with Jihye Lee*

Why was Iran hit so hard?

● Iran is dealing with one of the world’s worst outbreaks of the new coronavirus, and the disease was quick to reach the top ranks of the government. Four current and former Iranian officials have died so far from coronavirus: a member of the Expediency Council that advises 80-year-old Supreme Leader Ayatollah Ali Khamenei; an aide and mentor to Foreign Minister Mohammad Javad Zarif; a former ambassador to the Vatican; and a newly elected member of parliament. Iraj Harirchi, the deputy health minister in charge of the country’s coronavirus task force, has it himself, as does the head of Iran’s medical services. Vice President Masoumeh Ebtekar, once spokeswoman for the revolutionaries who took 52 Americans hostage at the U.S. Embassy in Tehran in 1979, says she’s sick with the virus, too.

● How did the virus reach Tehran?

Major General Hossein Salami, the head of Iran’s Islamic Revolutionary Guard Corps (IRGC), announced the likely culprit at a military ceremony in Kerman province on March 5: a U.S.

biological attack, first on China and then on Iran. Salami’s lashing out at foreign enemies underlines the sense of bewilderment in Iran as to why the disease has struck the country so hard. According to Iranian government statistics, as of March 11 there were 9,000 confirmed cases of Covid-19, as the disease from the virus is called, and 354 deaths across the nation of 84 million. The coronavirus seems to have shot up northern Iran’s highway artery from Qom, a major religious center, to the capital of Tehran, which is now the country’s most affected city. Despite its being the source of the earliest cases in Iran, Qom was never placed under quarantine—a stark contrast to containment measures taken in China and in Italy, the worst-hit European nation. (Following Iran’s trajectory, politicians in Italy and France have tested positive for coronavirus.)

Qom is an important center for a government in which many high officials—right up to President Hassan Rouhani—are also clerics. And Qom’s religious leaders are powerful political figures in their own right. A senior cleric who represents the city in parliament, Mojtaba Zonnour, is among the ▶

▶ A woman wears a mask in Tehran





◀ MPs receiving treatment for coronavirus in a hospital. He has close links to Salami's IRGC. "Many of the officials travel to Qom, and they go there frequently," says a person close to the government who asked not to be identified.

Senior conservative clerics are making unusual on-camera statements, urging the faithful not to kiss or lick religious shrines. But not everyone listens. In one clip posted on Twitter in late February, a young man warned against frightening the public with scare stories, then made a show of kissing Shiism's second holiest shrine, in Qom.

Many hospitals in Iran have been designated entirely to treating coronavirus patients. Six of 14 Tehran hospitals contacted by Bloomberg News on March 6 said that they were full and that new patients either would have to wait, or that they wouldn't be admitted at all. "We have 14 patients in the emergency ward who have been waiting for an empty bed for two days now," said an administrator at Torfeh Hospital in downtown Tehran.

A doctor in Gilan province says patients with coronavirus-type symptoms were coming to local hospitals two weeks before the government publicized the first Iranian case, in Qom, on Feb. 19. Chest scans showed signs of an unusually virulent pneumonia, "but nobody was taking it seriously," says the doctor, who asked not to be named. It took until March for the province to get its own testing facilities, the doctor says. Before that, tests had to be sent to Tehran, causing delays and errors.

With some doctors and nurses infected, medical personnel are in short supply, as are protective equipment and disinfectants, according to the doctor. Medicine is scarce, too, at least in part because of sanctions that the U.S. reimposed after President Trump withdrew from a multilateral 2015 deal that limited Iran's nuclear fuel program. "Divvying up a small amount of medicine

among a large number of patients is a daily headache," says the doctor, who estimates that 10 to 12 Covid-19 patients a day on average die at the hospital. "We had 18 to 20 deaths in one day alone, and some of the deceased are tested only after they die, to determine burial procedures." A hospital official said it could not confirm the number of deaths from coronavirus.

Many in Tehran are staying home, venturing out only to buy essentials. In the runup to the Iranian New Year on March 20, stores in Tehran would normally be jammed, but many—especially those offering luxury goods—are empty. "We've been caught in the crossfire," says Majid, a 42-year-old driver for the Iranian ride-hailing service Snapp, who would only give his first name. "On the one side, our incompetent officials have failed to contain the virus. They opened the gates to flights from China as if corona was a joke. On the other side, they have raised the price of gasoline and advised people to stay inside."

● Can Iranians trust their government again?

The government's response has been inconsistent. It blocked roads to provinces with high infection rates, such as Gilan and Mazandaran on the Caspian Sea north of Tehran, and schools have been closed. But no cities are locked down, and employees in government offices and state organizations were working on a normal schedule as of March 7. At the same time, a deputy health minister made a televised plea for people to stay at home: "We have 140,000 beds across all hospitals in the country, but we may have to add new beds by 10 times that number if people don't observe health measures," he said on March 6.

With Iranians sequestering themselves at home, state TV channels are airing dubbed foreign films, including the *Lord of the Rings* and *Toy Story* series,

▲ Masks dominate at a mosque

to keep people entertained. Instagram, WhatsApp chat groups, and Telegram channels have become hubs for plague jokes and at-home exercise tutorials. In a country where dancing in public is officially discouraged, videos of dancing nurses have become a phenomenon: Nurses filmed themselves swirling their hips and wrists to pop songs, their identities shielded by hazmat suits, masks, and hospital gowns.

Trust in the government, never high among a large share of Iran's populace, may be at an all-time low. A visibly ill Harirchi assuring the nation on live TV on Feb. 24 that the government had everything under control did little to inspire confidence. Memes ridiculing official responses to Covid-19 have gone viral. "The first Friday without wishing for the death of other nations," went one joke, shared on social media after Friday prayers were canceled on March 6. "Well done to the people of Iran."

Jokes aside, the outbreak in Iran is deadly and shows no sign of abating. Infections in the area are going up "exponentially," says Gholam Ali Jafarzadeh, an MP for the city of Rasht in Gilan province. "We will witness a humanitarian catastrophe if serious measures are not taken." —*Arsalan Shahla, Golnar Motevalli, and Marc Champion*

Should we bail out companies left reeling?

● Covid-19 will cause some companies to fail and will push entire sectors to the brink. The question is how much the federal government—and, by extension, the American taxpayer—should do to rescue companies felled by the economic effects of the virus. It's treacherous territory. Bailouts of financial institutions damaged by the 2008 crisis provoked populist anger on the left and the right. Donald Trump owes his presidency in part to the public's revulsion over taxpayer funds going to Wall Street while ordinary citizens suffered.

Now it's the Trump administration that has to decide which companies and sectors merit help, how much, and in what form. On March 10 the president pitched Republican senators on economic relief for the travel and hospitality industries, Lindsey Graham of South Carolina, who attended

the meeting, told Bloomberg News. Graham said Senators John Hoeven of North Dakota and James Lankford of Oklahoma suggested a federal bailout for the shale drilling industry. "I don't know at this point if that will be in any final package," Senator John Thune of South Dakota said.

The argument in favor of bailouts is that the Covid-19 pandemic is an out-of-the-blue disaster that no company could reasonably have been expected to prepare for, and if companies fail, there will be serious harm to their employees, customers, suppliers, lenders, and the overall economy.

The argument against bailouts is that companies can and do continue to operate even if they require protection from creditors in federal bankruptcy court. True, shareholders may lose everything without a bailout, and creditors will take a haircut, but that's how capitalism works. "Capitalism without bankruptcy is like religion without hell," says Jeffrey Miron, an economist at Harvard and the libertarian Cato Institute, quoting an economists' bromide.

The key question in assessing whether to bail out a firm is whether its failure would cause harm to the overall economy. Timothy Geithner, who was President Obama's Treasury secretary, argued that saving financial institutions in the 2008 crisis was crucial because they were too big to fail and too interconnected. If one defaulted, it could trigger a cascade of defaults that would shut down lending and destroy the economy.

In other industries, though, the failure of one company can help competitors. If one airline shuts down, its rivals pick up its customers, and with one less rival, their prices can rise to more profitable levels. So letting weaker companies go under could save an industry.

Another question is who wins from a bailout. After the financial crisis, some Democrats argued that the government should have done more to help homeowners pay their mortgages, rather than helping banks that recorded losses when they foreclosed on the loans. Similar arguments may be made this time around. Dean Baker, senior economist at the liberal Center for Economic and Policy Research, says the quid pro quo for any bailout should be a hard cap of \$1 million in annual compensation for the company's chief executive officer and other officers. ("I'm confident that they can find good help for under a million bucks," he says.)

Whoever wins from a rescue, though, someone else is going to lose by comparison. That's why most economists urge caution. "One should be very hesitant about bailouts," says Harvard's Miron. "Once you do it, it gets harder not to do it again the next time." —*Peter Coy*

What I'm telling my medical school students

Dr. Judith Aberg, the Dr. George Baehr professor of clinical medicine, Icahn School of Medicine at Mount Sinai, New York

For me, there's no single sentence for the medical students, as they have so much to learn. They should learn all they can about SARS-CoV-2. The more you educate yourself, the more you'll be able to educate and inform others. What is this virus? How is it similar or different than other respiratory viruses? Why is it spreading so fast? How do you protect yourself and others? How do you screen and diagnose people who may be at risk of Covid-19? What are the best infection prevention practices? How do we treat someone with Covid-19? What are the potential new therapies?

I think many would say wash your hands or stay calm, but in reality, [medical students] need to know so much more. —*As told to Cynthia Koons*

How will Africa

cope with an outbreak?

March 16, 2020

● In a red-roofed building at the edge of the University of Abuja Teaching Hospital campus, the walls are freshly painted, a crew is laying pipes for refurbished bathrooms, and others are hauling in furniture. The single-story concrete structure, meant for trauma victims at the largest health-care facility in the Nigerian capital, is being rapidly repurposed to quarantine patients diagnosed with the coronavirus, putting it on the front lines of Nigeria's—and Africa's—efforts to contain the illness. “We are moving, we are going to get there,” Yunusa Thairu, the leader of the hospital's coronavirus response team, tells staff crowded into an auditorium next door. “Let's be confident. This is not a death sentence.”

Across Africa, officials are bracing for a rapid spread of the pathogen. The worry is an outbreak could devastate the region, which accounts for 16% of the global population but just 1% of health-care spending. There's little money for ventilators and other life-support equipment needed for severe cases of Covid-19, and any sustained fight against the coronavirus would steer resources away from malaria and HIV, which kill hundreds of thousands every year. If Italy, with 41 doctors per 10,000 people, is struggling to contain the disease, virus trackers fear what would happen if it were to sweep across Africa, where there are just two doctors per 10,000. “It will be worse in an African setting,” says Nathalie MacDermott, an infectious disease specialist at King's College London.

Nigeria is where the virus first made landfall in sub-Saharan Africa, on Feb. 27, when an Italian businessman tested positive in Lagos, the country's sprawling, congested commercial capital. It has appeared in at least 10 other African nations, sparking a flurry of responses. On March 2, Senegal reported a French national had been infected. A few days later, Egypt said it had 48 cases, most linked to a Nile River cruise ship. Kenya has set up isolation facilities in Nairobi, activated an emergency operations center, and secured extra protective gear. “A

lot still needs to be done,” says Isaac Ngere, a member of Kenya's national coronavirus task force. “Our schools are crowded. Our living areas are crowded. Our public transport is crowded. That's a good environment for the disease to spread.”

The International Monetary Fund on March 4 pledged to make \$10 billion available at zero interest to help poor countries, especially in Africa, tackle the virus. The World Health Organization has supplied testing equipment and training throughout the continent while focusing on 13 countries with strong links to China, the region's top trading partner. Muhammad Ali Pate, a former Nigerian health minister now with the World Bank, fears the virus could devastate “the crevices of society” where health systems are weak. “If you look at a map, you will see areas where cases have not been detected,” Pate says. “That may reflect that the virus isn't there. But it may be telling us something else: that they may not have the capability to test.”

● Does Ebola offer any lessons?

Health authorities fret that efforts to fight the coronavirus will indirectly contribute to an increase in deaths from illnesses such as malaria, which kills about 400,000 Africans a year. The 2014-16 Ebola epidemic, which left more than 11,000 dead, highlights the risk of overwhelming health-care systems. Across West Africa, the Ebola crisis disrupted treatment of malaria, HIV, and tuberculosis: Many clinics shut down, and patients with other ailments avoided doctors for fear of contracting Ebola. “More people died from a lack of general health services than from Ebola,” says Jimmy Whitworth, a professor of public health at the London School of Hygiene & Tropical Medicine. “We must make sure we don't neglect those services while we fight the coronavirus.”

● Doctors per 10,000 people in Africa

2

With 60% of Africans under 25, the disease may not be as deadly there as it is in European or Asian countries with older populations. Unlike in the West, with its nursing homes, the elderly in Africa usually stay with their families, reducing clusters of vulnerable people. And Ebola may have given Africa a better sense of how to deal with outbreaks. As the disease—far more virulent than coronavirus, but less communicable—spread across Africa in 2014, Nigeria avoided an epidemic by tracking and isolating potential cases. “The structures and emergency response strategies that worked well for Ebola are being reactivated,” says Niniola Williams, head of a nonprofit that battles infectious diseases in Nigeria.

Chikwe Ihekweazu, who leads Nigeria’s Center

for Disease Control, is overseeing the country’s response. In February the German-trained epidemiologist joined a WHO mission on a visit to Wuhan, the epicenter of the outbreak in China. Since his return two weeks ago, he’s been in voluntary isolation, working from a cramped studio at his home in an upscale neighborhood in Abuja. While places such as the university hospital, with clean wards dating from the 1980s oil bonanza, are preparing, he says Nigeria is ill-equipped for an outbreak. Clinics in smaller cities and the countryside lack everything from bandages to beds to physicians, and he has a staff of just 250, with five laboratories to test new infections in a country of 200 million. The U.S. Centers for Disease Control and Prevention, by contrast, has 11,000 employees and hundreds of labs.

Ihekweazu fears the prevalence of malaria in Africa could make it hard to trace cases, as the ailments’ early symptoms are similar, and the widespread incidence of HIV has left many vulnerable to Covid-19. “It’s a challenge around diagnoses, a challenge around care,” he says, hunkered in his home office, as two assistants work at the table in the adjacent dining room. “My nightmare scenario is a situation like Italy, in which significant transmission has already started by the time you have a chance to control it.” —*Alonso Soto and James Paton*

◀ The coronavirus ward at Abuja Teaching Hospital is under construction

▼ Built for trauma patients, the facility is being repurposed for a virus outbreak



Is **business** for this?

● Every weekday morning at 8, a team of executives at French carmaker PSA Group gathers in a room an hour's drive west of Paris. Others dial in remotely, and for the next few hours, the team huddles to plot a path out of the massive supply-and-demand crisis caused by the new coronavirus ripping through the global economy.

For a well-oiled machine like PSA, with its 173,000 employees, multiple brands including Peugeot, Citroën, and Opel, and parts sourced from 6,000 suppliers around the globe, the risk of disruption is significant. Each car is typically made up of 4,000 components delivered just in time for final assembly. Just one missing item can have devastating consequences for an entire vehicle plant, slowing or forcing changes to manufacturing and output or even grinding a complete line to a sudden halt.

So when the virus brought China's car parts industry to a standstill, and the seriousness of what was happening in locked-down Hubei province became clearer, PSA switched into crisis mode. It settled on one location to pool together

senior managers and help them devise an action plan, says Maxime Picat, PSA's head of Europe. "We chose one room and called it the war room," he says. "We said war because we wanted people to understand that the pace of what happens inside has to be different from normal."

