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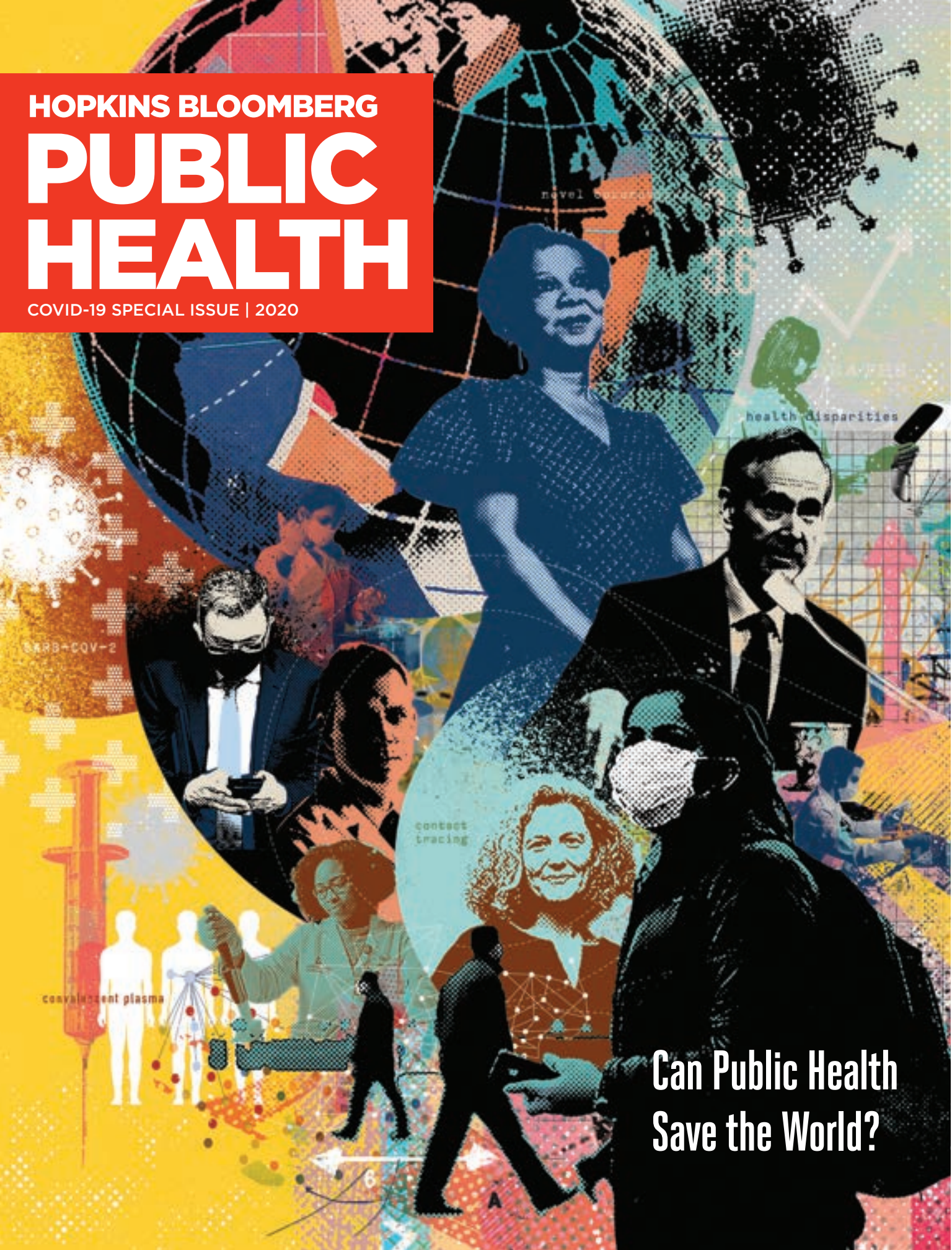

Can Public Health Save the World?

ESSENTIALS FROM DEAN ELLEN J. MACKENZIE, PHD '79, SCM '75

LET'S FIX THINGS FOR GOOD

COVID-19 is teaching us a brutal lesson: Invest in public health or suffer the consequences.

One of my first official functions as dean of the Bloomberg School back in the fall of 2017 was to preside over a symposium the School organized in collaboration with the Smithsonian Institution to reflect on lessons learned from the response to the 1918 influenza pandemic. It was entitled "When the Pandemic Hits, Will We Be Prepared?"

Our keynote speaker was none other than Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases. He was joined by many of the leading public health experts we are now hearing from on a daily basis. Revisiting the conclusions from this symposium sent chills down my spine. Tom Inglesby, director of the School's Center for Health Security, summed it up well: "A hundred years after the lethal 1918 flu, we are still vulnerable. Our public health infrastructure has improved greatly, but without a universal vaccine, a single virus could result in a world catastrophe." »

Z WEI/GETTY IMAGES

In response to the symposium's top-line question—"Are We Prepared?"—the answer from the experts was a resounding "No."

And here we are today. In the pandemic spawned by the SARS-CoV-2 virus, in the millions of cases and hundreds of thousands of deaths that happened with terrifying speed, we face the reality the experts painted for us in stark colors that afternoon almost three years ago. They were right: We were not prepared. And the U.S. will continue to suffer disproportionately due in part to the deficiencies in our public health system and our lack of commitment as a nation to prevention and to health as a human right.

We will make it through this current crisis, but what will happen then? Will we be any better prepared for the next one?

The answer is yes—if we can learn from our lived experience and make the bold decision, once and for all, to invest in the infrastructure and the workforce needed to secure the population's health every day and to serve us well in times of crisis.

I'm optimistic because a new understanding and appreciation for the value of public health strategies is emerging. I hear people talking about the need for a "public health approach" every day. They are seeing firsthand how protecting one's individual health depends on protecting the health of the people around them and those in their community. What has flattened the curve of the pandemic in cities around the world is not any medical discovery or drug, but our collective action to practice physical distancing, good hand hygiene, and disinfection combined with strategic testing, contact tracing, and isolation/quarantine. And if we are able to find an effective vaccine in the coming months, it will be the public health system that assures access and community protection.

The pandemic has also reminded us that our health as humans is inexorably interconnected with our global environment and the animals with which we share that environment. And perhaps most dramatically, it puts a spotlight—brighter than ever before—on the disproportionate vulnerability of communities of color and those who are marginalized due to long-standing structural inequities and racism. For too long, we have failed to comprehensively address the extreme disparities in the social determinants of health such as income, education, and housing.

> "We will make it through this current crisis, but what will happen then? Will we be any better prepared for the next one? The answer is yes—if we can learn from our lived experience and make the bold decision, once and for all, to invest in the infrastructure and the workforce needed to secure the population's health every day and to serve us well in times of crisis.

I am also realistic. Progress against these deep-rooted challenges is far from inevitable. In our response to outbreaks of H1N1 in 2009, Ebola in 2014, and Zika in 2016, we saw an infusion of resources for federal, state, and local public health agencies to boost their responses. But these commitments did not last. In fact, funding for public health—including disease surveillance, preparedness, and response efforts—has steadily declined over the last decade, and the public health workforce has contracted dramatically. Many jobs lost during the 2008 recession and its aftermath never came back. Large health departments alone shed more than 56,000 jobs from 2008 to 2018, according to the National Association of County and City Health Officials.

What can make a difference this time? We must start talking now about the need to invest for the long term. Rather than brigades of contact tracers, we need brigades of public health workers who will start with contact tracing and then move on to address many other critical challenges. Rather than pop-up testing sites in low-income communities, let's create more community health centers. Rather than temporary hotel housing for people experiencing homelessness, let's build more units to address access and affordability. Our advocacy for these and other long-term solutions must be relentless.

If we do not succeed, we will be faced with the further erosion of resources and trust in public health agencies and organizations. We cannot let the legacy of a public health crisis be the devaluing of public health itself.

To be effective, we need to advocate for a modern, 21st-century public health system as called for by our National Academies of Science and build political will for its support. Our leaders—at every level—must recognize the cost of ignoring public health and undervaluing prevention and preparedness.

Albert Einstein famously said, "In the midst of every crisis, lies great opportunity." We must seize this opportunity to help our nation prepare for the future. We must act now. We must act as if many lives depend on our success, because they do.