While some managers are on-site for the meeting, the gathering is largely virtual, with most employees dialing in. It's a deliberate choice to minimize close contact among people in a bid to contain the virus, which is rapidly taking hold across France and the rest of Europe. Managers from all aspects of production, including supply, purchasing, and engineering, participate. Particular emphasis is placed on those who can compile data on where and when parts are needed.

Much of the work has focused on "deep dives" to identify workarounds: Do suppliers have other production sites, can parts be sourced from a different subcontractor, can some components be eliminated? Carmakers in crisis "will need to find solutions with other suppliers, and this won't always

● PSA Group suppliers worldwide number about

6k



◀ A Citroën assembly line in Poissy, France

S ready

be possible,” says Felipe Muñoz, an analyst at Jato Dynamics, a research service focused on the industry. “They may realize that putting all their investments in one market is risky, and I’m sure they will be thinking hard about that in the future.”

Senior Peugeot executives who take direct charge of pressing bottlenecks have been granted full power and resources to fix an issue. In some cases, parts have been brought in via air instead of by road. But air cargo is more expensive and risks driving up costs over time. The company is also monitoring its product mix, potentially cutting back on variants such as diesel cars, and increasing hybrid or gasoline models. “We have a long list of issues, but we’ve managed to keep production going,” Picat says. “We could fail one day. So far so good.”

For PSA Chief Executive Officer Carlos Tavares, avoiding a shortage in components, models, or workers and keeping factories on course is crucial this year. He’s in the middle of pulling off the biggest industry deal in more than two decades, a merger with Fiat Chrysler Automobiles NV to create the world’s fourth-largest carmaker. With a reputation for efficiency and delivering industry-beating profit margins, Tavares has enjoyed PSA’s full order books and plants running at maximum capacity.

Like many corporations, PSA has taken some precautions to protect its workforce from the virus. Visitors are required to fill in questionnaires asking about recent travel to China, Italy, and other coronavirus hot spots. And Tavares himself refrains from too-direct contact with others. At a press briefing last week, he kept his distance, standing on a stage to address a room of journalists seated on chairs placed far apart from one another.

The war room gatherings have already helped PSA avoid some breakdowns. When a manufacturer in Hubei stopped supplying parts for rear vehicle sections, PSA’s engineers searched through the car’s development phase and tracked down prototype machines that could stamp out the parts in sufficient quantity—albeit at a slower pace—to fill the gap until the Chinese partner started up again. Turns out, the replacement machine was in Milan, in northern Italy, the epicenter of the European virus outbreak and now in a government-mandated lockdown. “We managed to get the machines to another Italian supplier, so it all worked out in the end,” Picat says. That was before March 9, of course, when all of Italy went into lockdown.

—Tara Patel and Chad Thomas



Do the Olympics really need an audience?

● With a \$5.9 billion budget and a decade of planning behind it, the 2020 Summer Olympics in Tokyo had been expected to draw 11,000 of the world’s elite athletes and more than 600,000 tourists when it starts in late July. But with the coronavirus spreading rapidly, and Japan having already closed schools and canceled public events, the International Olympic Committee is reportedly assessing its options—including a games with few, if any, spectators.

That prospect is becoming less unthinkable by the day. Some U.S. college basketball, European soccer, and Japanese baseball teams are competing in empty venues. The annual Formula One race in Bahrain on March 22 will be run without any fans. Even the Olympic torch-lighting ceremony, which usually takes place in Greece amid much fanfare, is scheduled to occur this week without spectators.

For organizers, an Olympics behind closed doors may be the best of a bunch of bad options. It would satisfy the athletes and, equally important, the media companies that pay the IOC billions to broadcast the events—but only if they happen.

What’s more, in-person fans are a diminishing source of revenue. When Atlanta hosted the 1996 Summer Games, tickets accounted for 25% of the budget. In Tokyo, they are half that. In a sign of things to come, Japan’s bid for the 2022 World Cup included technology to broadcast the matches ▶

▲ The Olympic stadium in Tokyo

◀ worldwide using holograms, meaning a packed stadium in Brazil could see the games unfold on the field much like those seeing the real event in Osaka.

● Are TV viewers more valuable?

“If it’s an issue of people physically being unable to go to the games, that’s not as big an issue as people [not] watching the games through broadcasts,” says Harvey Schiller, a longtime sports and media executive who ran the U.S. Olympic Committee from 1990 to 1994. Of the \$5.7 billion the IOC earned in the last four-year Olympic cycle, almost three-quarters came from media companies. An additional 18% came from top-tier sponsors, most of which are locked into the Olympics far beyond 2020.

The loser in this scenario is Tokyo. Japanese organizers are on the hook for selling \$840 million in tickets. And while the IOC’s partners sign on for multiple cycles, the host committee landed dozens of local sponsorships—worth a record \$3.3 billion—specifically for these games.

Sponsors’ planned activities can be substantial. Bridgestone Corp., the only worldwide Olympic partner based in Tokyo, expects to host several hundred customers, partners, and employees during the three weeks of the games. It’s renting a fan experience location in Tokyo Waterfront City with product displays, games, and demos. The official Tokyo 2020 buses will have Bridgestone tires, two new sporting venues will be earthquake-proof thanks to supports made with Bridgestone rubber, and the company has sponsored 75 athletes who can appear in global ad campaigns. For Bridgestone and other big sponsors, those hospitality and promotional efforts lose a lot of their value if few fans turn out in Tokyo.

The local economy was also counting on the games. From 2015 to 2019, more than 80,000 hotel rooms opened in Japan, many in anticipation of

the event. The 205-room Moxy Tokyo Kinshicho, a Marriott International hotel in east Tokyo, was entirely booked by a single party for the Olympics, says Seth Sulkin, whose real estate development firm Pacifica Capital developed the hotel. “We expect the prominence of the Olympics to boost Japan’s tourism for years to come,” he says. “That’s one of the reasons it’s critical that it happens—not for the short-term impact, but for the long-term impact.”

Goldman Sachs analysts predicted the Japanese economy would get a \$7.6 billion (800 billion yen) lift from the games, including \$1.4 billion from inbound visitors and an additional \$3.8 billion in domestic spending. If the virus isn’t contained by the end of May and the Olympics are canceled, Goldman estimates the economy could face losses eight times that total not only by losing the direct boost but also from the lingering effect on tourism, domestic consumption, exports, and capital investment.

The number of foreign visitors tripled, to 32 million annually, in the five years after Tokyo won the bid, but it’s still shy of the 40 million target. “People are expecting the Olympics to complete Tokyo’s standing as an international tourism hub,” says Hideo Kumano, an economist at Dai-Ichi Life Research Institute. “Missing that goal would cause irreparable damage.”

The IOC, with a \$900 million reserve fund for interrupted games, would likely help backstop the host committee if needed. Both groups have insurance, though both declined to offer coverage details. “We have never discussed canceling the Games,” the host committee wrote in an email. “Preparations for the Games are continuing as planned.”

Empty seats at sporting events are increasingly common. College football attendance has dropped in eight of the past nine years; MLB attendance is down 14% since 2007. But media money has bulked up budgets, and media companies hold evermore sway over decisions. That’s dangerous for the IOC, because empty stands would likely make it tougher to interest prospective host cities. As it is, fewer places want what’s become a dubious honor. Beijing was awarded the 2022 Winter Games over the only other bidder, Almaty, Kazakhstan. The 2026 games had no fully viable bidders six months before the IOC was set to announce a winner. It eventually went jointly to Milan and Cortina d’Ampezzo in Italy.

And there’s another reason that competing in a packed stadium might be critical, even in this broadcast-centric era. “Fans give the impression that the event is highly relevant,” says Rick Burton, former chief marketing officer for Team USA. That’s something money can’t buy. —Eben Novy-Williams, with Yoshiaki Nohara, Ayai Tomisawa, and Lisa Du

What I’m telling clients

Lee Jacobs, partner, Helbraun Levey, a New York law firm focused on the hospitality industry

One anxiety I’m advising clients on is what to do if an employee shows up sick. In the hospitality industry, you have to be aware that employees are hourly, and if they miss a day’s pay, that could have a serious effect on their finances. You have to assume a sick person will show up to work. So what to do? We isolate them, we ask them to exclude themselves, and we send them home. You don’t want to be known as “restaurant zero.”

Another question I’ve gotten: Can I take my employee’s temperature when they show up at work? No. Just think about that for a moment. If the restaurant owner does the thermometer wrong, or if the thermometer is miscalibrated, think of that slippery slope. Under the law, an employee’s health is private. This is a problem that’s happening in Washington state. Amazon and Facebook are telling people to telecommute, because if one person has been affected, you can’t say, “Jane Smith is the one who has coronavirus.” —As told to Kate Krader

◀ Juventus beat Inter 2-0 in the deserted Allianz Stadium in Turin, Italy, on March 8



Will Hollywood go dark?

● The crew fled so quickly after the Feb. 25 decision to delay filming of *Mission: Impossible 7* that Paramount Pictures forgot to cancel the welcome party at the opulent Gritti Palace Hotel in Venice, Italy. The handful of straggling technical workers who showed up feasted with silver cutlery and exquisite china in a mostly abandoned banquet hall.

That kind of confusion—and needless spending—has been characteristic of Hollywood in the coronavirus era. On-location production work, often planned years in advance, has been rescheduled at great cost. After halting filming in Venice, Paramount said the *Mission: Impossible* shoot scheduled for Rome this month would also be delayed.

Even completed films are in trouble: Shuttered theaters in Asia have forced studios to scrap some premieres and rethink their 2020 schedules. On March 4 the opening of the James Bond thriller *No Time to Die* was pushed from April to November. Looking at the state of the movie theater industry—the Chinese shutdown and plummeting attendance in France, Italy, Hong Kong, and South Korea—the film’s backers couldn’t stomach putting out a would-be blockbuster for only half the potential audience, says a person familiar with their thinking.

It’s likely more openings will be delayed, because no one can predict how soon governments will lift restrictions or when moviegoers will be comfortable sitting in a crowded theater. “The thing that’s scary about the coronavirus today is that we don’t know the extent of it,” says Jason Squire, a professor at the USC School of Cinematic Arts and editor of *The Movie Business Book*. Filming delays can cost \$1 million a day, he says. Festivals and press events, including the unveiling of the Disney+ streaming service in Europe, have also been canceled. Apple

Inc. and Netflix Inc. pulled out of the South by Southwest festival in Austin, where they’d planned to showcase new programming; only days later, on March 6, the entire event was canceled.

Production problems are spreading through the TV industry. The new lead character of *The Bachelorette*, a reality dating show meant to offer an escape from life’s concerns, will no longer be courted by her male suitors in Italy next season. The country has been in lockdown after a spike in Covid-19 cases.

Hollywood productions are meticulously planned, making it particularly painful when things go awry. Every hour of each day is scheduled, and there are complex tasks like shutting down city blocks, doling out pay to dozens or hundreds of crew members, and ensuring megaprops—say, a yacht—are available, says Tyler Thompson, a producer and president of Cross Creek Pictures.

Studios are used to dealing with emergencies, particularly weather-related ones, but an illness that keeps jumping to new parts of the world is unusual. With the *Mission: Impossible* series, the sets and props are particularly ambitious. For the seventh installment, slated for release in 2021, workers were building a replica of the Gritti Palace. It’s now gathering dust. And the crew that had descended on the Italian city earlier this month is in limbo.

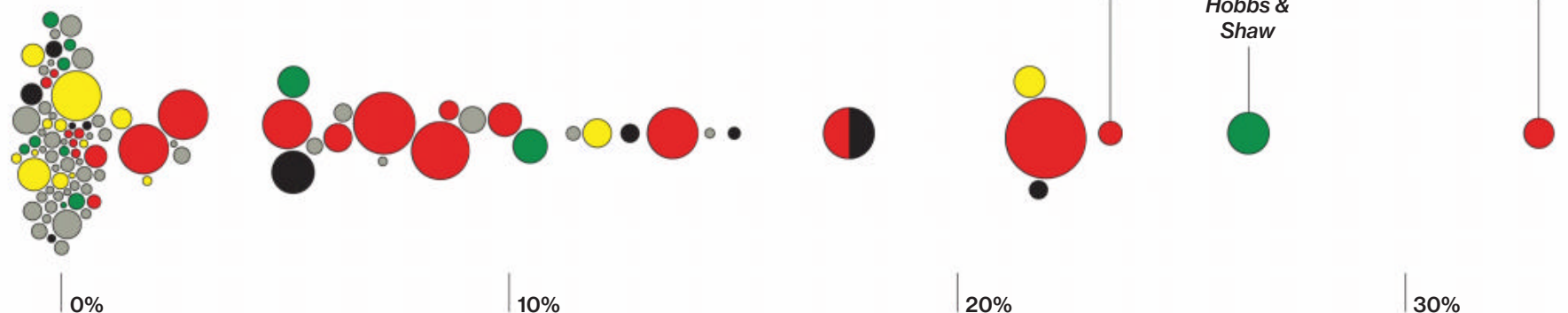
“They told us to pack our equipment and to leave ASAP,” says Arianna Pascazi, a Roman scene artist who’d just started to paint stained-glass pieces in the windows of faux buildings for the backdrop of the film’s action sequences. “They told us to leave some of the scenes already made here. But to be honest, we don’t know if we will come back at all.” —*Kelly Gilblom and Flavia Rotondi, with Christopher Palmeri*

“They told us to pack our equipment and to leave ASAP”

Which Hollywood studios are most exposed to China?

Share of box office revenue from the country among top-grossing movies of 2019*

● Disney† ● AT&T (WarnerMedia) ● NBCUniversal ● Sony ● Other



*FILMS FOR WHICH THE NATIONS OF ORIGIN LISTING ON THE INTERNET MOVIE DATABASE INCLUDE THE U.S. BUT NOT CHINA. EXCLUDES THREE SUCH FILMS THAT MET THAT CRITERIA BUT HAD CHINESE PRODUCTION PARTNERS. STUDIOS MAY HAVE HAD ADDITIONAL PARTNERS ON THEIR FILMS AND IN SOME CASES ARE NOT THE PRIMARY PARTNER. †INCLUDES 20TH CENTURY STUDIOS FILMS. DATA: BOX OFFICE MOJO, IMDB, COMPANY WEBSITES

What if the show



must go on?

▼ Leaders in global construction are gathering as usual for ConExpo in Las Vegas



● The longest line at ConExpo, the largest construction convention in North America, is the line to grab beer. As the bottles of Budweiser and Bud Light fly over the counter, the cashier at the beer station says she needs to run to the bathroom. “I’m getting a little terrified,” she says. “I didn’t see any hand sanitizer the whole time I was handing out beers.”

The beer seller, like the vast majority of attendees at the conference, which takes up 2.7 million square feet of space, was concerned about the transmission of coronavirus as about 130,000 attendees converged on Las Vegas on March 10 for this once-every-three-years event. But for her—and planners of many trade shows and events that are going forward despite the pandemic—the show must go on.

Even as college campuses are shifting classes online, sports teams are competing before empty arenas, and governments from Italy to Washington state are restricting mass gatherings, many American industries—including construction—are trying to go about business as usual. In the case of the huge ConExpo show, plans were just too far along when virus fears began to take hold in the U.S.

Moreover, given the three-year gap between confabs, this joint exhibition of construction and mining equipment couldn’t be easily postponed. So clients, potential new customers, and dealers for everything from backhoes and cement mixers to cranes and road-pavement gear trekked to Vegas to do deals and get a pulse on the market amid an unprecedented public-health crisis.

● Why would anyone go to a trade show with 130,000 attendees during a burgeoning pandemic?

“It’s a good chance to know the new technology and figure out what works better for our company,” says Jeff Herington, a project manager estimator at InRoads Paving LLC in Des Moines. “You can talk on the phone and email, but it’s just different to speak face to face, and when you have the company here you can get better answers.”

It’s easy to see why construction folks are eager to keep meeting and greeting. Demand is smoking. The industry added 42,000 jobs in February, helping push the overall U.S. unemployment rate down to 3.5%, a 50-year low. The convention is also a massive showcase for Caterpillar, John Deere, Komatsu, Volvo Group, and other global companies to display their latest products and technologies to buyers from around the world.

Still, soldiering on during a pandemic requires some accommodations. Hand sanitizer stations are

prominent, as are exhortations to be careful with coughs. And the show’s organizers have instituted a no-handshake policy, complete with buttons that show a slash mark over a drawing of clasped palms. That’s a big change for an industry where handshaking and backslapping is still very much in vogue, but alternatives like fist bumps and foot shakes are catching on among attendees. Industry bigwigs are getting into the act: Chief Executive Officer Jim Umpleby of Caterpillar Inc., one of the world’s largest machinery producers, greets people by bumping elbows, while Mike Ballweber, president of Bobcat North America, prefers “shoulder shimmies.”

That doesn’t mean the virus isn’t on people’s minds. “We haven’t seen anything slowing down or the need to do anything different, but we have this black swan out there, and we’re trying to look at it and understand what to do,” says Ballweber, whose farm and construction equipment company is part of South Korea’s Doosan Group. “Just this morning I was with dealers to talk to them, and that’s the conversation I’ve had with every one of them. They’re not oblivious to the news.”

Volvo, though, is one major manufacturer that decided days before the show’s start that it wasn’t coming. Instead, it sent a skeleton crew of local employees to exhibit its gear, which had already been delivered to the venue. Although Caterpillar chose to attend, it allowed employees to choose to stay home. But it says a lot of analysts and shareholders—who come to hear presentations, see new products, and schmooze with company executives—didn’t show up because of the virus.

“A lot of investors didn’t come, that would be the one thing that’s probably different this year,” says Chief Financial Officer Andrew Bonfield. He says that if investors could instead arrange meetings with managers at Cat’s headquarters outside Chicago, “they would probably take that rather than come to a very large event where they may need to self-quarantine afterwards.”

A group called Women of Asphalt, which promotes female participation in the construction



What I’m telling zoo visitors

Benjamin Tan, deputy CEO of Wildlife Reserves Singapore, which runs the Singapore Zoo

It’s outdoors, and the crowds are light, so it’s actually pretty safe. We think it’s important to have commonsense measures. As much as we are open for business, the last thing we want is to have cases spreading here. We are telling colleagues, “If you aren’t feeling well, please stay home.” All surfaces are disinfected regularly. There’s temperature screening in every park, including back-of-house areas.

The coronavirus being linked to zoological disease has produced some anxiety. We are against the wildlife trade. Let’s not confuse that with animals that are well cared for. We’re also telling people it is safe to share spaces with animals—our animals are regularly assessed by caregivers and vets. —As told to Joanna Ossinger

◀ “No Offense, Just Makes Sense”



trades, held a networking mixer for 250 on the night of March 10. Half of the 20 volunteers expected to help at the event couldn't make it after their employers restricted travel, says Michelle Kirk, a spokesperson for the group. The ones who came were taking precautions, including frequent hand-washing. "We're glad we could be here to spread the word, and we don't want to bring anything back home," Kirk says.

Dana Wuesthoff, vice president for exhibitions and events services at ConExpo, is working hard to make sure that doesn't happen. Wuesthoff, who works for the Association of Equipment Manufacturers, which puts on the convention, says the organizers rented large sanitizing stations to be placed throughout the show, especially in outdoor areas that display cranes and other large equipment, which don't have an obvious table where containers of hand sanitizer could be placed. She also increased the frequency of scheduled cleaning services and replaced cleaning chemicals with more appropriate germ-killing options. The AEM is also handing out the no-handshake buttons, which say "No Offense, Just Makes Sense."

Some attendees are stoic about the danger. Roland Karbaum, who owns a gravel pit in Maryland, was one of the few attendees who wore a mask during the show's first day—though he kept it hanging off his show badge rather than on his face. "If I'm looking at a machine and somebody gets in close, I might put it on," he says.

ConExpo organizers say exhibitors representing less than 3% of the show's 2.7 million square feet of

space canceled, and one-fifth of those booths were resold to other attendees. By midweek, attendance was trending above the 2017 show, they say.

On the exhibition floor, though, Henry Boschen, a sales manager at VMI Inc., says the number of attendees appears to be down, pointing out that most of his major parts suppliers canceled. He pulls out his phone to show vacant hotel rooms going for \$65 to \$85 a night on booking sites that normally have nothing to offer during the huge event. "It's nothing to laugh or sneer at," Boschen says about coronavirus, and he admits that he's unsure how it will play out in the U.S. "But you can get a room at Golden Nugget for \$87, which tells you they got a whole lot of vacancies."

But business is still taking place. Caterpillar's Umpleby says he has dinners scheduled for all five nights of the expo, and he expects they'll commence as normal. He'll take precautions—elbow-bumping, washing his hands frequently, and not touching his face—but he's not going to sit farther away from clients at restaurants. After ConExpo, he says he's not going to self-quarantine. "I'm going on to the next thing," Umpleby says. "I have a couple daughters at home, and they're in high school. And I'm going to go home."

Bobcat's Ballweber says he and his staff had a discussion about whether to self-quarantine after the event. "We haven't made that decision yet, but it is something we have absolutely talked about," he says. "When I got this job no one gave me the playbook on how to handle a potential pandemic."

—Joe Deaux and Christopher Palmeri

▲ Judges at the Caterpillar Global Operator Challenge measure a trench

But what if it doesn't?



▲ Businesses across Austin are in mourning

● Asif Khan has a new routine every time one of his ride-share passengers steps out of the Toyota minivan he drives in Austin: He grabs a can of Lysol and sprays everything down. “It says it kills all the germs,” he explains.

With diligence and luck, Khan might be able to avoid getting sick. But there isn't much he can do about the financial hit coming his way now that the city has canceled the 2020 South by Southwest music and technology festival over concerns about the coronavirus pandemic. Instead of the extra \$2,000 he expected to rake in during the two-week event, he'll likely make less than he does during normal times, driving 10 to 12 hours seven days a week. That'll mean forgoing plans to pay down debt, he says. “Now it's going to take a little longer.”

Organizers said SXSW, which draws hundreds of thousands of attendees from more than 100 countries every March, had a total economic impact on Austin of almost \$356 million last year. That includes hotel and Airbnb rooms, the money big corporations spend renting venues for dinners, the bar tabs for the revelers that flood downtown, and the surge in shopping at hipster boutiques as foot traffic picks up.

“It's like a hurricane of people, of humanity, that leaves behind money instead of wreckage,” says Brian Rush, who owns the Tears of Joy hot-sauce shop in the downtown entertainment district. March typically brings in two to three times the revenue he makes in an average month as he guides walk-ins to house-made concoctions with names like Dragon's Breath and Night Destroyer.

Rush expects business will be lower than in previous years, but isn't sure how bad it will be. That's because he figures many people who already bought tickets to Austin will still make the trip, especially those coming for the smaller, unofficial music shows that pop up during the festival.

That's also the hope of Miranda Welch, the lead barista at Gelateria Gemelli, which sells sweets, coffee, and cocktails just outside downtown. Welch also works as a doorman and bartender at the music venue Cheer Up Charlies and counts on a windfall from SXSW, during which they

typically see at least double the tips they'd make on a normal night. “I definitely won't be able to go on vacation anytime soon, and I was kind of hoping for that,” Welch says.

Fernando Marri, owner of the Boteco food truck in East Austin, said the cancellation will cost him \$45,000 of catering business, so he won't be hiring the 10 workers he'd planned to take on during SXSW. The timing is particularly bad—he was expecting a jump in customers after his business, which sells *coxinhas*, *brigadeiros*, and other foods from his native Brazil, was lauded by Food Network host Guy Fieri two months ago. In the video, Fieri said he'd been turned on to the truck by the actor and beloved Austinite Matthew McConaughey.

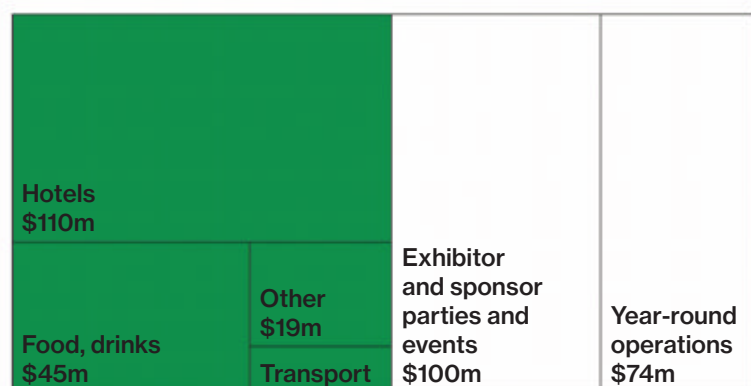
“For everybody that lives in Austin, go out and support small businesses,” Marri says. “Think about that a little extra this month.”

Austin has long considered itself a city that's friendly to the creative class, where musicians can find a steady stream of gigs and plenty of service-industry work to pay the bills before they make it big. But that reputation has changed in recent years; housing costs have shot up amid a technology boom that's seen thousands of jobs created by Apple, IBM, Oracle, and other companies. While that influx of tech employers helped give the region the fastest-growing economy ▶

What is South by Southwest worth?

A breakdown of its \$356 million economic impact on Austin in 2019

■ Attendee spending □ Other impact



People registered for SXSW in 2019

Attendees
86.6k

Speakers
4.8k

Members of the media
4.3k



▲ Marri, who'd been heading into SXSW on the heels of a great plug from a Food Network star, says the cancellation will cost him \$45,000



▲ Khan, a ride-share driver, had earmarked this year's expected SXSW windfall to pay down debt

▶ Welch will have to postpone this year's vacation



◀ among major U.S. metropolitan areas over the past decade, Austin also saw one of the nation's biggest increases in the economic gap between white and nonwhite populations, according to a recent Brookings Institution study.

Civic do-gooders are raising funds to support service workers who stand to take big losses from the cancellation of the festival. The Austin metro area has roughly 113,000 workers in the hotel and food-service sector, census data show. Two GoFundMe campaigns have generated more than \$27,000 of donations. (The company that runs SXSW also says it will lay off about a third of its 175 full-time employees.)

The cancellation is particularly hard on Mudathir Abdulgafar, a full-time ride-share driver who's lived in Austin for seven years. He says business usually doubles during the festival, and its scrubbing this year will be a blow to his finances. Abdulgafar had already stopped accepting pooled rides about three weeks ago, figuring the extra passengers on those trips increased the chance he could catch the coronavirus and be forced to take time off before the busy SXSW period.

He's been talking with other drivers about what to do, and many of his colleagues are thinking about seeking work piloting delivery vans for Amazon. They figure the job will be steadier, and there's less chance of catching an illness from a rider who is sick. Says Abdulgafar: "Packages instead of people." — *Brendan Walsh*

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Will airlines regain altitude?

● Globalization has been a boon for the airline industry, which has flourished as nations opened up to one another over the past 40 years. Now businesspeople and tourists can crisscross borders as easily as they travel close to home. Unfortunately, as the cascade of infections around the globe can attest, so can the coronavirus.

That frictionless movement has expanded the

Will cruise passengers return?

The cruise industry has survived torpedoes, terrorists, incompetent captains, the winter vomiting bug, and an iceberg that doomed a ship thought to be unsinkable. Now it may be facing its toughest obstacle yet.

On March 8, the U.S. Department of State, in an unprecedented alert, told citizens not to take cruises. Carnival Corp., the industry leader, saw its share price tumble to levels not seen since the Great Recession.

Many customers chose to abandon ship.

"We are definitely experiencing a high number of cancellations due to the virus," says Kristy Adler, chief operating officer at Cruise & Resort Inc., a travel agency in Sherman Oaks, Calif. "It's a very tough time in our industry right now!"

Cruise takers are a resilient bunch, but images of guests trapped on ships such as the *Diamond Princess*—where more than 700 contracted the virus

on an Asian voyage—may scare some off forever. And Carnival on March 9 got its first lawsuit regarding passengers who'd been stuck with sick guests on the *Grand Princess* off the California coast.

One way Carnival hopes to keep sailing: offering \$200 onboard credits to passengers who stick with their scheduled trips. — *Christopher Palmeri*



reach of the crisis to an unprecedented level. The lethal outbreak had been a multibillion-dollar headache largely for airlines in China and the rest of Asia until late February. Since then, the fear of flying has followed the virus westward, striking some of the biggest U.S. and European carriers. From Qantas and Cathay Pacific in Asia, to Lufthansa and Air France-KLM in Europe, to United and American in the U.S., airlines all share the common problem of virus-sapped bookings.

Amid the sudden plunge in global demand, commercial air traffic is poised to fall 8.9% this year, according to Jefferies Financial Group Inc. That would be the biggest decline in the 42 years of available data stretching back to 1978, dwarfing the impact of the Sept. 11 terrorist attacks. "The industry is facing its biggest challenge in modern aviation history," says Yu Zhanfu, a partner at consulting firm Roland Berger in Beijing.

As government advisories, travel bans, quarantines, and growing worries about being confined at 30,000 feet for many hours seated next to a possible virus carrier drain customer demand, airlines are responding by making massive cuts along their routes. Lufthansa is cutting its schedule by as much as 50%. United chopped its April domestic schedule 10% and reduced international flying 20%. Delta will cut domestic capacity as much as 15% and its international flights 25%; American will decrease foreign flights by 10% in the peak summer season.

The virus has already claimed its first casualties in the industry. Flybe, Britain's biggest domestic carrier, was under financial stress before the infections began spreading, and it finally collapsed on March 5 as demand dwindled. In China, government officials began taking charge of the parent of Hainan Airlines this month after it fell victim to the mass travel bans there.

Other governments are likely to step in as well.

Deutsche Lufthansa AG is looking for support to avoid layoffs. And, without offering details, President Trump said on March 10 his administration will provide assistance to U.S. airlines as a result of the outbreak. “We’ll be helping them through this patch,” he said.

A global revenue loss of \$113 billion in 2020—the International Air Transport Association’s most pessimistic forecast—would represent a 19% drop from 2019. Even the trade group’s best-case scenario assumes an 11% decline in passenger revenue, or \$63 billion. That may be why airlines are swinging the ax so brutally. Australia’s Qantas Airways Ltd. on March 10 slashed about a quarter of its international schedule for the next six months, while Air France canceled 3,600 flights scheduled for March, reducing its European network 25%.

Nowhere are the industry’s challenges more apparent than in China, whose airlines will shoulder more than one-third of IATA’s projected hit to industrywide income. China, fed by an exploding middle class happy to splurge on domestic and overseas trips, had long been on track to supplant the U.S. as the world’s largest air travel market in the middle of this decade. Now local airlines have found themselves on the front line of the crisis.