DEAN
BLOOMBERG DISTINGUISHED PROFESSOR

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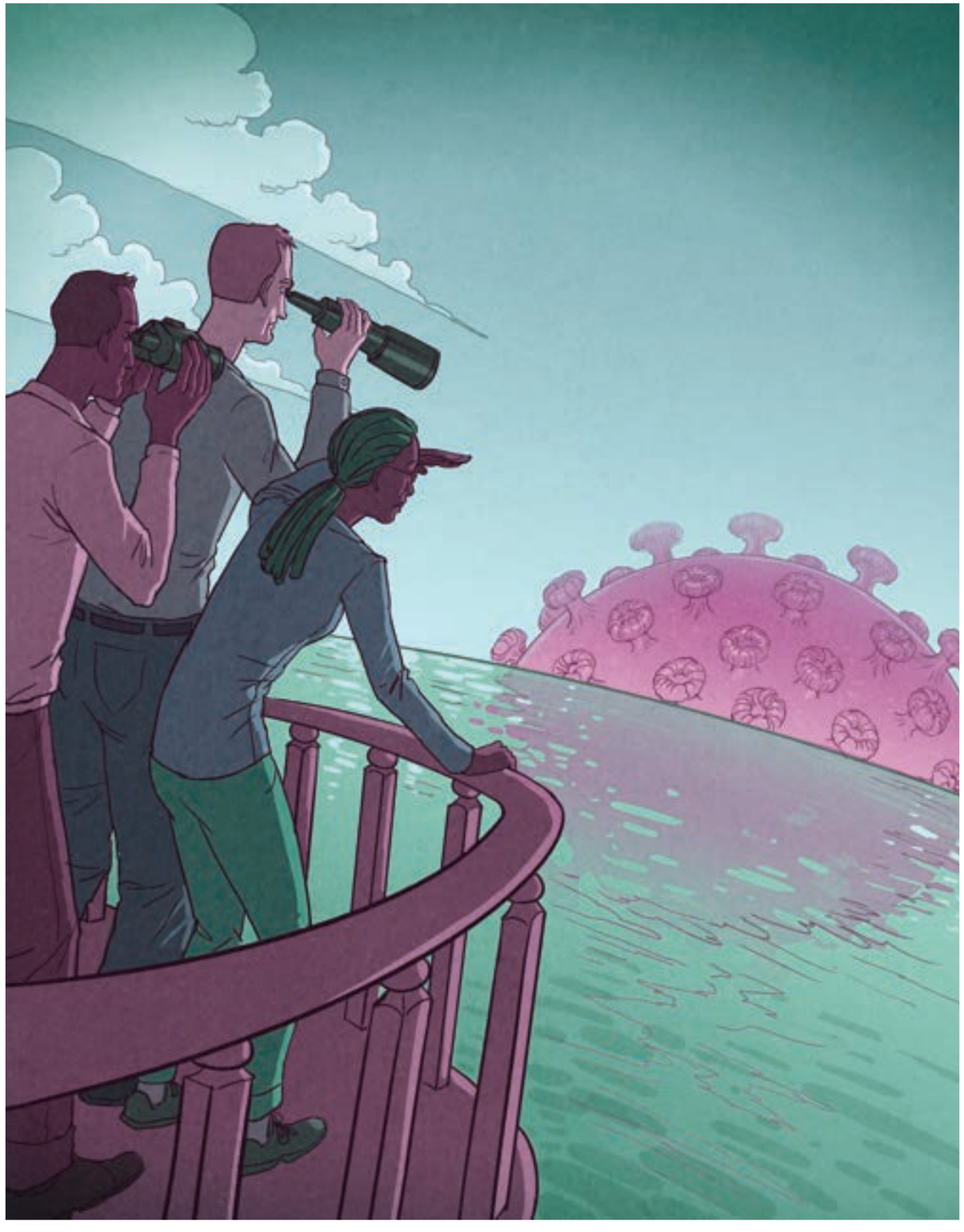
the prequel

FAMILIAR THREATS

Humans forget, but nature persists. Despite pathogens' long history of threatening nations—and sometimes the world—people tend to ignore the risks of emerging diseases. As these nurses tending the ill in Lawrence, Massachusetts, learned during the 1918 influenza pandemic, however, a lack of preparedness costs lives.



KOREN SHADMI

NEVER REST

Big biological threats over the last couple decades have taught us one thing: More are on the way.

BY TOM INGLESBY

In 1998, D.A. Henderson delivered a stark warning during a speech on the Johns Hopkins campus. It changed my life.

A former dean of the School of Public Health and leader of WHO's global smallpox eradication program, D.A. had an extraordinary perspective on epidemic threats. And he was worried. Emerging pathogens were continually probing weaknesses in humans and societies. Big biological events, whether manmade or natural, were inevitable. And the U.S. and other countries were badly unprepared. How could medicines and vaccines be developed more rapidly? How could hospitals get prepared for infectious disease crises? How quickly would surveillance systems recognize new outbreaks?

I was an Infectious Diseases Fellow at the Johns Hopkins School of Medicine at the time and had long been drawn to the study of epidemics. After D.A.'s speech, I introduced myself and volunteered to help with his work. He soon invited me to work with him on a report on U.S. preparedness. Within a year, he decided to start a new Hopkins center focused on strengthening the country's capacity to prevent and respond to biological threats. He asked me to join him, and I did.

New infectious diseases appeared in quick succession after the Center launched. In 1999, West Nile Virus surfaced in New York City and exposed major challenges around disease surveillance and the divide that needed to be bridged between human and animal health. In 2001, the anthrax letters followed 9/11. They illustrated how poorly prepared the U.S. was to cope with even a small-scale use of a biological weapon. And new infectious disease threats continued to emerge, including SARS in 2003–04, H5N1 in 2005, H1N1 in 2009, MERS-CoV in 2012, Ebola in West Africa in 2013–14 (and in the DRC in 2018), and Zika in 2015. Each revealed new gaps in national and global preparedness.

Over the years, our Center's team has grown to include researchers and practitioners in science, medicine, public health, government, law, social sciences, economics, and national security. We study the tools, organizations, systems, and policies needed to prevent and respond to infectious disease threats with a high priority on strengthening national and international policies and programs. We focus on naturally occurring epidemics as well as those that could be started accidentally or through deliberate use of a biological weapon. We conduct research and analysis, work to educate policymakers, and bring together experts and leaders to solve problems and find consensus. We convene international scientific dialogues with senior government officials and scientists aimed at improving understanding and collaboration around biological threats. And we are excited to have recently been named a WHO Collaborating Centre for Global Health Security.

One way we to try to shine a light on major infectious disease challenges and provoke action is through high-level tabletop exercises. Policymakers' attention to these issues waxes and wanes, and we've found that exercises can powerfully engage them and explain complex issues.

In October 2019, with the World Economic Forum and the Bill & Melinda Gates Foundation, we held an exercise in New York. Event 201 simulated the international response to a fast-moving pandemic started by a novel coronavirus. Global business, government, and public health leaders were confronted with a fictional pandemic that caused substantial loss of life and major economic and societal disruption. We published our recommendations and call to action from that fictional coronavirus exercise in mid-January. That same week, China confirmed human-to-human transmission of the very real coronavirus, SARS-CoV-2, and announced the largest quarantine in history in Wuhan.

Since the pandemic's early days, our Center has been focused intently on helping to improve the preparation for and response to COVID-19. We warned in January that the U.S. and other countries needed to get prepared for a pandemic. We've published a series of reports aimed at policymakers on social distancing; reopening; guidance to governors; risk assessment for businesses; the needed research agenda for schools; serology and diagnostic testing; health care system impact and recovery; and more. We briefed members of Congress, governors, mayors, international leaders, and public and private organizations. We testified before five different committees on Capitol Hill. And the media has turned to us for insight since the pandemic's start.

Our Center will continue its work to lessen the overall impact of COVID-19. Later, we'll also look at what's gone right and wrong, and we'll consider how the U.S. and other countries can be far better prepared for the next event like this.

We lost D.A. Henderson in 2016, but if he were here today, I think he would say that the world must get much better at dealing with epidemics because big ones like COVID-19 will keep coming in the future.

My colleagues and I are resolved to doing all we can to make that happen.

» Tom Inglesby, MD, is the director of the Johns Hopkins Center for Health Security.

CAUGHT OFF GUARD

How policies for preparedness could—and should—have protected us.

BY CARRIE ARNOLD

The post-9/11 anthrax attacks—when spore-laced letters were delivered to victims in the mail—terrorized the country. The government ordered millions of doses of the antibiotic ciprofloxacin to prevent the life-threatening disease—and then replenished the nation's stockpile so that it might have enough in the event of a future attack.

But after a few years, memory of the attacks began to fade from America's collective psyche, and funding to maintain the cipro in the stockpile dropped off. Five years after the anthrax attacks, the nation's stash of cipro had returned to its pre-2001 level.

For Gerard Anderson, PhD, a professor in Health Policy and Management, this cycle confirmed his belief that governments tend to fund public health only in the immediate wake of an emergency. Before long, the money gets redirected to other projects and the country reverts to its usual, unprepared state.

So Anderson was hardly surprised when the U.S. struggled with its response to COVID-19. The problem isn't so much a lack of policy on issues like stockpiles, he says, but rather a lack of funding and a clear delineation of which agencies are in charge of what aspect of the emergency response. And when the threat of a future pandemic seems nebulous, politicians feel little urgency to rectify the matter.

"Policymakers tend to emphasize what is happening today instead of planning for the future," Anderson says. As a result, public health represents just 2.5%—$274 per person—of all health spending in the country, according to a 2019 report by the Trust for America's Health.