Chinese airlines by February had cut 10.4 million seats from their domestic schedules, according to OAG Aviation Worldwide. Ticket bookings in the country for April are down almost 80% from a year earlier, IATA says. With fears about the spread of Covid-19 weighing on demand for the rest of the year at least, it’s inevitable that other Chinese airlines will fail, says Joanna Lu, head of consulting for Asia at travel analytics company Cirium. “It’s more those smaller or private airlines, the low-cost carriers, that we should be worrying about,” she says.

State intervention may be the only way forward. The government in Beijing controls the country’s Big Three—China Southern Airlines, Air China, and China Eastern Airlines—and has signaled it’s prepared to step in. The Civil Aviation Administration of China said on Feb. 11 the government would support measures, including mergers, to help the beleaguered industry recover.

Then, on March 4, Chinese regulators announced state funding for domestic and foreign airlines operating international services to and from China during the crisis. On the table was as much as 0.0528 yuan per seat, per kilometer. For an 8,175-kilometer (5,080-mile) flight from London to Beijing, the subsidy would total 432 yuan (\$62) per passenger.

Led by giants China Southern and China Eastern, the country’s airlines started adding back domestic flights the week of March 2, OAG’s analysis shows. Some were extraordinary bargains: A 3½-hour flight from Shanghai to Chengdu, for instance, was going for just 90 yuan, plus 50 yuan in taxes, almost a tenth of the usual price. Overall capacity in China is still only about half the level of late January, before the outbreak erupted in earnest. With the coronavirus taking hold in Europe and the U.S., low prices may not be enough to win back international passengers in China, says Yu, of Roland Berger.

Still, the global airline industry has bounced back from every crisis it’s seen. After the SARS outbreak in 2003, which cost Asia-Pacific airlines about \$6 billion in lost passenger revenue, international traffic returned to normal within nine months. And this time around, plunging oil prices resulting from the feud between OPEC and Russia will also favor carriers, because fuel is one of their biggest expenses.

“I’ve been in this industry for 35-plus years, seen wars, terrorism, disease, and accidents,” says Jared Harckham, a vice president and managing director of aviation at consulting firm ICF International Inc. “So far, nothing has changed the long-term growth trajectory of the industry. Problems get controlled, memories fade, and people cannot pass up a good deal.” —Angus Whitley and Chunying Zhang

What I’m telling staff and residents

Lucinda Baier, CEO, Brookdale Senior Living, Brentwood, Tenn.

The most questions I’m getting are “What are you doing?” We normally respond that we’ve created an emergency response command center, a cross-functional team of experts from around the country that’s looped in with the CDC, the local health agencies, and all the leading health institutions to provide the guidance and support that our associates and communities need.

We’re primarily focused on prevention and barriers. So we get a lot of questions about how you take appropriate personal protection, whether it’s hand-washing or using hand sanitizers, and how to clean an environment so the virus can’t spread, and we educate people on that. Flu is a significant issue we address every year, so we have protocols in place that are easy to apply to the current situation.

People are also asking about how to protect oneself in the office and at home. We ordered cleaning supplies for our associates, so they could learn how to clean things like cellphones and doorknobs. One of the most common questions was about reading the instructions on the back of the product. There are so many different sets of instructions for different uses, and people wanted to know which one to apply to this situation. —As told to Suzanne Woolley

◀ Disinfecting an airplane cabin at the Haikou Meilan Airport in China’s Hainan Province on Jan. 31



Can price gouging be stopped?

● Governments worldwide are sounding alarms about price gouging and threatening crackdowns as the Covid-19 pandemic spreads fear and a surge in demand for hand sanitizer and face masks. But it's unlikely that some vendors will stop demanding \$400 for a two-pack of 2-ounce bottles of Purell any time soon. (Yes, it happened; the stuff goes for \$10.)

The anti-gouging laws on the books are tricky to enforce when demand suddenly outstrips supply. Sometimes even just defining a violation is difficult, says Geoffrey Rapp, a law professor at the University of Toledo in Ohio. "While there's an instinctive reaction that prices shouldn't swing wildly after a major natural event, man-made disaster, or something like the current coronavirus scare," he says, "there's a blurry line between responses to the natural movement of supply and demand and those that should truly be prohibited."

● Can we suspend the law of supply and demand?

Most American states have laws targeting the pricing of food, fuel, and other essentials during an emergency. But they're largely symbolic, Rapp says, because prices often jump before an emergency is declared. And some economic thinkers argue anti-gouging rules prevent the laws of supply and demand from efficiently resolving a shortage.

Efforts are under way nonetheless. In Washington state, Attorney General Bob Ferguson has encouraged residents to report possible price gouging. A New York lawmaker introduced a bill that would impose fines of up to \$25,000 on stores selling face masks at "unconscionably excessive" prices.

For Amazon.com Inc., eBay Inc., and other online retailers, the immediate issue is how to react to price surges on their sites. Their algorithms are designed to fight profiteering; they also assign employees to manually monitor items. But that's often a whack-a-mole exercise, with products getting pulled off only to quickly reappear. Massachusetts

Senator Edward Markey complained in a letter to Amazon Chief Executive Officer Jeff Bezos that the company isn't doing enough, citing the \$400 Purell recently found on the giant e-tailer's site.

Sky-high prices are also spilling over to peer-to-peer marketplaces like Craigslist Inc. and OfferUp Inc. One entrepreneur in Seattle is making his own hand-sanitizing concoction with aloe gel and rubbing alcohol, packing the green slime in empty sports-drink bottles, and selling it on Craigslist for \$45 a jug. He declined to be interviewed.

At the Lampe Berger Paris smoke shop in Midtown Manhattan, employee Moses Ifti said he got some side eyes when he doubled the price of a hand sanitizer to \$10. But three people snapped up all 30 bottles he had on display. "The customer is looking at me crazy, but it's sold out everywhere," he says. "People know they can't get it anywhere else. What are they going to do?"

There's no question that panicked shoppers want things right now. Nine of the top 10 search terms on Amazon since Feb. 26 were coronavirus-related, according to Helium 10, which tracks the site. Amazon searches for hand sanitizer over the past 30 days spiked to 1.5 million on March 1, up from 90,000 on Dec. 1, according to Helium. Prices for some bestselling sanitizers doubled.

The demand is rippling out to survival-related products. Sales of freeze-dried food and emergency food supplies on Amazon rose 432% and 391%, respectively, last week compared with the previous week, says Michael Lagoni, CEO of Stackline, an e-commerce data analytics company.

The Amazon algorithms that determine which products people see punish merchants that let their products run out. So some merchants use pricing systems "designed to raise prices so products don't run out of stock before they're replenished," says Juozas Kazuikenas, founder of New York e-commerce researcher Marketplace Pulse. "That causes prices to spike during demand surges."

Amazon, eBay, and OfferUp say they're monitoring their sites. "There is no place for price gouging on Amazon, and that's why our teams are monitoring our store 24/7 and have already removed tens of thousands of offers for attempted price gouging," a spokesman says. "We are disappointed that bad actors are attempting to take advantage of this global health crisis."

OfferUp has taken down hundreds of listings that violate its policies, a spokesman says. The company wouldn't say precisely how it calculates a violation, but the spokesman says \$100 for a container of hand sanitizer would likely fit the bill. —*Spencer Soper and Gerald Porter Jr., with David R. Baker*

What?

Prices of sold-out Amazon products, as of March 10



● Augason Farms emergency food supply

Amazon:

\$109.64

Third-party seller:

\$347.90



● Clorox wipes, six canisters of 75 wipes

Amazon:

\$22.41

Last available third-party seller:

\$79.99



● Clorox bleach, 121 oz.

Amazon:

\$16.58

Third-party seller:

\$29.99



● Purell, 8 fl. oz. pumps, 12-pack

Amazon:

\$45.34

Last available third-party seller:

\$299.99

How much can we buy?

● Anneliese Bischof was on a business trip in Thailand in the second week of January when conversations with Chinese colleagues about a new virus spreading across the region made her realize a major outbreak might be occurring. For Bischof, the business director of disinfection at German chemicals company Lanxess AG, this was initially no cause for alarm. After all, she and her team had seen spikes in viral infections before, like the African swine fever that swept across the Asia-Pacific region last year, driving up demand for the company's Virkon industrial-strength disinfectant.

It was only when Bischof returned to Germany that she realized this time was different. Back home in Cologne, the phones in her department started ringing off the hook. The inquiries were from nations that had never previously been on the Lanxess corporate map. "We had an off-the-charts number of calls coming in," says Bischof, who works at the company's Material Protection unit, which took over the Virkon brand of disinfectants a few years ago with the \$230 million purchase of a biocide business from Delaware-based Chemours Co. "Places like Trinidad and Tobago, all kinds of small countries that for the majority of our business wouldn't have been on our radar. That's when we really started noticing the bomb dropping."

Virkon, a powder dissolved in water and then sprayed on surfaces, kills viruses quickly, often in minutes. That sets it apart from other agents that may take a full hour to eliminate them, Bischof says. "You wouldn't want to soak or spray a desk and let it sit for 60 minutes if you want to disinfect it."

The German company isn't alone in having to scramble to meet demand for products that have become hot sellers in the wake of the coronavirus outbreak. Even before the spread of Covid-19 outside of China accelerated, American shoppers were stocking up on items such as medical masks, hand sanitizers, and thermometers—in the week through Jan. 25, sales of masks were up 428% from the same period last year, according to Nielsen data. And companies such as Gojo Industries Inc., which sells Purell hand sanitizer, kicked into high gear after demand for disinfectant hand gels spiked 1,400% from December to January, according to Adobe Analytics.



Manufacturers say the current stockpiling is more frenzied than that which occurs before a natural disaster. "I'm from Florida, so when it's hurricane season you see people with the same kind of behavior or pretty similar," says Rick McLeod, vice president of product supply for Procter & Gamble Co.'s family care unit—home of the coveted Charmin and Bounty brands. "What's different here is that it's not as concentrated as you would see in a hurricane response—it's obviously more widespread."

Indeed, retailers such as Target, Kroger, and Tesco in the U.K. are limiting certain purchases. Costco Wholesale Corp. is struggling to keep items in stock, Chief Financial Officer Richard Galanti told analysts, saying the buying frenzy has been "a little bit crazy." In France, shoppers snapped up pasta, rice, ready-cooked meals, and toilet paper, says Michel-Édouard Leclerc, chairman of supermarket chain E.Leclerc. "Everyone rushed like they had lived through a war, which is incredible, because three-quarters of the people who came to stock up have never known war."

With demand soaring, Lanxess began air-freighting Virkon to China instead of shipping it—getting it to customers within a week, rather than 30 to 45 days. Lanxess also installed a second shift, doubled capacity at the factory making Virkon in Sudbury, England, and is leaning on other European production sites. Bischof predicts sales will remain high for the foreseeable future. "Demand is here to stay at least for this year, if not going forward," she says. "The topic of disinfection is present in people's minds now." —Andrew Noel, with Gerald Porter Jr. and Thomas Buckley

▲ Shoppers for hand sanitizer at a Target store in New York were met with empty shelves and purchase limits

"We had an off-the-charts number of calls coming in"

How will the change us?



▼ Reducing pole contact in New York City's subways



his ?



▲ People are changing their behavior fast to contend with the new coronavirus threat. Those who must still take transit, for example, wonder if avoiding surfaces on trains and buses will help them stay healthy. A survey of about 11,000 people in 11 countries conducted in early February by Britain's Reckitt Benckiser Group Plc, which makes cleaning products under its Lysol brand, found that 44% are avoiding crowds and 29% are staying off public transit. Campaigns from public-health agencies seem to be resonating: 54% said they're washing their hands more often, and 32% are trying not to touch their eyes, nose, and mouth. Whether any of the lessons on cleanliness will lead to lasting behavioral changes is perhaps a question for later. —*Deirdre Hipwell*

Will gender inequality worsen?

● In strictly medical terms, the new coronavirus seems to hit men harder than women. In an analysis of almost 45,000 cases in China, the death rate was 2.8% for men, compared with 1.7% for women. And men made up a slight majority of the infected, at 51%. One theory is that men, particularly in China, are more likely to smoke cigarettes, so they have weaker lungs. Cardiovascular disease, which is highly correlated with coronavirus fatalities, is also more prevalent in men. But as the virus spreads globally, it appears women are bearing the brunt of the social and economic disruption.

The vast majority of nurses, flight attendants, teachers, and service industry workers are female, and their jobs put them on the front lines of the outbreak. At home, women still do more caretaking, so when the virus closes schools, restricts travel, and puts aged relatives at risk, they have more to do. “The challenge of the emergency really puts additional strain on existing inequalities,” says Laura Addati, a policy specialist in women and economic empowerment for the International Labor Organization. “If there’s not already an egalitarian sharing of child care or housework, it will be women who are responsible for remote school, for ensuring there’s food and supplies, for coping with this crisis.”

Eight out of 10 nurses are women, perhaps the most extreme example of how this crisis squeezes women at home and at work. Eleanor Holroyd, a professor of nursing at the Chinese University of Hong Kong in 2003, collected the first-person accounts of student nurses during the SARS epidemic. They detailed the confusion, anxiety, and stress of long days with patients and of watching colleagues fall ill. Some slept in the hospital, both to care for the sick and to protect their own families. “There’s this idea that if there’s a gap in the system, the nurses will fill it. The duty is to be ever-present and visible and offering empathy and care,” says Holroyd, who now teaches at New Zealand’s Auckland University of Technology. “Add that to anything else, a sick child or parent, or a husband or partner out of work, the very uncertain nature of an epidemic, and it can be hard to hold on.”

As part of the containment efforts, 15 countries have closed schools nationwide, affecting more than 300 million kids, according to a March 10 estimate from Unesco. For most families, that constitutes a crisis in its own right. In Hong Kong,

where schools have been closed since Feb. 3, many parents—mostly moms—have become de facto home-schoolers, managing remote classes and emailed assignments along with their own professional responsibilities. On Facebook and in group chats, they troubleshoot glitches with Zoom or Google Classroom and swap tips for dealing with stir-crazy kids. There is a lot of 🤔 and #winetime.

● Or will there be a more even distribution of caretaking?

Some companies have begun to realize that the spread of Covid-19 has also brought extra pressures for their workers. In Japan, Pasona Group Inc., a human resources service provider, gave employees the freedom to work from home or bring their kids to the office. Workers at beauty company



Shiseido Co. can take up to 10 days of paid leave to care for their children while schools are closed, and they won’t lose pay if they have to work slightly shorter days. In the U.S., labor leaders, including the heads of big unions for flight attendants, teachers, and nurses, have been using the coronavirus epidemic to draw attention to the fact that America is alone among developed countries without mandated paid sick leave. “No one should have to go to work sick because they are worried about being penalized or missing a day’s pay,” says Mary Kay Henry, the president of the Service Employees International Union.

Advocates for equality hope this global health crisis will result in a more even distribution of professional and domestic caretaking. Before the U.S. entered World War II in 1940, 28% of American women worked outside the home; five years later, 37% did, a percentage that ticked upwards for decades. In Japan, the tsunami and nuclear

▲ In China’s Hainan province, where overseas organizations are shipping more masks

meltdown of March 2011 drew new attention to the needs of single dads in the country and prompted broader social emphasis on active fathering. It “changed men’s sense of value in housework participation,” says Tetsuya Ando, head of advocacy organization Fathering Japan. “The coronavirus will have a similar social impact.”