One of the most recent bellwethers of these policy shortcomings occurred in January 2017. A week before President Trump's inauguration, his team and Obama administration officials convened for a roundtable on pandemic influenza that illustrated weaknesses in the nation's preparedness. In the summary of the exercise's discussion points, Obama administration planners noted that, as cases of respiratory illness flared across the U.S. in the hypothetical scenario, the country would begin running short of medication, ventilators, and personal protective equipment. Shoring up the supplies in the Strategic National Stockpile would have been a smart response, but politicians have historically had little stomach for such funding allocations.

The anecdote illustrates the paradox of American public health preparedness: Everyone wants a national stockpile, but no one wants to pay for it. As a result, the supplies actually stockpiled tend to dwindle until an emergency alerts everyone to our shortsightedness. Then, as happened after 9/11, funding will increase for a period before hubris—and tightfistedness—takes over once again. The reason is simple. If two politicians are running for office and one says she will spend money on PPE and another says she will build a community center, most voters will prefer the latter, according to Anderson. Ditto for politicians wanting to beef up spending for surveillance, emergency operations capabilities, or any of the other 15 preparedness core competencies outlined by the CDC. The results: More than 55,000 jobs at local health departments were lost from 2008 to 2017, according to the Trust for America's Health. And CDC funding dropped by 10% from fiscal years 2010 to 2019, after adjusting for inflation.

But since pandemics are rare, the chances that the lack of preparedness will come back to bite the politician are pretty slim.

"Something that might happen in 10 years is not given much importance because it is probably going to occur after they leave office," Anderson says.

Another factor that has hindered America's response to COVID-19 is that the country's public health system is a combination of local, state, and federal government programs. The bulk of public health work is done at the local level, Anderson says, but the challenges of responding to the pandemic have overwhelmed their limited resources. The federal government has also been accused of hoarding resources, and Trump administration officials have asserted that the Strategic National Stockpile is not for state use, despite laws indicating otherwise. In this confusion, Anderson says, limited resources don't get to where they are needed.

This lack of focus on the larger picture characterizes other health-related policies as well. The U.S. is one of the only industrialized nations with no universal health care and no paid sick leave—two factors that underlie not just pandemic preparedness but basic public health, says Keshia Pollack Porter, PhD '06, MPH, associate dean for Faculty and a professor in Health Policy and Management.

The U.S. has been debating paid sick leave for more than a century. But, Pollack Porter says, disagreements about the government's role in providing social services to its citizens have meant that many social services are seen as a privilege rather than a right.

> "Something that might happen in 10 years is not given much importance because it is probably going to occur after [politicians] leave office.

This creates immediate problems during a pandemic, especially in the early days when social distancing is the best first step for mitigating transmission. Instructions to stay home when ill are helpful, but if a job doesn't offer sick pay, many workers are forced to choose between a paycheck and their own (and everyone else's) health.

"Paid sick leave is a public health policy," Pollack Porter says.

With unemployment estimated at 20% as a result of COVID-19, Pollack Porter says that a solid policy response to this secondary crisis will be key to helping the U.S. recover from the pandemic.

"This pandemic has illustrated vast systemic failures, including an underfunded public health system, lack of safety for frontline workers, and the absence of social policies like paid sick leave," Pollack Porter says. "Things will only get better if we learn from the failures and address them. And if we don't, these same failures will be present for the next outbreak that is sure to come." ○

ANTHONY GERACE

the fight

A BURDEN SHARED

Science and technology are key to the global pandemic response. But, in delivering a "family box" of food, soap, and other essentials on May 25 to Gene and Bertha Mitchell, a Navajo couple in Chinle Valley, Arizona, Center for American Indian Health staffer Janice Dunn shows the greatest impacts begin with a human connection.

NINA MAYER RITCHIE

BREAKING THE CHAIN

One COVID-19 patient could lead to thousands of new cases. Contact tracers use calls, texts, and personal persuasion to prevent that from happening.

by **CATHY SHUFRO**

illustrations **DUNG HOANG**

In May, the patient had hosted a party for a dozen friends in Salt Lake City, fallen sick, and tested positive for SARS-CoV-2.

The next day, Salt Lake County contact tracer MacKenzie Bray, MPH '19, asked the patient for names and phone numbers of all the guests. The patient told Bray: "If I'd known I was contagious, I'd never have been around other people." It's something she hears often.

Bray notified the guests. One had quickly gotten a test, and it was negative. He declined to quarantine, but Bray kept calling. Then the man got sick. This time, he tested positive, and so did his family, though only he had symptoms.* "If people test too soon and are negative, they think they're fine," says Bray.

On average, one person with the novel coronavirus infects two or three other people. If a person passes the virus to three others and that same reproduction rate continues, 10 generations of infection could lead to more than 88,000 infections in fewer than two months.

Social distancing had slowed the spread of the virus in Bray's county in May, however; at that point, people with the virus were likely infecting one or two others. Assuming a reproduction number of 1.5, the party guest's hypothetical family of four could have infected more than 600 people by July. Even if the case-fatality rate was just 1%, six of those people might have died.

Bray's contact-tracing process hadn't gone perfectly, but it almost certainly reduced the virus's spread. »

** Details of Bray's account have been altered to protect anonymity.*

PHOTO: WILL KIRK/JOHNS HOPKINS UNIVERSITY

"Contact tracing is one of the few available strategies we have to stop the chains of coronavirus transmission, and ultimately reduce the number of cases and deaths," says epidemiologist Kelly Henning, MD, who leads the public health program at Bloomberg Philanthropies. "It will also allow us to continue to slow the spread of the virus while safely reopening the economy, and keeping it open."

It's a simple but difficult process. After calling patients who have recently tested positive and asking them to stay home and isolated from others in the household until they recover, contact tracers then call their recent close contacts and urge them to quarantine themselves for 14 days. (See sidebar.) Health departments in the U.S. have used this strategy since the early 20th century—originally for tuberculosis and syphilis. Globally, it contributed to the smallpox eradication effort in the 1960s and '70s, has helped South Africa control tuberculosis since the 1990s, and played a role in ending West Africa's 2014 Ebola outbreak.

Before COVID-19 arrived, the U.S. had only about 2,000 credentialed contact tracers, mostly for sexually transmitted diseases. In a national plan published on April 10, the Bloomberg School's Center for Health Security called on health departments nationwide to hire an "army" of 100,000 contact tracers.

Their work will be crucial as people return to work, schools, restaurants, hair salons, and gyms. "In theory, if we are able to find the vast majority of cases, trace their contacts, and ask them to quarantine at home, that will limit the amount of surge that we experience," says epidemiologist Crystal Watson, DrPH '17, MPH '09, lead author of the Center's plan.

Watson and colleagues recommend that Congress provide $3.6 billion to help state and local health departments hire those 100,000 contact tracers for a year at $17 per hour. In comparison, Congress passed four bills by mid-May that, together, allocate $3 trillion to businesses, individuals, and government programs.

Other countries have already used contact tracing successfully against COVID-19. South Korea is one of several nations that have controlled the virus without extended lockdowns by using widespread testing and contact tracing. When the virus flared there in early May after nightclubs reopened, South Koreans traced thousands of contacts, says Watson. "They had the capacity. That's what I want to have for the U.S.," she says.

On April 22, New York Governor Andrew Cuomo and former New York City Mayor Michael R. Bloomberg announced that the state health department would immediately hire 6,400 new contact tracers, and up to 17,000, if needed. Technical advice would come from Resolve to Save Lives, led by former CDC director Tom Frieden, MD, MPH. The Bloomberg School would provide recruits with free online training. To make this happen, Bloomberg Philanthropies pledged $10.5 million.

These new hires would learn the basics from an online course developed by Bloomberg School epidemiologist Emily Gurley, PhD '12, MPH, and several colleagues. In designing COVID-19 Contact Tracing, Gurley drew on her 15 years' experience using contact tracing against everything from acute hepatitis to Nipah virus, mainly in Bangladesh. Gurley's team designed the five-hour course to be understandable to anyone with a high school diploma. Lectures teach SARS-CoV-2 basics, explain how to trace contacts, and address ethical considerations. A segment on interviewing cases and contacts includes a video of mock phone calls with two actors: an elderly, coughing patient, and a woman who'd sat near him at choir practice.

When it went live on May 11, the course caught fire. Within three weeks, 345,000 students enrolled, and 35 million people viewed the Coursera landing page. Of the first 40,000 applicants for the New York jobs, 5,000 had completed the course before applying.

Emails poured into Gurley's inbox. The media asked for interviews nonstop. Some people wrote to tout their contact tracing apps, while others let Gurley know they were translating the course into Portuguese, Spanish, Nepali, Arabic, and Ukrainian. A public health official in Louisiana wanted everyone in her parish to take the course so they would understand contact tracing's power and be more likely to cooperate.

By early May, NPR reported that 44 states and the District of Columbia expected to hire a total of 66,000 new contact tracers. When Massachusetts posted 1,000 contact tracing jobs, 15,000 people applied. "I do think there's a real sense of 'how can I help?' People feel that they want to be part of something; they want to be part of reopening our communities," says Adriane Casalotti of the National Association of County and City Health Officials.