If so, whether the changes persist is another question. In the wake of the 2008 financial crisis, necessity pushed more women into the workforce, conferring more child-care responsibilities on newly

unemployed men, but as the economy improved, most households reverted to the pre-crisis division of labor, says the ILO’s Addati. The coronavirus crisis is an opportunity to challenge entrenched social dynamics in a way that benefits both women and men. “We have to think of ourselves as all being care providers and all being care recipients,” she says. “It should be our responsibility to make sure everyone can take care of himself, his loved ones, and make sure the workplace is safe for everybody.”
—Janet Paskin, with Bei Hu and Grace Huang

Why should more of us work from home?

● You want to do what you can to protect yourself and others from the spread of the new coronavirus. You’re already washing your hands raw, bumping elbows instead of shaking hands, pressing elevator buttons with your knuckles, and valiantly fighting the urge to touch your face. What else can you do to fight Covid-19? Well, you could just work from home today instead of going to the office.

I know, I know: Most people can’t do that. Only 29% of U.S. workers in a 2017-18 U.S. Bureau of Labor Statistics survey said they had the option to do their jobs from home. Those who can tend to have much higher incomes and education levels than those who can’t. Doing your job via an internet connection is simply not a possibility for most people working in retail, food service, manufacturing, health care, and lots of other sectors.

But this is *Bloomberg Businessweek*, and, according to the BLS, 60% of people in management, business, and financial occupations can work from home. If you’re reading this, there’s a good chance you can WFH at least some of the time. There’s also a good chance your employer will be ordering or strongly encouraging you to stay away from the office in the near future, as several prominent tech companies already have. But you don’t have to wait.

Think of it as your own little contribution to lowering R_0 , the reproduction number, generally pronounced “r-naught.” R_0 is the average number of people an infected person is likely to infect, thus determining whether an epidemic spreads

($R_0 > 1$) or peters out ($R_0 < 1$). It varies by disease, with measles at a spectacularly contagious 15 or so, and the average for the seasonal flu usually around 1.3. Current estimates of Covid-19’s R_0 are in the 2s.

Changing behavior can change the effective R_0 , though. One way to think of R_0 is that it’s the probability of infection given contact with an infectious person, multiplied by the contact rate, multiplied by the infectious duration. Hand-washing, elbow-bumping, and the like bring R_0 down by lowering the probability of infection given contact with an infectious person. Working from home does it by reducing the number of contacts.

● Is it more effective than closing schools?

By not going to the office, and by staying off public transportation if that’s how you usually get there, you’re not just protecting yourself from the virus, you’re also protecting everyone who still has to go into work or take the train or bus. Such behavior is often labeled social distancing. It may feel a bit anti-social, but during an epidemic it’s actually quite pro-social.

In China, making everybody stay home seems to have brought the coronavirus’s R_0 below the disease-spreading threshold, at least temporarily. More limited shutdowns such as school closings have also been shown to play a role in curbing or at least slowing past influenza epidemics. ▶

◀ Given Covid-19's seemingly minor impact on children, schools might not be the best target this time around. All the more reason to stay out of the office. Also, such moves have generally been most effective when a virus has only spread to a small percentage of the population. Waiting until the epidemic is raging is too late.

Just you staying home from the office isn't going to have a major impact, of course. But it's still something, and—unlike, say, forgoing restaurant meals or movies or travel—it comes at a low cost to the economy. It may even come at no cost at all, considering that remote workers generally appear to get more done than their in-office peers. One big experimental test of this: In 2010 and 2011 at Shanghai-based travel agency Ctrip (now Trip.com), productivity rose 13% among call-center workers who were allowed to work from home.

So, seriously. Do it for your co-workers. Do it for your fellow commuters. Do it for firefighters and delivery workers. Do it for humanity. If you can, work from home. —Justin Fox, *Bloomberg Opinion*

and deepening the sense of seclusion.

China's notorious tech culture—espoused by business leaders including Alibaba billionaire Jack Ma for driving productivity—was already starting to encounter resistance from workers, as the biggest slump in the sector since the 2008 financial crisis spurred job losses. The worsening morale among tech foot soldiers, some in isolation weeks before the virus spread beyond China's borders, might be a lesson for the world's corporations contemplating similar contingency plans on how not to do work-from-home.

A recently hired employee at the Shenzhen branch of ByteDance Inc., which owns TikTok, has yet to meet her colleagues in person because the epidemic forced the company to temporarily shut its offices. The product specialist, who asked to be identified only by her surname, Huang, says her days are so packed with teleconferencing—brainstorming sessions with her team can last four hours—that she can start to tackle her workload in earnest only at night. "I feel I'm enduring the pressure of work but not enjoying the benefits," Huang says. "I didn't even get to know my new colleagues. I'm just a machine that works all the time."

● Does it increase the workload?

Mobile applications manager Stella Ma's mornings start with a team conference call that she takes from bed. After briefing her manager, the 28-year-old hits mute, brushes her teeth, and downs a bowl of oatmeal before settling in at her dining room table for 12 hours or more on her laptop. She says she's putting in longer days than ever. "I was stupid to think working from home was easy," says Ma, who asked that her company's name not be disclosed. Sunny Chen, a 26-year-old Beijing-based product manager in NetEase Inc.'s online education unit, also says she's facing a heavier workload than usual because of increased demand for remote learning during the public-health crisis. "Being on standby 24/7 is more of a norm under the work-from-home situation," she says.

Managers at Huawei Technologies Co. are requiring workers to complete a survey about their health condition every day before 9:30 a.m. Allen Chen, a 26-year-old engineer at Huawei's research institute in Wuhan, says it's also a way for the company to keep tabs on attendance. A Huawei spokesman says the checks are intended to monitor the health of workers, not attendance.

What I'm telling my stuck-at-home students

Andrew Hancock, director of education at Cognita, which runs international schools in Hong Kong

In Hong Kong at the moment, the schools are not open to students, you're not meant to go out in the community, and the apartments are notoriously tiny. One of the schools has been in an online-learning situation for quite some time. They've been talking a lot about routines. If they're at home, kids can start sleeping in, not brushing teeth. So they are spending time communicating with kids about getting up in the morning, having breakfast, taking brain breaks. At the end of the day, the kids need routines—they need to have that structure and cadence to the day. The physical education group has also been communicating the importance of exercise—exercise that can be done in a small space. A regular routine allows them to deal with the ambiguity outside. —As told to Joanna Ossinger

How can WFH go wrong?

● A relentless office schedule dubbed "996"—9 a.m. to 9 p.m., six days a week, plus overtime—has long been a burdensome reality for China's tech workers. With the new coronavirus outbreak forcing hundreds of thousands of the sector's employees to log in remotely, they're discovering that working from home can be even worse.

Instead of bringing employees greater freedom, telecommuting means professional life is encroaching even more on private life, as bosses subject workers to hourslong conference calls, regular check-ins to ensure they're not slacking off, and expectations that they'll be available 24/7. Compounding the problem are unstable virtual office tools that frustrate smooth communication, stymieing productivity

Without regular check-ins, employees might not be working, says Gu Xi, chief marketing officer at online education startup Higgz Technology in Beijing. Gu, 25, tightened supervision over her team of more than 10 during about three weeks of remote working. She demanded that staffers reply to all messages on WeChat Work, Tencent Holdings Ltd.'s virtual office app, within 20 minutes, and she monitored who was the quickest to read her recommended reading items sent via the app as early as 7 a.m. At the end of each day, staffers had to rank their performance on a scale from 2 to 10. "If I'm not harsh, the employees might be working out at home during the office hours," Gu says. Higgz recently let workers return to the office to improve productivity. They sit at every other desk and wear masks.

● How to build more resilient companies?

Search company Baidu Inc. estimated that more than 40% of the country's businesses still had office shutdowns in place as of March 3, citing data collected via its map service. Alibaba Group Holding Ltd., the e-commerce giant that serves as a barometer for the world's No. 2 economy, warned last month of a "significant" hit to revenue for the quarter ending in March because people such as merchants, couriers, and factory workers couldn't get to their jobs. Thousands of its employees are still working from their homes in Hangzhou, where Alibaba has its headquarters. That city has imposed some of the harshest quarantine and virus-prevention measures outside of Wuhan.

The need for greater trust between employees and management and for better tools to accommodate mass telecommuting are among takeaways China's tech companies should consider after their remote working experience during the outbreak, says Alvin Foo, managing director of Reprise Digital, a Shanghai digital ad agency. "It's a wake-up call for companies to be really looking into building a more resilient organization," he says. After all 400 of the company's employees worked remotely for two weeks, Reprise Digital now allows half back to the office on a rotating basis. "Meeting people in person also allows you to build back the momentum that has been lost during the outbreak," Foo says.

Eric Zhu, 35, a game developer in Beijing, got a glimpse of what the return to the office might look like when he had to go to his company's



▲ Claire Tu working from home in Shanghai for Reprise Digital, which recently allowed half its staff back to the office on a rotating basis

headquarters to turn his desktop computer's power on—so he could continue accessing files from home—after a security guard had shut it down. The place was empty and reeked of disinfectant. "I risked my life," he says, half-jokingly. Before heading out, he left a Post-it on his monitor reminding others not to switch off the computer. Zhu, who asked that his company's name be withheld, is apprehensive about being in close contact again with colleagues and commuters. For him, telecommuting hasn't been more arduous, he says: "We are result-oriented. As long as you finish your job before the deadline, no one cares what you do in the middle."

A growing number of major companies are making work-from-home recommendations as the virus infects more people around the world and as health authorities enforce containment measures in regions with the greatest number of cases. The tech sector, in particular, has been an early mover: Apple Inc. is encouraging employees in Silicon Valley to work from home as an additional precaution against the outbreak, joining Alphabet, Microsoft, and Twitter.

Global companies may not encounter the same lower employee morale tied to working from home as in China, where the broader corporate culture doesn't put a high priority on the well-being of staff, says Marlon Mai, Shanghai-based managing director for recruitment consulting firm Morgan McKinley. "China has yet to enter the stage where you can truly have work-life balance and where companies have people's needs foremost in mind," he says. "Internet firms have turned 996 into a default setting, and other companies are following suit. To put it bluntly, workers in this sector are just exchanging their time for money." —*Zheping Huang and Claire Che, with Gao Yuan*

How will we worship?



48

● In Milan, churches sit empty as the faithful follow Mass on television. And with five months to go before Islam's most sacred pilgrimage, it's unclear if Saudi Arabia will reopen holy sites to millions of foreign Muslims. Able-bodied believers are required to make the 10-day hajj, set for late July and August, once in their lives. Visas for the umrah, a shorter pilgrimage that can be made throughout the year, have been suspended.

Religion asks people not only to gather together, but often to touch and share food. Now everyday rites and traditions are being interrupted. Some

synagogues in the U.S. have discouraged hugging or kissing to greet one another—one in New Jersey suggests a slight bow at the hips or a friendly wave when saying "Shabbat shalom." In Hong Kong, some churches took away hymnals to minimize contact with possibly contaminated surfaces. Others stopped singing, to limit the expelling of droplets. Some Catholic dioceses in the U.S. told parishes to suspend offering wine for communion.

A religious group in South Korea was linked to a spike in cases there. Some churches were also identified as coronavirus clusters in Singapore, where

▲ A sanitation sweep at Basilica San Domenico Maggiore in Naples

many congregations have now moved activities online. Employees go online to fulfill pastoral care and administrative duties. Bible studies, sermons, and some group meetings have moved to platforms such as Zoom, Google Hangouts, and Facebook Live. Employees at the Hindu temple Akshardham in New Delhi have been asked to wash their hands six to eight times a day. The temple receives as many as 10,000 visitors a day.



Juliana Lee, whose husband and two young sons attend Our Lady of Mount Carmel Church in Hong Kong, says the suspension of Sunday classes for kids and Masses are prudent measures. "You're packed like sardines in a church," she says. "You're sitting and kneeling, holding hands, going up to take the host, and dipping it in wine. It doesn't feel comfortable right now to be in an enclosed space with lots of worshippers." Her sons are doing Bible lessons sent to them by email instead, and the family plans on catching Mass online.

Religions have more experience than any other institutions in the world in dealing with epidemics and surviving them. But the economic cost limiting the spread of the coronavirus in places of worship and devotion is significant. The hajj and umrah pilgrimages contribute an estimated \$12 billion a year—or 7%—to Saudi Arabia's gross domestic product. In Hong Kong, one church in a district popular with expatriates is in dire straits. St. Anne's has seen a decline in members, some of whom relocated after the city was gripped by

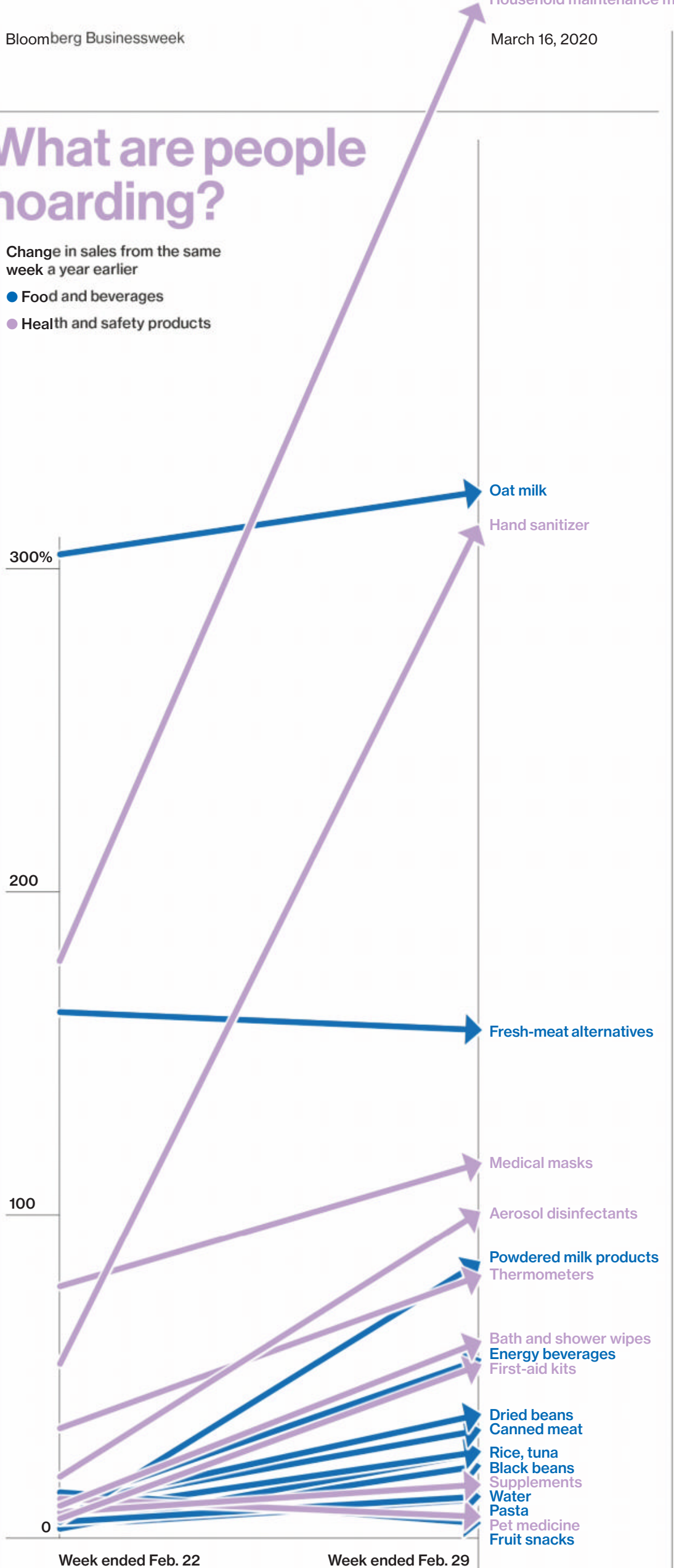
months of protests. That, plus suspended services, has caused a sharp fall in income from donations at Mass, says parish priest Paulus Waris Santoso. "If we do nothing, we'll collapse," he says.