Contact tracing requires more than knowing the coronavirus's natural history and details about transmission. "There are a lot of interpersonal skills that are important to make it through those interviews," says Tyler Shelby, a contact tracing supervisor in New Haven, Connecticut. When calling an index patient, "you're not really sure what you're getting into until you're on the phone. Some of these individuals are very sick."

Initial calls to patients last from 30 to 40 minutes, says Shelby, an MD/PhD student at Yale School of Medicine who oversees 170 volunteer tracers (all graduate students in health-related programs at Yale).

The calls often require persistence and people skills. Utah contact tracer Bray said patients and contacts are often worried about scams and can be reluctant to answer calls. Some have told Bray they can't stay home because they lack sick pay or fear losing their jobs if they call in sick. She also sometimes worries that patients haven't told her the truth—for instance, when a person says she's quarantined but Bray hears children playing nearby. "You're not responsible for your patients' actions," she says. "But it still weighs on you."

It's not easy work, concedes former CDC director Frieden. "You have to really explain to people that they may be spreading [the virus] without knowing it. You have to put it in personal terms: 'This could be your neighbor's kid with leukemia who dies, or your coworker's wife who has breast cancer,'" he says. "This really is about people's lives."

He also suggests that health departments make sure that people entering isolation or quarantine have what they need, such as medical care, medications, groceries, and supplies like masks and trash bags. Best practices, Frieden says, include stipends to replace lost income. "If people who are infected, and their contacts, are safer and stay isolated, we will all be safer," Frieden says.

As states, cities, and towns experiment with ways to live with the virus in our midst, says Watson, "investing in contact tracing can prevent communities from yo-yoing between controlling the virus and having it spread unchecked."

Contact tracing, she says, can reduce suffering and death while we wait for a vaccine.

> "In theory, if we are able to find the vast majority of cases, trace their contacts, and ask them to quarantine at home, that will limit the amount of surge that we experience.

PHOTOS: WILL KIRK/JOHNS HOPKINS UNIVERSITY

CONTACT TRACING IN 3 STEPS

Here's how contact tracers work to break chains of transmission:

A contact tracer calls the person identified by a health department as positive either via testing or a presumptive diagnosis by a physician. The tracer collects information about symptoms, underlying conditions, and risk factors for exposure, such as attending a big party or working in a warehouse. Then she asks the patient to isolate from other people for at least 10 days from the onset of symptoms (or longer if symptoms persist).

The tracer collects names and contact information of anyone who had been in close contact with the patient beginning two days before symptoms appeared. Close contact means being within 6 feet of a person, usually for 15 minutes. A patient's calendar, text messages, and credit card bills can help the person remember where they were and with whom. Some governments use proximity apps on phones to identify contacts.

The tracer or a colleague alerts each contact. Taking care to maintain the index patient's privacy, the contact tracer can use phone calls, voice mail, texts, email, and letters to connect with contacts. Each is asked to quarantine and avoid contact with other household members for 14 days from the last time they saw the infected person. Best practice calls for supporting people in quarantine with necessities like food and medications. —*CS*

WILL KIRK/JOHNS HOPKINS UNIVERSITY

RACISM AND COVID-19

Lisa Cooper explains why the pandemic hit African American communities especially hard.

BY KAREN KRUSE THOMAS AND DAYNA KERECMAN MYERS

There's a saying that when America catches a cold, African Americans catch pneumonia. The axiom proved tragically true as COVID-19 cases began surging in the U.S. this spring. Nationally, African American deaths are nearly two times greater than would be expected based on their share of the population, according to The COVID Racial Data Tracker.

The heightened risk for communities of color was the first concern for Lisa A. Cooper, MD, MPH '93, Bloomberg Distinguished Professor and director of the Johns Hopkins Urban Health Institute and the Johns Hopkins Center for Health Equity.

In this Q&A, Cooper, a practicing physician and epidemiologist, discusses racism's role in COVID-19 cases in African American communities and solutions for the inequities.

Why are more African Americans dying of COVID-19 and suffering more from the pandemic?

Before COVID-19, minority communities were already disproportionately impacted by health inequities. People in those communities already have higher rates of obesity, diabetes, heart disease, and lung disease, so these are the folks who were actually going to be at more risk of getting seriously ill with COVID-19. These health inequities result from the financial stresses of being poor and the social stresses of being from a marginalized group with a history of institutionalized, sanctioned mistreatment by law enforcement and other societal institutions.

There's a confluence of all these different factors—not having access to food, not having access to good quality housing, being crowded in small houses where there are multiple generations and unable to engage in social distancing or stock up on groceries for several weeks at a time, having to use public transportation, to work in essential jobs, and having less access to health care. These are all manifestations of structural racism.

Are you concerned that higher-risk populations might be stigmatized?

Yes, there is always the concern that when we highlight that certain groups are disproportionately impacted by a condition known to be deadly and easily spread, those groups will experience stigma. This is even more concerning for people of color and poor persons because they are often the target of bias and negative stereotypes—interpersonal racism. To counteract these negative stereotypes, we must balance the narrative around health disparities that overemphasizes individual responsibility with an examination of our collective social responsibility. Do our laws and organizational practices provide everyone with the opportunities they need to be healthy? We should make the links between social conditions and health clearer.

> The pandemic could bring a shift in thinking toward valuing all people regardless of background, economics, or what's on the surface.

What can be done right now to reduce the toll of COVID-19 on Black and minority communities?

Keeping an eye on the data is an important priority: knowing who is impacted and where they're impacted.

Communication is also really important—making sure that the public understands why we might be seeing these patterns, and that it's more about our society and the way our resources and opportunities are allocated than it is about individual behaviors. We need to do what we can to better understand the challenges of those communities, engage with trusted leaders, listen with respect, and show empathy and concern. We need to recognize the remarkable contributions of African American communities and follow our words up with real actions that bring about positive change.

We also need to focus on frontline workers and low-wage workers, and understand their needs—providing protective equipment, safe spaces to work, paid sick leave, hazard pay, or health insurance and access to testing and care. And, we need to provide for people's basic needs: stable housing, food security, and digital access to education and health care.

Why is leadership from within the community important for ensuring that the response reaches disadvantaged populations?

Community leadership is important across the board during a pandemic when cooperation among government and private sector groups is essential. We have seen communities where social distancing is not being practiced getting hit hardest. The results have been better where there is greater trust in leadership, and where leaders began earlier with fact-based, consistent messaging to the public but gave no false reassurances. This strategy is particularly important in ethnic minority communities where discrimination is common and people are predisposed to fear and distrust authority.

In disadvantaged communities, leaders are not necessarily people with titles or elected officials; they are the people who have served others in ways that enable them to deliver well-received messages.

Could this pandemic open the door to new solutions to reduce health disparities?

I think the COVID-19 pandemic has revealed how interconnected and vulnerable we all are, and how our well-being depends as much on what those around us do as our own steps. When others don't have the opportunity to be healthy by engaging in social distancing, it puts all of us at risk.

The pandemic could bring a shift in thinking toward valuing all people regardless of background, economics, or what's on the surface. We know now more than ever that every member of our society is important. It may force us to come up with new ways, including technology, to connect everyone with the things they need.

What makes you hopeful about the future?

I see people coming together in a way that they haven't in a very long time. I see a lot of empathy and connections based on our shared vulnerability. I see leaders committing to make real changes.

This is also an opportunity to remember that our fates are intertwined. The pandemic has shown us that what happens to one of us affects all of us. If we want to be healthier and have more opportunities, it's not enough to just worry about ourselves.

» Ed. Note: This Q&A draws on previous interviews published in Global Health NOW and on the Bloomberg School's website. It has been edited for length and clarity.

VOICES OF THE VULNERABLE

For asylum seekers, the incarcerated, frontline doctors, and others, COVID-19 has made hard lives harder.

as told to LAURA WEXLER AND BRENNEN JENSEN

"CHRISTINA," 34

Sex worker
Southwest Baltimore

I'M LOSING AT LEAST $150 TO $200 A DAY BECAUSE OF THE STAY-AT-HOME order. I was renting a room for $500 a month. Because the motel owners knew we weren't working on the street, they wanted all of the money up front.

I moved out April 12 or 13, and I'm in a 'bando [abandoned house]. You can't secure your doors. You got busted windows. I've already had most of my clothes stolen. I don't even have money to wash the couple of outfits that I have.

I have some regulars I still see, and I'm trying to get by on that. I wear a mask. A few of the regulars do, some don't. If one of my regulars cancels, I don't have money that day.

Right now, I need $60 a day [just to avoid heroin withdrawal]. If I only get $60, it's either be well or eat. A lot of the dealers are taking advantage of the situation. After the stay-at-home order, within two to three days, $5 heroin pills went up to $10.

I've tried methadone before and did really well on it. I can't get it now because I lost my ID, and the MVA is closed. I usually get food stamps. I was supposed to have a recon [reassessment] done in April. Because of COVID, that got canceled. I don't have any food stamps.

A lot of girls have been robbing girls that are making money, stealing from people, stealing from grocery stores. Myself, I don't believe in beating people up and stealing to provide for my needs—but I see why some of them are doing it. They have kids. They have to be well to take care of their kids, to go out and make money.

MATTHEW HORNER, 51

Carpenter (formerly incarcerated)
York County, Pennsylvania

I WAS IN NORTH BRANCH CORRECTIONAL INSTITUTION [IN MARYLAND] FROM Thanksgiving 2008 until I was released on April 15, 2020. It's a maximum security prison that holds about 1,250 men.

Normally, we have 90 people in chow hall twice a day. Middle of March, they eliminated that. Then they took the picnic tables, the pullup bar, the water coolers, the basketball net out of the yard. Beginning of April, the prison staff started wearing masks and plastic shields. There were no masks for the inmates. The staff never explained anything to us. Communication-wise, they could have done better.

They would let us into the day room for a half hour. They had three bleach guys working 24 hours a day taking turns. The day room, the microwave, the telephone, the hot pot were all wiped down with bleach. I respected the levels of protection they were taking.

You would fight more with the person in your cell because you were locked up with them 23.5 hours a day. The cell—I measured it—is 10-foot-3 by 7. Normally you could go to the chow hall and yard to get away from each other.

I was in a cell with someone in his 70s. He was terrified. Every waking moment he would watch the TV and say, "If I get it, it's going to be bad. I'm not going to get the care I need."

There was one case of COVID while I was still inside. It was an outside contractor. I didn't learn this until I was being released. A guard told me because now I'm no longer an inmate, I am a citizen.

> "I've used this experience to see the bigger picture. This situation is highlighting inequities for people with disabilities.

BONNIELIN SWENOR, PHD '13, MPH '09; 41

Associate professor, Johns Hopkins, and person with a visual disability
South Baltimore

ON FRIDAY, MARCH 27, I WAS ON A CALL WITH LOCAL POLICYMAKERS ABOUT MARGINalized populations and the COVID response. I remember thinking, "I just don't feel right."

By late Saturday morning, I knew I was sick. My husband said, "You need to get tested." I said, "How would I get there?" I was diagnosed with retinal disease in 2005, and I have been losing my vision since then. I stopped driving more than a decade ago.

I get to work every day with Uber, but it didn't seem appropriate for an epidemiologist to get in a car and possibly expose someone. I knew there was a good chance if I had COVID-19, my young children and husband had been exposed, so having someone come stay with my kids while my husband drove me felt inappropriate.

The other option was for all of us to go. But if my family hadn't been exposed to COVID, they certainly would be in the car.

All the options were bad. I decided not to get tested.

Not getting tested was the right decision, but I felt immense guilt that I couldn't follow through as a good epidemiologist should. I know how important the data are. I had to violate my own code.

I've used this experience to see the bigger picture. This situation is highlighting inequities for people with disabilities. The true impact of me not being counted and the other people with a disability not being counted is it's affecting our COVID-19 estimates and therefore our response. We're not surveilling disability. We ask people their ethnicity, race, gender, and age in a health care setting. We don't do that for disability.

It's a silent disparity. No one is paying attention. »

DOROTHY "DOT" SHEPPARD, 96

Senior home resident
Aspen Hill, Maryland

THEY SAY GETTING OLDER IS NOT FOR SISSIES, AND THAT IS SO TRUE. WE'RE IN lockdown, and I wouldn't wish this on anybody.

We're all concerned about COVID and waiting for the other shoe to drop. So far, we've only had two cases, and that was some time ago. I think everybody in this place is depressed. Why not?

There is a lovely dining room that we all would go to, but now we have to take meals in our rooms. They're really very careful here. They have sanitizers all over the place. It does disturb me that we have so much food and then I read in the paper where people are going hungry.

Freedom is what I miss most. Never since I was a little kid has anybody told me what to do. But right now, you have to do what they say. You have no alternative.

Our hairdresser closed down at the beginning of all this business, and we can't go out to get our hair done. I know that seems like a minor thing. For guys, it is.

We're supposed to wear masks and stay 6 feet apart. That's kind of hard to do, like when you pass somebody in the hall. They used to show a movie every night, which they had to cancel. We are all so bored.

Never in my lifetime did I ever think the United States would be in this situation.

> "Freedom is what I miss most. Never since I was a little kid has anybody told me what to do. But right now, you have to do what they say. You have no alternative.

DAIRON ELISONDO ROJAS, MD, 29

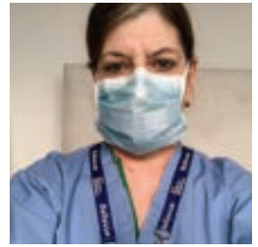
Asylum seeker and migrant camp doctor
Matamoros, Mexico
Translated from Spanish

CONDITIONS HERE ARE REALLY BAD. PEOPLE LIVE IN tents in a dirt field with no security. There is a river nearby where a lot of people clean themselves, but the river is contaminated so there's a lot of disease. People are desperate, but they have to be here because of MPP [Migrant Protection Protocols enacted by the U.S. that mandate asylum seekers remain in Mexico]. Also, since COVID, immigration hearings are being postponed. Mine has been rescheduled once already and probably will be again.

Most people here are from Central America—Honduras, El Salvador, and Guatemala. They're all ages—families and old people—maybe 1,500 in all. I am part of a medical team for Global Response Management [an international medical NGO]. There are two other doctors and a nurse who are Cuban asylum seekers like me.

We are worried about COVID. If one resident from the camp gets it, all the camp is going to be affected. A lot of residents understand the dangers, but many don't. We can't compel people not to go to the city to buy things. We have put in some handwashing stations and are working to get everyone to wear a mask and go to the clinic if they have any symptoms. If we have a patient with a cough, we can get them into isolation and tested. No one has tested positive yet, thank God. It would be terrible.

The work helps keep my mind off things—the responsibility of a doctor is saving lives.



JUDITH SALERNO, MD, MS; 68

Retired clinician called back to patient care
New York, New York

AS PRESIDENT OF THE NEW YORK ACADEMY OF Medicine, I do advocacy work and had not seen patients for five years. But from my New York apartment, I could hear the ambulances carrying COVID patients. When the governor put out a call to retired health professionals, I didn't hesitate. A special call came to assist the public hospital system. That's exactly where I had to be. Within a week, I was working at Bellevue, the largest public hospital in the city.

I worked with palliative care teams for COVID intensive care units. And during my first three weeks of service, 100% of my patients were intubated and many were in medically induced comas. I never spoke to most of my patients. What I did was take the medical information from morning rounds and call their families. They couldn't visit and were starved for information. It was as if they were my patients as well.

I often had to deliver very dire news: "Your loved one is not getting better. They've been on a ventilator for a month, and I'm concerned that they will die." I had to use that word because every family was hoping that their loved one would be the miracle patient seen on TV walking out of the hospital. I can only speak for the patients I followed, but the overwhelming number of them died.

Of the well over 100 patients I saw during my five-week service, only one was not a person of color. I saw the pandemic of racism—the inequities in care systems and how these communities are disadvantaged.

Right now, we are experiencing the enormous tensions over the death of George Floyd. We're in another crisis. Now I hear those sirens out my window.

A CORONAVIRUS CLEARINGHOUSE FOR THE WORLD

As the world fights SARS-CoV-2, the numbers funnel through one critical Johns Hopkins map.

WORDS AND GRAPHIC BY KATIE PEEK

One January day, Ensheng Dong was again watching the COVID-19 numbers in his home country of China.

His PhD adviser, Lauren Gardner, suggested they create a dashboard. The team had previously built something similar to assess U.S. measles risks. Ensheng, a first-year PhD student at the Center for Systems Science and Engineering at Johns Hopkins University, had a working coronavirus map by the end of the day.

Four months later, Ensheng has seen the dashboard behind world leaders and across news sites. Many other virus trackers rely on it as a source, and the team maintaining it has grown to 25 people. "I had to drop a class," he said of the project's impact on his graduate career. "But it's worth it."

KEY

The dashboard's 41 sources appear along the bottom.