Community Church Hong Kong has seen attendance drop by more than half, says its pastor, Steve Gaultney. The majority of donations to it come as electronic payments, and the church is working to expand such options, and to use technology to keep people connected. "All churches will be impacted by the coronavirus," Gaultney says. —*Faris Mokhtar*

What are people hoarding?

Change in sales from the same week a year earlier

- Food and beverages
- Health and safety products



DATA: NIELSEN

Should I stay or should I go?

● The pyramids of Egypt have been on Genelle Edwards's travel bucket list for years. She started having second thoughts about her two-week trip to Egypt, due to start on March 16, after an outbreak of the new coronavirus on a cruise ship on the Nile River and the death of a German tourist from Covid-19 at a hospital in a Red Sea resort. "I'm worried about being quarantined and stuck when I'm there," says the 68-year-old retired business owner from Austin. "But also I'm concerned with my age, as I'm almost at the highest-risk category."

Edwards says she now plans to cancel, a decision that could be costly: She spent \$8,500 plus rewards points on the trip and may only be able to rebook the flight. The conundrum—to travel or not—is a common one, as the coronavirus spreads globally: Those with existing reservations face potentially steep losses for canceling, while those contemplating trips must weigh the risk of getting sick or being quarantined against the discount offers from airlines, tour operators, and cruise companies coping with plummeting sales.

While trip insurance doesn't typically cover disruption tied to epidemics or fear of travel, some coronavirus claims are nonetheless being accommodated: German insurer Allianz SE has started covering medical treatment and trip cancellation and interruption for customers who become ill with Covid-19 or who are scheduled to visit regions with major outbreaks, under certain circumstances and for those with applicable benefits. Tourism in Italy has practically ground to a halt after the country issued a nationwide lockdown on March 9.

For destinations with just a few cases, travelers who cancel can generally expect to lose at least part of the money. TUI AG, a tour operator based in Hanover, Germany, reimburses excursions affected by government-issued travel warnings, but not those canceled because customers are simply wary of traveling. "Fear of infection is not a reason to withdraw from a trip," says Susanne Stuenkel, a spokeswoman for TUI.

The travel industry is starting to loosen some conditions to encourage people to take advantage of deals. German carrier Deutsche Lufthansa AG, which is cutting as many as half of its flights because of the virus, has waived rebooking fees

through April. Melia Hotels & Resorts of Spain is offering rebates of up to 45% and free cancellations. "Many hotels are trying to be more flexible, because they want the travelers to come, if not next week, maybe in three months," says Alexis Waravka, public affairs manager of Hotrec, an association of hotels, restaurants, pubs, and cafes in Europe.

● Will bargains win over wary travelers?

Royal Caribbean Cruises Ltd. is offering guests full credit on their fare even if they opt out as late as 48 hours before embarkation on trips before the end of July. After that, the policy returns to the stricter charges that usually apply for the industry: They'd have to cancel at least 57 days before sailing to get everything but their deposit back.

The looser terms may not be enough to offset declining business for cruise operators. Travelers on several ships have been quarantined for days to weeks after confirmed cases of Covid-19 or because of fears of possible infections, highlighting a risk for the global industry's more than 300 vessels. Most notable was Princess Cruises Inc.'s *Diamond Princess*, which saw about 700 people become infected and was forced to dock for weeks off the coast of Japan. The Centers for Disease Control and Prevention recommended travelers defer all cruise ship travel worldwide because of a higher risk of person-to-person spread.

HolidayPirates Group, which runs travel deal websites in 10 countries, is trying to quell some of the traveler concerns by promoting information on safe destinations, cancellation policies and insurance, and tips on staying healthy. The Berlin-based company, which saw sales slump 30% from late February to early March because of virus-related fears, is expecting the campaign and low-cost deals to bring some business back. "The longer the situation takes, the more travelers will get used to it and the less panic there'll be," says Chief Executive Officer David Armstrong.

Claire Fletcher, 33, a marketing manager in Durham, N.C., took advantage of a cheap offer in January when she booked a round-trip flight for \$349 to San Francisco. The trip to see the city and the redwood forests with two friends in early May is on for now, but Fletcher says she'd be deterred

How low?

● Change in flight fares,* March 4 to March 7

Los Angeles to Calgary

-11.4%

Los Angeles to Nairobi

-11.0%

New York to Casablanca

-11.3%

New York to Lyon

-16.7%

San Francisco to Rio de Janeiro

-17.3%

San Francisco to Stuttgart

-14.3%

by a large outbreak like the one in Italy or even one that spreads city-wide. She expects she'd be reimbursed for accommodation and car rental if she is forced to cancel the trip. "I'm pregnant and have asthma, so I need to be cautious as even the regular flu could be dangerous," she says.

—*Stefan Nicola and Corinne Gretler*

What is it like to live through this?

Wuhan, China

The two women were on the empty streets of Wuhan for three hours that day in January. Zhu E'Yan, 61, pushed her 86-year-old mother, Ren Zhengzai, down the road in a wheelchair, trying to find the nearest hospital willing to treat a patient with a fever. All bus and taxi services were shuttered. When they finally got to a hospital, the hallways were packed with people coughing, many with IV fluid drips on makeshift beds. Zhu sat on the floor the entire night as they waited for a room. But none was available. The next day she wheeled her mother—untreated—home on another three-hour trek.

In the next five weeks, they were turned away by one hospital after another—and both women are now dead. Li Yaqing, 38, wasn't with her mother and grandmother when their ordeal began; she's

reconstructed it from phone calls and texts. In January her grandmother came down with a fever. Rumor had it that people were contracting a weird disease near the Huanan Seafood Wholesale Market. The family didn't take it seriously at first, because they lived far from the market and Li's granny rarely left the house except to play mahjong with her friends. Then, after a few days, the old lady began to have trouble breathing. At the same time, the rest of Wuhan went into lockdown.

On phone calls, her mother and grandmother told Li—who lived alone in her own apartment—about the illness but said she shouldn't visit, because they didn't want her to get infected. She called everyone she knew who might have influence to try to get help. Li made hundreds of calls—to the police, hospital emergency lines, government directories, and hotlines listed by netizens. No one answered. She blasted posts seeking help on Chinese social media including WeChat, Weibo, and Bytedance. She pleaded for help with the local authorities who enforced the quarantine on her neighborhood. After three days a community hospital called to say there was a spot for Li's grandmother, but it was too late. She died that night. The community authorities then dispatched people to disinfect the woman's apartment.

On the same day, Li's mother, Zhu, came down with a fever. At Wuhan Hankou hospital, her lungs showed mild signs of infection. But she tested negative on the nucleic acid test, which identifies the virus in a patient's body through its specific genetic sequence. A lack of test kits and the unreliability of test results caused many patients to be excluded during the early weeks of the outbreak. The staff told Zhu to go home and take pills to bring down her fever. After six days of self-quarantine, on Feb. 6, she began to have trouble breathing and started vomiting. Three days later the authorities moved her, not to a hospital but to a hotel, where she continued to go untreated.

On Feb. 10, after more online pleading and phone calls by Li, her mom was rushed to an intensive care unit. She called Li to ask her to tap more of her connections to get her into a better hospital. "She was going through a mental breakdown," her daughter says. Zhu had seen two of her wardmates die by then. "I told her, 'You're in the ICU because I pulled all the strings I could,' and she got upset and hung up the phone." Li would desperately try to find help—even unproven cures—for her mother. But, she says of the phone call, "that was our last exchange." ▶

What I'm telling my union members

Sal Rosselli, president, National Union of Healthcare Workers, Emeryville, Calif.

During the onset of the HIV/AIDS epidemic in the early 1980s, I was living in San Francisco and helping lead a large health-care workers' union in California. We didn't have all of the answers on how the disease was passed from one person to another and how best to contain it.

Once again I find myself dealing with a national health emergency which we don't yet know how to fully contain. I tell our members the same thing about Covid-19 today as I did about AIDS back then—that we are going to get through this together with brutal honesty and transparency. Health-care workers don't always know whether they can trust their employers. As a union we can help by monitoring health-care providers, determining which ones are best at protecting caregivers and holding the others to that standard. We don't want to scare people, but the more honest and open we are about the illness, the faster we will learn how to limit infections.

Caring for the sick is a calling. Our members are committed to doing their jobs, but they want to know that their employers—and government—won't take any shortcuts in protecting their safety or abandon them if they become infected or placed in quarantine. The last thing we want is for caregivers to be afraid to seek treatment themselves—and risk spreading the illness to patients—because they can't afford to be sick.

—*As told to Cynthia Koons*

◀ Beginning on Feb. 15, the hospital put Zhu on a feeding tube, a catheter and, eventually, a respirator. The next few days were full of dread, and Li's heart sank every time the phone rang, fearing bad news. She finally got the call at 8 a.m. on Feb. 26: The doctors said her mother might not make it. By the time she got to the hospital, her mother had died, her body wrapped in plastic and cremated.

"People who die are just a number on paper," she says. "My grandma didn't even make it as a number," because she died before testing positive for the novel coronavirus. "The worst part is I couldn't be there to take care of them in person. I never saw my mom or even got to say goodbye to her in her final days." —Lulu Chen

Monterubbiano, Italy

In late January entrepreneur Ermanno Vitali, 41, decided he would leave Nanjing, China, with his Chinese wife and two of his three daughters and return to his central Italian hometown of Monterubbiano. The novel coronavirus was already spreading in and beyond Wuhan, about 335 miles from Nanjing, and the long Lunar New Year holiday would be a good time to sit out the outbreak in his native land. After two weeks of quarantine at the behest of Chinese authorities, he and his family flew to Italy, where they would join his third daughter, who lived near Monterubbiano with Vitali's parents and attended school there.

He didn't get the welcome he expected from his hometown. Within days, news of the Vitalis' return from China spread like wildfire in WhatsApp groups and among the parents of his daughter's classmates. The walls, bus stops, and schools of Monterubbiano were plastered with anonymous messages warning the local population to stay away from the family. "They came back secretly from China, the Vitalis, without notifying the authorities," read the notices, which had been handwritten and photocopied. "They are dangerous."

"As soon as we arrived, a hunt for 'plague-spreaders' started," he says, using a term familiar to Italians from their school days. The classic 19th century novel *The Betrothed* recounts a plague in Milan in the 17th century. As contagion spreads, the terrified population starts looking for *untori*, or plague-spreaders, on whom to vent their anger. In a memorable scene in the book, a mob exacts summary justice on a suspected untore.

Vitali, chief executive officer of the Chinese branch of Faam, an Italian battery maker, is well aware of the complicated feelings Italians have for

China. He's witnessed how China's rise in the past 20 years created opportunity and hostility in one of Europe's most fragile economies. As many Italians see it, competition from China's manufacturers since the late 1990s contributed to the country's slow economic decline. At the same time, China has been a boon for Italian exporters—from Prada to Ferrari to hundreds of smaller companies such as Faam. Italian consumers also spend billions of euros on smartphones, toys, and other Chinese-made goods.

But the animosity has been simmering, with occasional flare-ups of anti-Chinese demonstrations in cities including Prato, near Florence, and Milan, home to large Chinese immigrant communities. The outbreak of Covid-19 helped bring the anger into the open. Luca Zaia, governor of the



Veneto region and a member of the anti-migrant League party, said the virus spread in China because the country lacks a culture of hygiene and food safety compared with Europe. "We have all seen them eat live rats or other stuff," he said in a TV interview, only to apologize some days later in a letter to the Chinese ambassador in Rome.

In Monterubbiano, the Vitalis decided to self-quarantine again, pulling their daughter from school and avoiding social contact, even though at the time the Italian government was imposing no restrictions on those returning from China. No other incident occurred, and the family joined the local Carnevale festivities in late February. "Even if someone doesn't love us," Vitali says, "most of the town does."

Still, the posters had shaken the family. Vitali decided to return to Nanjing with his wife and all three daughters in early March. He thought the timing might be opportune for his business: A competitor in Wuhan was struggling amid the containment. By then, however, Italy had become

▲ Zhu E'Yan, 61, and her 86-year-old mother died within weeks of each other in Wuhan

the epicenter of the pandemic in Europe. The Chinese authorities, fearful the contagion would return just as it appeared to be getting under control, informed the family they would have to undergo yet another quarantine. In an additional twist, Vitali's plans to expand his business were hampered by Italian measures that threw snags into that end of his supply chain.

"It's kind of ironic to be pushed back from China after what happened in my hometown," Vitali said with a laugh a few days before his scheduled departure for China. "But maybe we can learn a lesson. I hope that fear can bring us all together." There was one final hurdle: On March 9, Italy imposed a nationwide quarantine—but the Vitalis made it out two days later.

—*Alberto Brambilla and Alessandro Speciale*

Tehran, Iran

The days before March 21 this year were supposed to be busy with shoppers in Tehran and elsewhere in Iran preparing for Nowruz, the Persian new year, the most prosperous time for merchants and shopkeepers. But pedestrian traffic is sparse in the capital. Some people who have ventured out are wearing masks and gloves, while others seem indifferent to protective measures. Restaurants and cafes are empty; the confectioneries—usually packed with folks shopping for new year's candies and sweets—are deserted, stark and almost naked because of the bright lights shining through their tall windows, exposing tray upon tray of unsold pastries, nuts, and chocolates.

On the sidewalks, peddlers spread their products on the ground, but no one's paying attention. "People are afraid of corona," says one seller, using the popular shortened term for the new coronavirus. "They don't want to touch anything. They think they'd carry corona to their homes." On Enghelab Square, near the University of Tehran, some bookstores are closed, and those that aren't have no customers, not even window-shoppers.

At one of the sweet shops, the 56-year-old manager—"Haj Mehdi," as his

employees call him—stands staring at his store empty of the usual holiday consumers. "It's awful," he says. "On a good day we earn one-fourth of the pre-corona days. We used to make 2 million tomans a day [about \$130 at current depressed rates of exchange]. Now, 300,000 to 400,000 tomans. We used to have 80 to 100 customers. Nowadays, fewer than 20. I might actually start drawing tally marks to count the customers every day just to keep myself entertained." He's thinking of cutting down on work hours to save money. "We have 12 people and have asked them to work in shifts every other day," he says. "We're not going to close, but if this situation persists, we may have to let go of them one by one."

At a downtown branch of Bella Shoes, a venerable brand established in 1966, store manager Behnam Soleimani, 26, sounds desperate. "We're selling one-third of February and just a tiny fraction of what we could've been selling in March," he says. "We're part of a company with many branches, and it's unlikely that the spread of coronavirus will lead to the closure of the entire company. But our branch, our staff, or myself might as well get the ax if it goes on like this." Bella has survived calamities before: several stages of bankruptcy and restructuring over the years, as well as the 1979 Islamic Revolution. The epidemic is another existential threat. "It's that time of the year when we shouldn't have time to scratch our heads," Soleimani says. "But nowadays we sit around for a couple of hours without anyone coming in to even ask a price." —*Arsalan Shahla*

▼ The Mashad shopping district on March 8



What do we know about the virus?

● It's quite unlikely that you will die of Covid-19. The case fatality rate as tracked by the World Health Organization officially stands at 3.5%, but that calculation misses out on a lot of unreported cases in the denominator. In South Korea, where testing for the new coronavirus has been most widespread, the fatality rate is about 0.7%. Then again, in Italy, which has also done a lot of testing, it's 6.2%.

Focusing too much on these estimates, though, can be an exercise in missing the point. For one thing, Covid-19's fatality rate is much, much higher for those age 65 and older—who happen to make up a second-highest-in-the-world 22.8% of Italy's population (Japan is No. 1 at 27.6%), which helps explain some of that country's problems. Those with pre-existing conditions such as heart disease and diabetes also face much higher risks than the rest of us.

Perhaps the more important set of statistics to ponder is that in 1918, an estimated 97.3% of people worldwide and 99.3% of Americans didn't die of influenza. Yet that year's pandemic still killed more people than any disease outbreak in history. Maybe, just maybe, the biggest concerns that most of us should have about Covid-19 involve not personal risk but risks to people we care about and to society at large.

● Will this overwhelm hospitals?

One key issue is hospital capacity. In the most severe recent flu season, that of 2017-18, the Centers for Disease Control and Prevention estimated that

45 million Americans contracted influenza-like illnesses, 810,000 were hospitalized, and 61,000 died. That makes for a fatality rate of 0.14%, five times lower than even South Korea's Covid-19 death rate. Multiply those 2017-18 flu hospitalization and fatality numbers by five—or 10, or 20, both of which seem at least conceivable—and it's easy to see how the rapid spread of the coronavirus could overwhelm U.S. hospitals, which have 924,107 staffed beds total and only 46,500 in medical intensive care units. If that happens, the fatality rate will go up, not just for Covid-19 but for other ailments as well. It's probably no coincidence that low-fatality-rate South Korea has the world's second-most hospital beds per person (Japan is again No. 1), with more than four times as many per capita as the U.S.

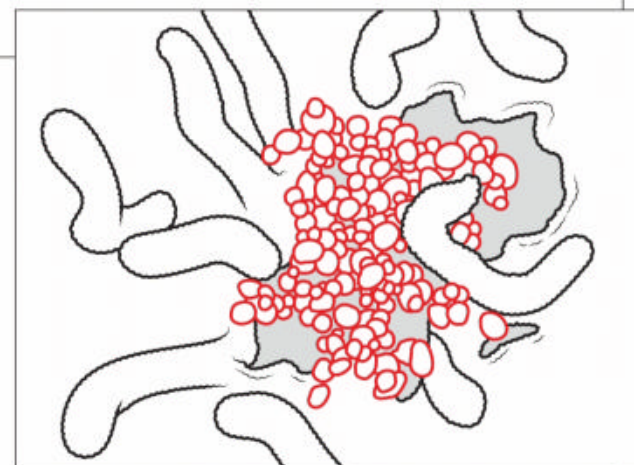
It's this prospect of an overwhelmed health-care system that has motivated lockdowns in China and Italy. It has also spurred the intensive efforts to test and isolate Covid-19 patients that appear to have halted the spread of the disease in several East Asian countries. Epidemiologists in the U.S. seem to be divided on whether it's still possible to stop the spread of the coronavirus here this way. It's definitely possible to slow it, though—which is what the current rash of event cancellations, college shutdowns, and work-from-home advice is about. Almost all of us are going to survive this. The question is whether we can avert a situation where millions of us don't. —Justin Fox, *Bloomberg Opinion*

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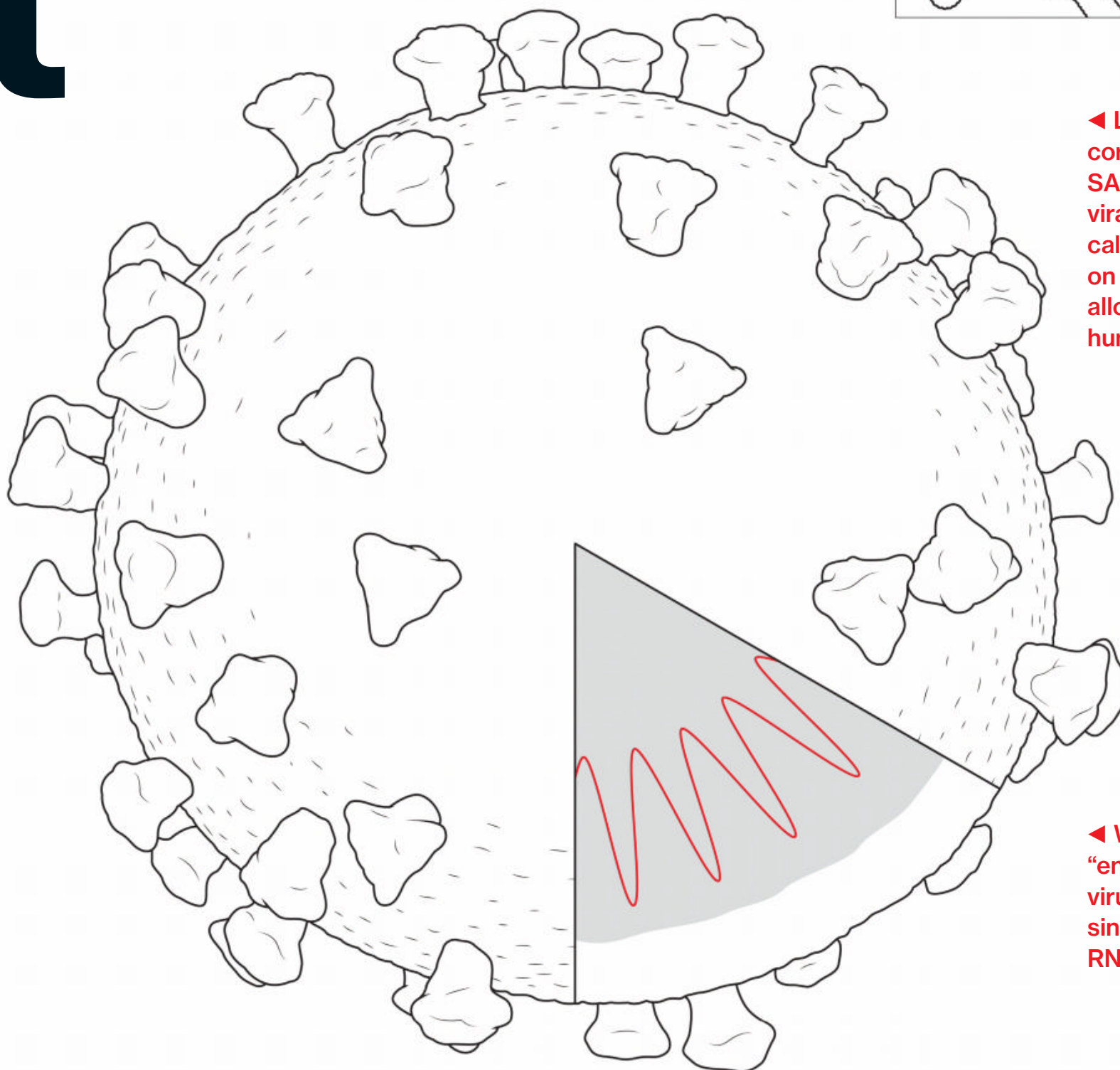
This is the particle responsible for Covid-19, the pneumonia-causing disease spreading around the world. The virus is called SARS-CoV-2, short for severe acute respiratory syndrome coronavirus 2.

—Jason Gale

► SARS-CoV-2 particles (red) emerging from the surface of a human cell (black).



◀ Like other coronaviruses, SARS-CoV-2 has viral spike proteins, called peplomers, on its surface that allow it to infect human cells.



◀ Within the “envelope” of the virus is a long, single-stranded RNA genome.

● **Targeting humans**
SARS-CoV-2 spikes bind on the human cell surface to receptors called angiotensin-converting enzyme 2 (ACE2).

● **Infection sites**
Human cells that express ACE2 are vulnerable to infection. These are present along the epithelium lining the respiratory and gastrointestinal tracts, including on the tongue and stomach.

● **Latching on**
The spikes latch on to human cells and undergo a structural change, allowing their membrane to fuse with the host cell membrane. The viral genes can then enter the host cell and multiply.

● **Lethal pneumonia**
The vast surface area of the lungs makes it highly susceptible to inhaled viruses, with the alveoli sacs that help bring oxygen into the blood vulnerable to invasion.

Why is testing so complicated?



▲ Landt

● Shortly after New Year's, Olfert Landt started seeing news reports of a strange disease spreading in China. The German scientist, who's developed tests for ailments ranging from swine flu to SARS, sensed an opportunity—and a new mission. He spent the next few days quizzing virologists at Berlin's Charité hospital and scouring the internet for more information on what soon became known as the novel coronavirus, and by Jan. 10 he'd introduced a viable test kit. His phone hasn't stopped ringing since. "Everyone here is putting in 12- to 14-hour shifts," the ponytailed Landt says as he rushes through the corridors of TIB Molbiol Syntheselabor GmbH, the Berlin biotech company he started three decades ago. "We're nearing our limit."

In the past two months, Landt and his staff at the company's production facility—a former industrial building just south of the disused Tempelhof airport—have produced 40,000 coronavirus diagnostic kits, enough for about 4 million individual tests. TIB has reoriented its business toward coronavirus, running its machines through the night and on weekends to make the kits, which sell for about €160 (\$180) apiece. As orders have poured in from the World Health Organization, national health authorities, and laboratories in some 60 countries, TIB's revenue in February tripled from the same month in 2019.

TIB, which last year generated €18 million in sales, is one of about a score of test-kit producers worldwide. Companies such as LGC Biosearch Technologies in Britain, Spain's CerTest Biotec,

and Seoul-based Seegene Inc. are seeing an explosion in demand as authorities seek to slow the virus's spread. South Korea has tested more than 210,000 people and Italy more than 60,000. Efforts in the U.S. got off to a rocky start when a diagnostic tool from the Centers for Disease Control and Prevention proved to be flawed. The U.S. has since changed the test and taken steps to expand availability, but the CDC has warned kits won't be ready in the numbers promised by the Trump administration.

● How do virus tests work?

Over the years, TIB has made tests aimed at diagnosing more than 100 ailments. For the coronavirus, Landt teamed up with Roche Holding AG to distribute the kit, which works with the Swiss drug-maker's diagnostic machines. The tests use what's called the polymerase chain reaction, a diagnostic method recommended by the WHO that amplifies the virus's genetic code so it can be detected before the onset of symptoms. The kit comes with two vials: a primer to help detect an infection, and a synthetically engineered piece of the virus, which labs use to produce a surefire positive match to ensure their machines are working correctly. A lab technician combines these ingredients with a patient's mucus sample—usually from a throat or nasal swab—and results are usually available in a few hours.

The Robert Koch Institute, Germany's equivalent to the CDC, is urging scientists to come up with a simple tool that patients can administer themselves and get almost immediate results—something like home pregnancy tests. An interim step could be revised procedures such as asking patients to ►

◀ TIB's lab has been running flat out for weeks

► Each kit costs €160 and can be used for about 100 tests





Total weight (incl. packaging): 14 g/41 g
 used to diagnose an infection by detection of the viral genome in a
 obtained from respiratory tract specimens for

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◀ take their own samples for drop-off at a doctor's office, says Lothar Wieler, head of the institute. "There will need to be more such solutions," Wieler told reporters on March 9 in Berlin. "Otherwise, we won't be able to handle the number of patients needing tests."

With demand surging, Landt is trying to rent space in a building across the street to expand packaging and mailing—the bottleneck of his operation. He's hired a team of students who sit at a long table packing the kits in flat plastic bags, and he bought a used machine that folds instruction manuals to fit in the bags. His 21-year-old son, Aaron—a math student—oversees labeling. ("It's a 60-hour-a-week part-time job," Landt says.) His wife, Constanze, a biology Ph.D. in charge of TIB's procurement, anticipated the demand surge more than a month ago and laid in extra supplies of the basic chemicals for the tests. Without that, "nothing would be working anymore," Landt says, but those stocks are running low. The next challenge, he predicts, will be keeping up with likely mutations of the virus, which would render his tests less reliable. "A virus like this is a major evolution machine," he says before hustling back to his office. "We can calm down when there's a vaccine." —*Stefan Nicola, with Tim Loh and Heejin Kim*

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Why do some people get so sick?

● The new coronavirus causes little more than a cough if it stays in the nose and throat, which it does for the majority of people unlucky enough to be infected. Danger starts when it reaches the lungs.

One in seven patients develops difficulty breathing and other severe complications, and 6% become critical. These patients typically suffer failure of the respiratory and other vital systems, and sometimes develop septic shock, according to a report by February's joint World Health Organization-China mission.

The progression from mild or moderate to severe can occur "very, very quickly," says Bruce Aylward, a WHO assistant director general who co-led a mission in China that reviewed data from 56,000 cases. Understanding the course of the disease and

identifying individuals at greatest risk are critical for optimizing care. About 10% to 15% of mild-to-moderate patients progress to severe, and of those, 15% to 20% progress to critical. Patients at highest risk include people age 60 and older and those with preexisting conditions such as hypertension, diabetes, and cardiovascular disease. "The clinical picture suggests a pattern of disease that's not dissimilar to what we might see in influenza," says Jeffery Taubenberger, who studied the infection in victims of Spanish flu, including one exhumed more than 20 years ago from permafrost in northwestern Alaska.

Covid-19 most likely spreads via contact with virus-laden droplets expelled from an infected person's cough, sneeze, or breath. Infection generally starts in the nose. Once inside the body, the coronavirus invades the epithelial cells that line and protect the respiratory tract, says Taubenberger, who heads the viral pathogenesis and evolution section of the National Institute of Allergy and Infectious Diseases in Bethesda, Md. If it's contained in the upper airway, it usually results in a less severe illness. But if the virus treks down the windpipe to the peripheral branches of the respiratory tree and lung tissue, it can trigger a more serious phase of the disease. That happens because the virus directly inflicts pneumonia-causing effects, and the body's immune response to the infection causes secondary harm.

"Your body is immediately trying to repair the damage in the lung as soon as it's happening," Taubenberger says. Various white blood cells that consume pathogens and help heal damaged tissue act as first responders. "Normally, if this goes well," he says, "you can clear up your infection in just a few days."

● When does the body fight itself?

In some more severe coronavirus infections, the body's effort to heal itself may be too robust, leading to the destruction of not only virus-infected cells but also healthy tissue, Taubenberger says. Damage to the epithelium lining the trachea and bronchi can result in the loss of protective mucus-producing cells as well as the tiny hairs, or cilia, that sweep dirt and respiratory secretions out of the lungs. "You have no ability to keep stuff out of the lower respiratory tract," Taubenberger says. As a result the lungs are vulnerable to an invasive secondary bacterial infection. Potential culprits include the germs normally harbored in the nose and throat, and the antibiotic-resistant bacteria that thrive in hospitals, especially the moist environments of mechanical ventilators.

What I'm telling everyone

David Ho, M.D., world-renowned pioneer in HIV research. Scientific director of the Aaron Diamond AIDS Research Center and professor of medicine at Columbia University Irving Medical Center, New York

I say act sensibly. An infected person should stay home. If you're coughing or sneezing, wear a mask to contain the virus as much as possible. I usually advise a mask for a sick person and a health worker who has to be face-to-face with a sick person. I don't recommend wearing masks as the Chinese wear them, everywhere on the street. To a large extent that's useless, and most aren't appropriate. If you use an N95 mask, it's suffocating. It's extremely uncomfortable.