Types of sources
- Global
- National
- U.S. states

Types of connections
- Computer-friendly API
- Custom web-scraper code

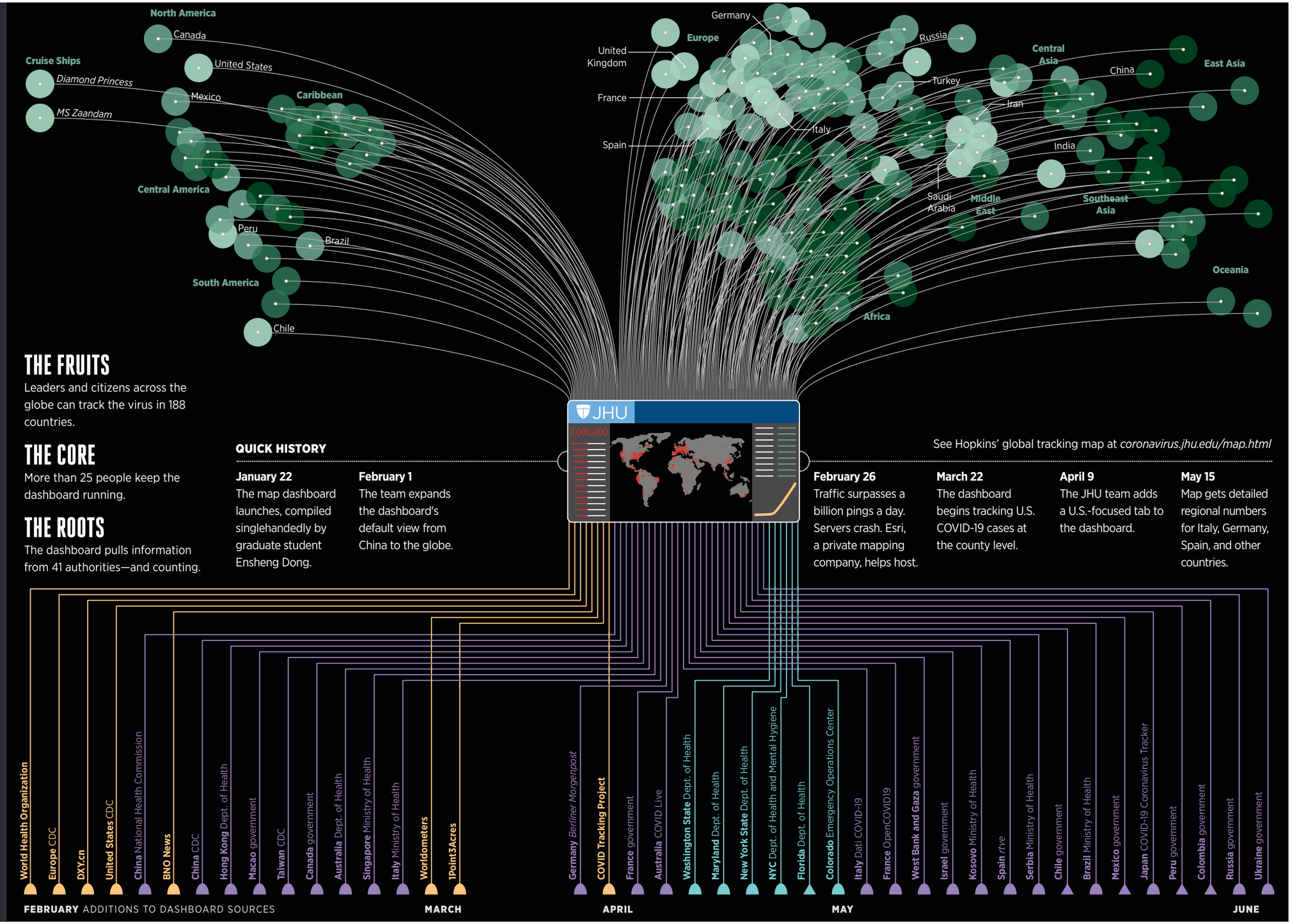
Sources are listed in the order they were added.

It tracks COVID-19 in 188 countries, shown at the top.

Each country appears as a single dot.

The dot's color reflects the number of cases per million residents.

Below 125 | 125 to 500 | 500 to 3,000 | Above 3,000



THE FRUITS

Leaders and citizens across the globe can track the virus in 188 countries.

THE CORE

More than 25 people keep the dashboard running.

THE ROOTS

The dashboard pulls information from 41 authorities—and counting.

QUICK HISTORY

January 22
The map dashboard launches, compiled singlehandedly by graduate student Ensheng Dong.

February 1
The team expands the dashboard's default view from China to the globe.

See Hopkins' global tracking map at *coronavirus.jhu.edu/map.html*

February 26
Traffic surpasses a billion pings a day. Servers crash. Esri, a private mapping company, helps host.

March 22
The dashboard begins tracking U.S. COVID-19 cases at the county level.

April 9
The JHU team adds a U.S.-focused tab to the dashboard.

May 15
Map gets detailed regional numbers for Italy, Germany, Spain, and other countries.

WILDPIXEL/GETTY IMAGES

COUNTERING THE INFODEMIC

Misinformation about SARS-CoV-2 is as contagious as the virus itself.

BY CARRIE ARNOLD

In mid-March, reports of mysterious illnesses and deaths began leaking out of Iran. But the cause wasn't COVID-19—at least not directly.

Earlier in the month, rumors began circulating on social media in the Islamic Republic (one of the countries hardest hit by the novel coronavirus) that some people had cured themselves of COVID-19 by drinking ethanol, also called grain alcohol. Because alcoholic beverages are illegal in Iran, the frightened public instead obtained their liquor from bootleggers or tried to make it at home. Some of the batches were contaminated with methanol, which is far more toxic than ethanol. Consuming even small amounts of methanol can cause blindness, kidney failure, and death. In just two weeks, more than 1,000 people were sickened and over 300 died, according to Iranian media reports.

This is a classic—and deadly—case of misinformation, according to Tara Kirk Sell, PhD '16, MA, a senior scholar at the Johns Hopkins Center for Health Security and an assistant professor in Environmental Health and Engineering. Falsehoods, which can range from deliberate lies to genuine confusion and errors, often travel alongside novel threats like COVID-19. But the problem has been so prevalent with the coronavirus pandemic that the WHO has called this swirl of online falsehoods an "infodemic."

"There's a lot more misinformation out there than we're used to. All of that detracts from our ability to come up with constructive solutions," says Amesh Adalja, MD, also a senior scholar at the Center for Health Security.

Adalja says he's spending a lot of time convincing people that the virus didn't originate in a lab or that aiming a hair dryer up their nose will not save them from the novel coronavirus. "The whole pandemic has been polluted with [misinformation]," he says.

Some perpetrators of misinformation claim what they're sharing is from a reliable source. One such example is a post circulating incorrect information on coronavirus prevention that claimed to be written by a Johns Hopkins immunologist. But such credentials aren't always necessary. One of the most challenging aspects of this infodemic is that, on social media, the bar for what constitutes an expert is very low, says Susan Krenn, executive director of the Johns Hopkins Center for Communication Programs. As a result, she says, "even the definition of what's considered true or a fact has shifted a bit."

But when this misinformation comes from historically trustworthy sources and public figures, "it gives it a life it doesn't deserve," Adalja says.

Much of this misinformation is underlaid with political meaning. Long after scientists were urging action to prevent the spread of the novel coronavirus, many conservative pundits and like-minded officials continued to dismiss the looming threat. Krenn saw similar issues in the 2014 Ebola outbreak in West Africa. Politicians often tried to blame the virus and missteps with its containment on their rivals or enemies, either within the state or in other countries—something that is also happening in the current pandemic.

"Misinformation can be used as a political tool, both by our own politicians and by enemies to spread discord," Krenn says.

The good news is that there are potential solutions to the infodemic. The popularization of "flattening the curve" images worked because they were easy to remember and share. Pairing the truth with an emotional appeal can also help people change their minds more readily, Krenn says. The key is to make it personal so people can connect with the message. Without that, "the information is over my shoulder and it's gone," she says.

Take the antimalaria drug hydroxychloroquine touted as a "miracle cure," despite the lack of reliable evidence supporting its efficacy against SARS-CoV-2. Instead of simply saying the claim isn't true, a more effective message, says Krenn, is to express understanding of the desire for a treatment but also a concern for people experiencing severe, even deadly, side effects of a drug that may not even work.

People are more receptive to hearing evidence when it comes from a messenger who is already trusted by the community. These messengers must be able to share information that is clear and understandable—and they also need to share what they don't know, Sell says. This is crucial to combating misinformation and helping people cope in an environment where the scope of what's known is constantly shifting. Otherwise, she points out, "there's a lot of space for hucksters to take advantage of people."

To fight the infodemic, researchers need to understand who people do—and don't—trust. In Krenn's Ebola work, she found that in some places messages from government spokespeople often backfired because few people trusted these officials.

During the COVID-19 pandemic, one voice that has earned trust on both sides of the political aisle is NIAID director Anthony Fauci. His clear presentation of what's known and unknown, combined with his long history as an effective civil servant and scientist, has cemented Fauci's appeal. It seems counterintuitive, but a spokesperson's ability to say "I don't know" and to convey uncertainty can make them more believable to people, Sell says. The ability of Fauci and other public health officials to communicate facts in clear language that's easy to understand can go a long way in bridging the information gap that can exist between scientific knowledge and the general public, Krenn says.

Fighting misinformation could prove as important as other steps people are taking to flatten the curve. Communication, says Sell, is critical in public health and health security. "We can have the best vaccine, but if no one takes it, it doesn't help," she says.

THE MANY FACES OF MISINFORMATION

Experts like Tara Kirk Sell divide misinformation into four different categories:

False cures. Influencers on social media have been promoting a "miracle mineral supplement" to cure coronavirus that, in actuality, contains diluted bleach, a known toxin.