I emphasize hand hygiene. We know from flu and SARS that most of the infection is acquired from touching contaminated surfaces and bringing the virus to your mouth or eyes. That's the major route.

Here in my lab, we try to disinfect the common areas—doorknobs, handrails, elevator buttons—on a frequent basis. Everyone should be on alert about hand hygiene and cleaning. —*As told to Susan Berfield and Robert Langreth*

Secondary bacterial infections represent an especially pernicious threat because they can kill critical respiratory tract stem cells that enable tissue to rejuvenate. Without them, “you just can’t physically repair your lungs,” Taubenberger says. Damaged lungs can starve vital organs of oxygen, impairing the kidneys, liver, brain, and heart. “When you get a bad, overwhelming infection, everything starts to fall apart in a cascade,” says David Morens, senior scientific adviser to the director of the National Institute of Allergy and Infectious Diseases. “You pass the tipping point where everything is going downhill, and at some point you can’t get it back.”

That tipping point probably also occurs earlier in older people, as it does in experiments with older mice, says Stanley Perlman, a professor of

microbiology and immunology at the University of Iowa, who’s studied coronaviruses for 38 years. Still, even healthy younger adults have succumbed to the illness. Li Wenliang, the 34-year-old ophthalmologist who was one of the first to warn about the coronavirus in Wuhan, died last month after receiving antibodies, antivirals, antibiotics, and oxygen and having his blood pumped through an artificial lung. Some people may be more susceptible, possibly because they have a greater abundance of the distinctly shaped protein receptors in their respiratory epithelial cells that the virus targets, Taubenberger says. It’s also possible certain individuals have some minor immunodeficiency or other host factors that relate to underlying illnesses.
—Jason Gale

● Share of coronavirus patients who become critical

6%

Why do we need mice to develop a vaccine?

● It’s a basic rule of medical research: Before you inject anything into humans, conduct experiments on animals—frequently mice—to determine whether treatments are safe and effective. In the race to develop a vaccine for the new coronavirus, however, your everyday mouse won’t do. While mice have a gene similar to the one scientists believe allows the virus to affect humans, researchers think those mice don’t exhibit the symptoms that make the illness so deadly for people. “You can infect them, but they have very little, if any, clinical disease,” says Richard Bowen, a professor of veterinary medicine at Colorado State University.

That’s great if you’re a mouse, but not if you’re a researcher. So scientists often seek mice that have been genetically modified with a humanized gene, called ACE2, that makes the virus more virulent—and thus better for studying its effects. As Covid-19 spreads around the world, though, it’s almost impossible to find transgenic ACE2 mice needed to study the virus. There are no global statistics on availability of those animals, but several vendors of transgenic mice say they have none available, and researchers expect it will take weeks or months to develop a sufficient supply. “Almost nobody has these mice in a viable colony now,” says Stanley Perlman, a professor at the University of Iowa’s medical school. “Everybody I know is trying to find them.”

It’s not possible to keep mice on hand for every potential disease. Despite short outbreaks of coronavirus-caused illnesses such as SARS, which paralyzed China, Hong Kong, and other parts of Asia for months in 2003, most scientists stick with more lucrative opportunities in cancer, hepatitis, and other chronic ailments that require different varieties of lab animals. “Research follows trends, and at the moment people are mainly focusing on oncology and metabolic disorders,” says Kader Thiam, who oversees genetically modified mice at GenOway SA, a lab animal developer in Lyon, France.

The Jackson Laboratory, a nonprofit in Maine that supplies animals to medical researchers, sells more than 11,000 varieties of mice. But when the coronavirus started making headlines in January, Jackson didn’t have any with the necessary gene. As orders began flowing in, the Jackson crew started scouring medical literature for people who’d worked with humanized mice and might donate some for breeding. They found Perlman, a coronavirus specialist who had used transgenic mice in the fight against SARS. Perlman didn’t have any live mice, because a decade ago he decided his lab couldn’t afford to maintain them, but he’d extracted sperm samples just in case. Last month he sent those frozen remnants of the discontinued colony to Jackson, which is using them to impregnate mice and begin a ▶



▲ A mouse from the line donated by Perlman

◀ new line. “We’re getting our first animals and are in the process of doing additional breeding,” says Charles Miller, Jackson’s global logistics chief. “Right now we are just scaling as fast as we can.”

Pregnant mice need about three weeks to deliver their pups, and newborns need about six more weeks to reach maturity so the cycle can start again. Jackson is taking preorders and hasn’t yet told would-be customers when they’ll receive deliveries. China’s Cyagen Biosciences Inc. says it will have mice ready next month. GenOway aims to develop a newer breed that’s better targeted to coronaviruses, but it says that could take a year or more.

The mouse crisis is one reason talk about the speedy introduction of a vaccine isn’t realistic. Without mice to study, scientists simply can’t fully test potential drugs and vaccines. “It’s a major bottleneck,” says Nikolai Petrovsky, a professor at the medical school of Flinders University in Adelaide, Australia. He says animal testing is “absolutely essential” and cautions against political pressure to speed up the process. “I know some people are talking about bypassing animals and going to human studies,” Petrovsky says. “But that’s fraught with difficulty and danger.”

In the meantime, some in the field are exploring alternatives. Bowen, the Colorado State researcher, says he’s trying tests with ferrets, hamsters, guinea pigs, and rabbits, though they all have ▶



▲ Frozen mice semen at Jackson

▶ When the virus started spreading, the Jackson Laboratory had none of the mice needed to develop a vaccine



◀ disadvantages vs. mice. Xavier Saelens, principal investigator at VIB, a life sciences research institute in Ghent, Belgium, is considering using other mice as a stopgap measure, arguing that they're better than nothing. And he's looking into the possibility of breeding humanized mice on-site, since obtaining them from the usual sources is so tough. "That's the surest way," he says, "to get the mice."
—Bruce Einhorn, with Tim Loh

How is the hunt for a cure going?

● The deadly new coronavirus arrived by courier on Feb. 6, delivered to a windowless air-locked laboratory in a secret location on the University of North Carolina at Chapel Hill campus. It came sealed in two 500-microliter vials, wrapped inside plastic pouches, placed inside a third sealed plastic container, all packed with dry ice.

A team of scientists—protected head-to-toe by Tyvek bodysuits with battery-powered respirators—opened the vials, got down to work, and haven't stopped since. Members of an elite lab of virologists at the university's Gillings School of Global Public Health, they've taken on the mission of developing a drug to treat the pathogen. For veteran researcher and lab leader Ralph Baric, it's the moment he's both long feared and expected. As early as the 1990s, Baric's work was raising red flags: Coronaviruses had an extraordinarily high ability to mutate, adapt, and jump between species. Scientists say the new coronavirus might have begun with bats spreading it to other animals in the wild. Some of those eventually wound up in one of China's open-air markets where live animals are caged in close proximity—a perfect setting for transmitting viruses to humans.

Until two months ago, Baric was little known outside academic circles. When he began his career, coronaviruses were understood as causing little more than a common cold in people. But his work has suddenly taken on new urgency. Baric's 30-person team was one of the first in the U.S. to receive samples of the virus isolated from a patient in Washington by the Centers for Disease Control and Prevention. Several other labs are also racing to find anything that might slow the virus's spread

or ease its symptoms, the University of Maryland School of Medicine and Vanderbilt School of Medicine among them.

Baric's team is growing as much of the virus as it can to test possible drugs for their ability to inhibit it inside human lung cells in a test tube.

This first round of testing will likely wrap up soon. If it works, scientists will test a slew of new drugs in mice that have been engineered to carry human lung receptors the coronavirus can infect. "Now that we have the virus, it's a lot of people working all the time," says



Lisa Gralinski, an assistant professor under Baric. The pace is as frenzied at the few other labs with samples. "It has been 18- to 20-hour days for the last two months," says Matthew Frieman, a University of Maryland virologist and a Baric protégé.

▲ Baric

World Health Organization researchers have called Gilead Sciences Inc.'s remdesivir, developed with Baric's assistance, the most promising agent identified so far to use against the new virus. Trials of the drug are under way in affected areas of China, the U.S., and elsewhere, and Gilead says it expects some results by April. To speed the efforts, government agencies are redirecting funds to bolster coronavirus research. On March 6, President Trump signed a spending bill with \$7.8 billion in emergency funding, some of which will go to drug and vaccine development. The government is working with Regeneron Pharmaceuticals Inc. and Johnson & Johnson to create new drugs or identify existing ones.

Baric says he was "shocked" in January to see how fast the coronavirus was spreading. Now the workload is overwhelming as companies and researchers around the globe turn to his lab for help. He's narrowed down the search to about 100 drugs that are likely to show promise against coronaviruses. Even if the Gilead drug works—a big "if"—it would have drawbacks: It can't be offered in pill form, for instance, but must be infused in a hospital or doctor's office. More crucially, other drugs may need to supplant it to fight even newer coronaviruses. "The goal of our program is to find broad-based inhibitors that work against everything in the virus family," Baric says. That makes the challenge sound matter-of-fact, but Baric knows there's a long road ahead. "I have a lot people who are really tired," he says. "They are working really hard." —Robert Langreth

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How can you help?

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● An unfamiliar, invisible threat like the novel coronavirus can make people feel helpless and turn inward just when they most need to reach outward, both helping and leaning on others. Here are concrete ways you can help your family, co-workers, and neighbors.

● **Be a role model**

Good personal health habits help prevent respiratory infections: Cover coughs and sneezes with a tissue or an elbow sleeve; wash hands often with soap and water for at least 20 seconds; clean and disinfect frequently touched objects and surfaces; and avoid touching one's eyes, nose, and mouth. But don't just do it—be conspicuous about it. Talk about it. Make it a community norm.

● **Promote a workplace culture that supports people staying home when sick**

People should stay home when they have a respiratory illness. But many still feel pressured to work. They need hourly wages, are essential personnel, or face looming production goals. If you're a manager or business owner, implement realistic sick leave policies, be flexible with workplace arrangements—such as allowing people to work from

home—and act on public-health recommendations. For everyone else, don't make your co-workers feel guilty about not coming in.

● **Steward resources wisely**

Novel disease outbreaks can make extra demands on everyday goods and services, such as surgical masks and hand sanitizer. Because community well-being comes from collaboration and not competition, weigh your own needs alongside those of others. Refrain from hoarding items that are in short supply.

● **Look out for the most vulnerable**

Be sensible about not exposing frail seniors or people with other health conditions to respiratory illness. Neighbors and family should pitch in with groceries, supplies, and moral support when such people must avoid public spaces. Share phone numbers, email, and messaging contacts so it's easier to reach out. People who live in racially and ethnically diverse communities should double their efforts at sharing information and offering mutual aid. If the 2009 H1N1 influenza outbreak is a guide, minority groups may face higher rates of complications, hospitalizations, and deaths.

● **Help with child care and meals**

Efforts to stem the spread of Covid-19 have sometimes included school closures. This can place huge burdens on working families and keep needy students from regular nutritious meals. In addition, employees at health-care facilities may experience increased work demands, inhibiting them from tending to and feeding their families. Step in where you can to provide alternative child-care and meal options for neighbors and family.

● **Remember that viruses don't discriminate**

When an outbreak emerges, some people blame perceived outsiders or avoid people from groups they assume are contagious. Such behaviors turn a mysterious illness into something that feels more controllable. But these anti-social ways of coping may build on preexisting prejudices and blame victims of infection or their care providers unfairly. They undermine the social bonds we'll need to get through this and can keep us from the things that we know help. Again: Wash your hands. Cover your cough. And wash your hands. —*Monica Schoch-Spana*

Schoch-Spana, a medical anthropologist, is a senior scholar with the Center for Health Security at the Johns Hopkins Bloomberg School of Public Health. (The school is supported by Michael Bloomberg, founder and majority owner of Bloomberg LP, parent company of Bloomberg Businessweek.)

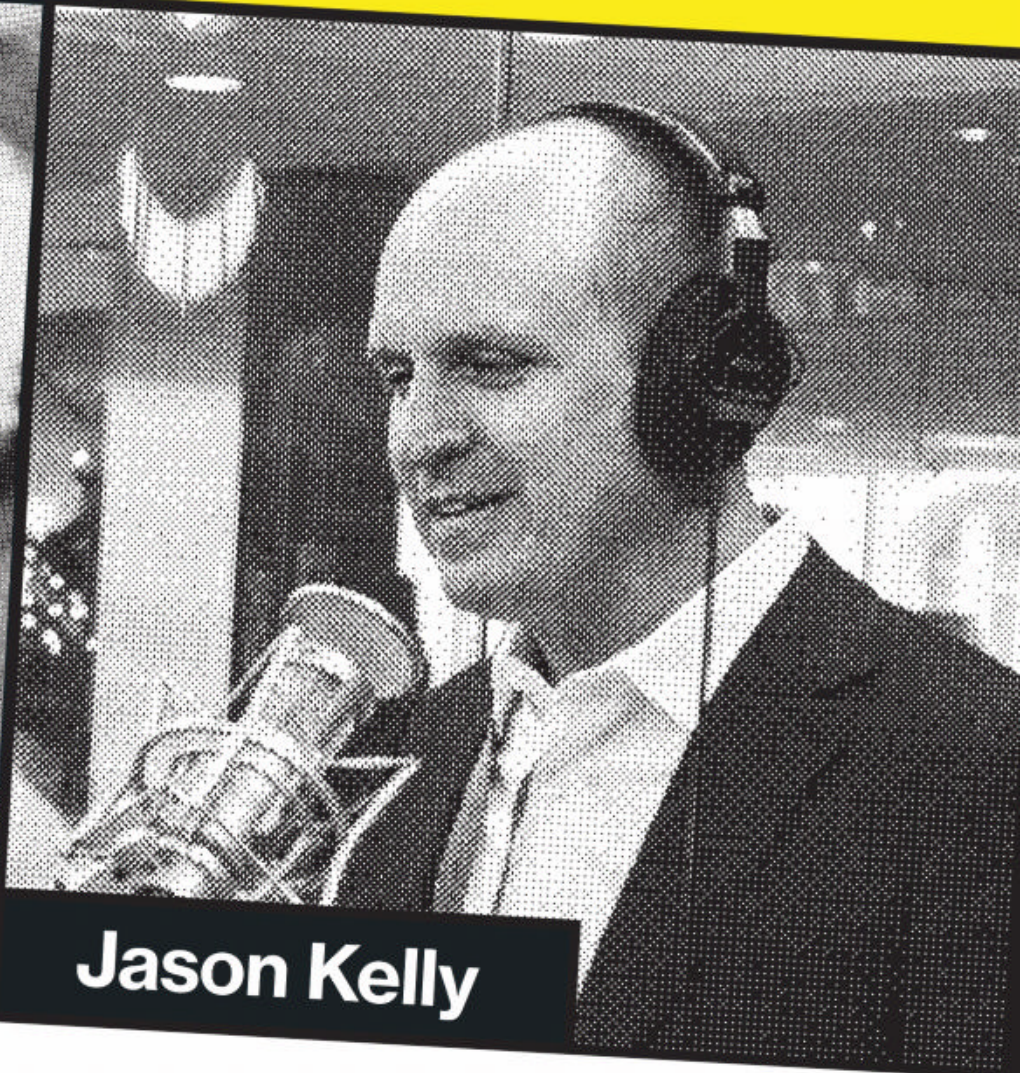
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