Conspiracies. Accusations that the virus may have originated in a bioweapons lab from any number of countries have emerged on Twitter, despite conclusive evidence from scientists that SARS-CoV-2 has a natural origin.

Scapegoating. Some media outlets and politicians continue to refer to SARS-CoV-2 as the "Chinese virus" or "Chinese disease."

Misinformation about the disease. In the early days of the pandemic, some politicians and intelligence officials dismissed COVID-19 as "just the flu," despite data from Wuhan, China, showing otherwise.

REAL-TIME RESPONSE

FROM A VIRTUAL ICU TO A NAVAJO NATION QUARANTINE, PUBLIC HEALTH EXPERTS SOLVE NOVEL CHALLENGES.

by EMAN QUOTAH

photos NINA MAYER RITCHIE, JOHN HOSTEEN, AND CHAD PLAUCHE-ADKINS

INSIDE THE VIRTUAL ICU

The intensive care nurse stands inside a plexiglass box mounted on casters, something like a phone booth that rolls. Two sleeves through the glass allow her to attend to the patient. The nurse doesn't need a mask and won't have to change protective gear between COVID-19 patients. Cameras enable two doctors inside the room to work with five doctors far away.

This is the "virtual ICU," the present and future of patient care in a pandemic.

"We can have doctors in New York taking care of patients at night via telemedicine," says Roberta Schwartz, PhD, MHS '94, executive vice president and chief innovation officer at Houston Methodist, a system of seven hospitals in Greater Houston. "This is also how families are able to visit ventilated patients."

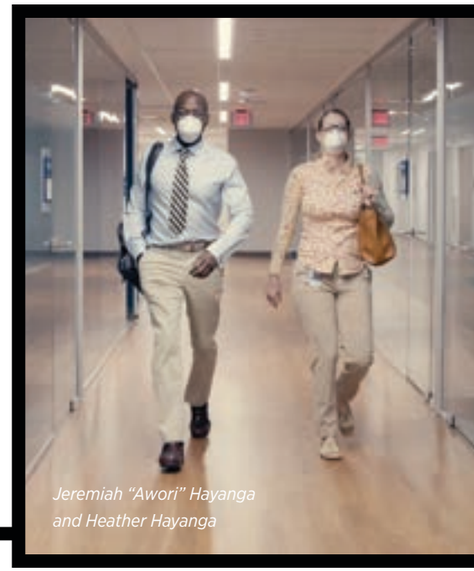
Schwartz's technology innovation team had been working on rolling out the virtual ICU for months, with the first unit set to open in March. The technology of the virtual ICU converts clinical patient data into algorithms that identify which patients most need attention and enables the hospital's intensive care doctors to respond quickly, whether there's an ongoing pandemic or not.

When COVID-19 hit Texas, physicians who'd had difficulty accepting the new technology were suddenly all in. Now, wired cameras are in use in 130 rooms, and hundreds of tablets allow virtual care in other units.

To provide protection for staff performing in-person procedures, Houston Methodist's machine shop built the plexiglass boxes, as well as special intubation boxes that improve upon models created in Wuhan, China. The boxes go over patients' heads as they lie in bed, allowing medical staff to safely intubate, free from exposure to aerosolized particles that could contain coronavirus.

"As an academic medical center, we've got the inhouse talent and wherewithal to build this out ourselves quickly, and we're sharing these plans with other hospitals," Schwartz says.

LEFT PAGE, CLOCKWISE FROM TOP: Cherish Redhouse from the Center for American Indian Health in Chinle, AZ, delivers essential supplies to a family on the Navajo Nation; Roberta Schwartz; and Laura Hammitt.



Jeremiah "Awori" Hayanga and Heather Hayanga

FIRST-RESPONDER COUPLE

While many medical professionals have felt isolated from their families while serving on the pandemic's front lines, husband and wife physicians Heather Hayanga, MD, MPH '08, and Jeremiah "Awori" Hayanga, MD, MPH '08, have been in the fight together.

As a member of West Virginia University's COVID-19 incident command team, cardiac anesthesiologist Heather Hayanga led development of systemwide protocols for safely caring for surgery patients at WVU hospitals. One example: Ensuring that anesthesiologists intubate patients in a negative pressure room, which traps dangerous particles and keeps them from getting into the rest of the hospital.

Meanwhile, thoracic surgeon Awori Hayanga, also of West Virginia University, advised incident command on protocols for conducting extracorporeal membrane oxygenation, or ECMO, on COVID-19 patients whose heart and lungs are not working. (With ECMO, surgeons drain the patient's blood, pump oxygen into it, and return it to the patient's body.)

Because of his ECMO expertise and his work studying the use of artificial intelligence to prevent outbreaks, in April Awori Hayanga was appointed special adviser to the U.S. Department of Health and Human Services.

All of this with a 3-year-old at home.

"We've just gone with the flow and we've done what we needed to do to get the job done," Heather Hayanga says. »

» See jhsph.edu/real-time-response for Real-Time Response videos.

COMMUNICATOR AND ADVISER

When other people were stocking up on shelf-stable food, medication, and toilet paper ahead of COVID-19 lockdowns, Josh Sharfstein, MD, bought a microphone.

With that simple tool and some help, the Bloomberg School's vice dean for Public Health Practice and Community Engagement launched the podcast *Public Health On Call*. It offers listeners daily coronavirus insights from experts in fields ranging from epidemiology and medicine to history and business.

From its first episode on global preparedness, misinformation, and community transmission in early March, the podcast has been downloaded more than a million times.

Since the start of the pandemic, Sharfstein has stepped—or rather sat—in front of the camera many times, too, appearing on MSNBC, PBS, C-SPAN, and others from his basement office. And every Thursday, he shares information with mayors across the nation in a weekly briefing cohosted with Bloomberg Philanthropies, the Harvard Kennedy School, and Harvard Business School.

"I want to be of direct assistance to health officials, governors, mayors who are reaching out," he says. "But I also want to bring the strength of the School to all of those people and their organizations. So I'm constantly linking faculty [to officials], trying to identify ways to bring the research that the School does to the point of action."

FROM LEFT: Josh Sharfstein, Laura Hammitt, and Jaimie Shaff

NAVAJO NATION'S COVID-19 FIGHT

They call it Dikos Ntsaaígíí-19. It means "the big cough that is called 19" in Diné Bizaad, the language of the Navajo people.

The Navajo Nation, in the southwestern U.S., has been hit hard by COVID-19, with 5,661 cases by early June. That translates into the highest known rate of infection in the country.

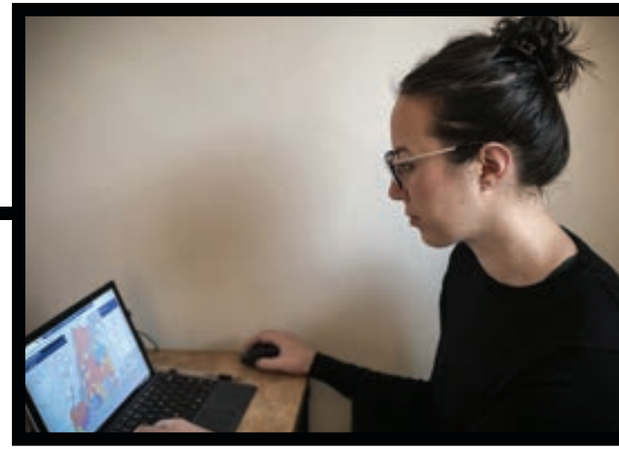
Systemic barriers like lack of running water, crowded living conditions, poor indoor air quality, widespread poverty, and pervasive chronic diseases are to blame, says Laura Hammitt, MD, an associate professor in International Health who directs infectious disease programs at the Bloomberg School's Center for American Indian Health.

The Navajo Nation is working with the Center and others to expand testing and roll out a contact tracing program that will employ many tribal members who can't do their regular jobs during the pandemic.

But people who test positive can't wash their hands without water, multigenerational households can't quarantine without sending someone to get the groceries, and individuals can't isolate themselves without a safe place to go, Hammitt says. So, the Nation and its partners—including the Center—support those who are infected, and their families, by providing clean water and handwashing stations, distributing food and cleaning supplies, and providing shelter for isolation and quarantine. Contributors to the effort include the U.S. Indian Health Service, FEMA, and relief groups like actor Sean Penn's CORE and chef José Andrés' World Central Kitchen.

Could this wholesale emergency response lead to long-term solutions for problems that predate the coronavirus?

"I'm cautiously optimistic," Hammitt says.



FOLLOWING THE DATA

Between March 11—the day the WHO declared COVID-19 a pandemic—and May 2, New York City saw over 24,000 more deaths than normal for that time period.

Most of those deaths were confirmed or probable COVID-19 cases. But more than 1 in 5 were not immediately known to be related to the virus that causes COVID-19.

Jaimie Shaff, a Bloomberg School DrPH student in the Health Equity and Social Justice track, leads a team of data scientists who are crunching the numbers for the New York City Department of Health and Mental Hygiene. Using data from New York City surveys, the Census Bureau, death reports, location services from phones and other devices, and other sources, they have helped the city shift its thinking on how to battle the pandemic.

In addition to focusing on individual COVID-19 patients, the health department is now zeroing in on neighborhoods and communities most hard hit by death and illness during this unprecedented public health emergency.

That's the best way, Shaff says, to keep people safe not just from the new coronavirus but also from other, invisible epidemics worsened by isolation and stress, like domestic violence, mental health crises, and heart disease.

"There are so many aspects to this pandemic we need to look at as we think through how we're going to respond to an uptick in the future," she says.

THE NATURAL FIX

An old-school approach—using antibodies from COVID-19 survivors—may be a fast, stop-gap solution for a modern pandemic.

by CARRIE ARNOLD
illustrations DUNG HOANG

In January 1934, J. Roswell Gallagher faced a major problem. The staff physician at a boys' boarding school outside Philadelphia, Gallagher learned that one pupil, identified as C. Y., had been exposed to measles. While confined to the school's infirmary, C. Y. exposed two other boys. Fearing a measles outbreak, Gallagher took decisive action. He collected blood from C. Y., purified the plasma that was rich in antibodies against the measles virus, and administered it to 62 other students. Three developed mild symptoms, but no one else got sick.

To modern eyes, Gallagher's actions may seem reckless, even foolhardy. At the time, however, use of this convalescent plasma was standard medical practice. Until the age of antibiotics at the end of World War II, antiserum (as it was then called) was used to treat and prevent everything from influenza to smallpox. As the world faced an emerging pandemic coronavirus that has no effective treatments or vaccines, Arturo Casadevall, MD, PhD, remembered J. Roswell Gallagher's gambit and decided his strategy deserved another chance. He floated the idea in a *Wall Street Journal* op-ed in late February.

Since then, the chair of Molecular Microbiology and Immunology has worked 18-hour days with a cross-country network of colleagues to treat more than 20,000 hospitalized U.S. COVID-19 patients with convalescent plasma. The National COVID-19 Convalescent Plasma Project, a group chaired by Casadevall, has become a national movement that has rapidly deployed plasma use across the U.S. If Casadevall has his way, the convalescent plasma effort will not only remind the world of a near-forgotten therapy but also demonstrate the power of scientists teaming up to tackle one of humanity's greatest threats.

Before the antiviral drug cocktails that gave HIV patients a chance at life, before the polio vaccine made summer and swimming pools once again safe for children, and before Alexander Fleming discovered the *Penicillium* mold growing on a pile of unwashed petri dishes, microbiologists created one of the world's first "miracle drugs" from a very different source. Beginning in the late 1800s, German and Japanese scientists »

PHOTOS: WILL KIRK/JOHNS HOPKINS UNIVERSITY & CHRIS HARTLOVE

found that when they injected horses, goats, and other barnyard residents with toxins produced by the bacteria that caused diphtheria and tetanus, the resulting antibody-rich antiserum could be purified and used to treat or prevent a range of infectious diseases. Although the antibodies (immune proteins that neutralize pathogens) provided only temporary protection, the work was so lifesaving and revolutionary that one of its creators, Emil von Behring, received the first-ever Nobel Prize for Medicine in 1901. (The work of his collaborator, Japanese scientist Kitasato Shibasaburō, was not formally recognized until recently.)

Soon, scientists were discovering and using antiserum with an almost Oprah-like enthusiasm: You get antiserum! You get antiserum! Everybody gets antiserum! That everything would look like a nail when microbiologists first discovered a hammer was understandable, Casadevall says, especially when infectious diseases killed so many and were unstoppable by any other method. But antiserum worked, and it often worked quickly. What's more, it was generally safe, especially compared to ingredients of other so-called therapies, such as arsenic and radium. It was also readily available.

"As soon as you have survivors, you have convalescent plasma," Casadevall says.

The development of antibiotics largely made convalescent plasma obsolete, but when new infectious diseases popped up that no one could treat, the treatment was dusted off and hauled out. Desperate physicians used the plasma to treat Ebola, SARS, and MERS, and a variety of anecdotes showed both safety and efficacy. So when COVID-19 came knocking, Casadevall knew immediately that the strategy would be worth trying—and testing. (In fact, researchers in China had begun piloting use of convalescent plasma in patients in late January.)

That he would spearhead such an initiative came as no surprise to MMI colleague David Sullivan, MD, or to the Mayo Clinic's Michael Joyner, MD. Both scientists say that the combination of his critical thinking skills, intense desire to alleviate human suffering, and can-do attitude made Casadevall the perfect person to launch the project.

For the last decade, Casadevall, Joyner, and a small cadre of like-minded colleagues had been pushing for the U.S. to spend more money on broad, one-size-fits-all public health measures rather than investing so much in personalized medicine. Convalescent plasma fit right in with this ethos. It was cheap and low tech, and it didn't require months of innovation that the world simply didn't have. When Joyner first read Casadevall's *Wall Street Journal* piece, he had to confess that he hadn't read anything about convalescent plasma since medical school. But years of working with Casadevall told him that his friend was onto something, and Joyner wanted to help.

"One bright spot in this whole pandemic is being able to go from these casual conversations about *have you seen this paper* to really working with Arturo to help solve this problem," Joyner says.

After Joyner forwarded Casadevall's op-ed to fellow physicians at Mayo, hundreds of doctors inundated Casadevall with requests for plasma. But he had a major problem: "When we first started thinking about this, there was no infrastructure. We had no testing and few survivors," Casadevall says.

Others recognized these shortfalls, and within days, Casadevall received a $3 million grant from Bloomberg Philanthropies and $1 million from the state of Maryland to investigate convalescent plasma. Casadevall also paired up with Liise-anne Pirofski, MD, from Albert Einstein College of Medicine, to write a more formal, peer-reviewed article on the topic for the *Journal of Clinical Investigation*, which was published on March 13.

Closer to home, physicians and scientists at the Bloomberg School and Johns Hopkins School of Medicine began assembling a team to set up clinical trials. Infectious disease physician Shmuel Shoham, MD, knew of a protocol to administer the plasma; Aaron Tobian, MD, PhD, and Evan Bloch, MBChB, MS, came on board to lead the plasma collection and transfusion efforts. Others, including Sullivan and MMI Professor Sabra Klein, PhD, MS, MA, volunteered their expertise in data management, statistical analysis, and other aspects of clinical trial design.

"That's the great thing about Hopkins—no matter what you want to do, there's always a network of people to help," Shoham says.

By mid-March, a national team led by Joyner and Michigan State University epidemiologist Nigel Paneth, MD, MPH, had assembled around Casadevall and dubbed itself the COVID-19 Convalescent Plasma Project. They wrote up a guidebook for plasma therapy that they published in *JCI*. Once the FDA granted an Emergency Use Authorization for the convalescent plasma on Friday, March 24, they could start moving forward. The following Monday, the first patients received convalescent plasma therapy in an ICU at Methodist Hospital in Houston, Texas. Less than two months later, more than 10,000 people had been treated.

"I don't think anyone thought this would get so big, so quickly," Joyner says. "This whole thing is just wild."

But Casadevall knew that convalescent plasma, like any therapy, was less likely to be successful in the sickest patients. At that stage of illness, early reports from China showed that much of the physical damage was caused by the immune system itself, not the virus, something that convalescent plasma can't reverse. While he believed the plasma could help—the scientific literature had more than a few near-miraculous deathbed recoveries from the treatment—he knew that the therapy's promise lay more in its ability to prevent the onset of severe illness or to prevent symptoms completely than as a cure for advanced disease.

The problem was where to get enough plasma for all the patients who needed it. Shoham knew the coronavirus had ravaged New York City's Orthodox Jewish community and reached out to a friend, Chaim Lebovits, to ask for help. The New York–based shoe salesman launched into action and rallied thousands of COVID-19 survivors to donate plasma around the metro area. Each donor could provide enough plasma to treat two patients. Rabbis allowed, even encouraged, the throngs of faithful to break the Sabbath if that was the only time they could donate. In just over a month, the country had enough convalescent plasma to treat more than 7,000 hospitalized COVID-19 patients.

The treatments, however, weren't part of a formal clinical trial. And the plural of anecdote isn't data, as Casadevall never tires of reminding people. Now the Plasma Project is working to test the approach in hundreds of highly exposed health care workers, to see if it will prevent them from getting sick (a project led by Shoham), and among hundreds more COVID-19 patients being treated at home to determine whether it might keep them from needing hospitalization (led by Sullivan). An agreement with the U.S. Department of Defense will further allow Sullivan to carry out two outpatient clinical trials.

"This seems like it's our best hope before a vaccine, and it's something we can save lives with now," Sullivan says. He also hopes the project will provide scientists with a good benchmark about how the immune system protects people from COVID-19, a key piece of evidence when it comes to evaluating vaccines.

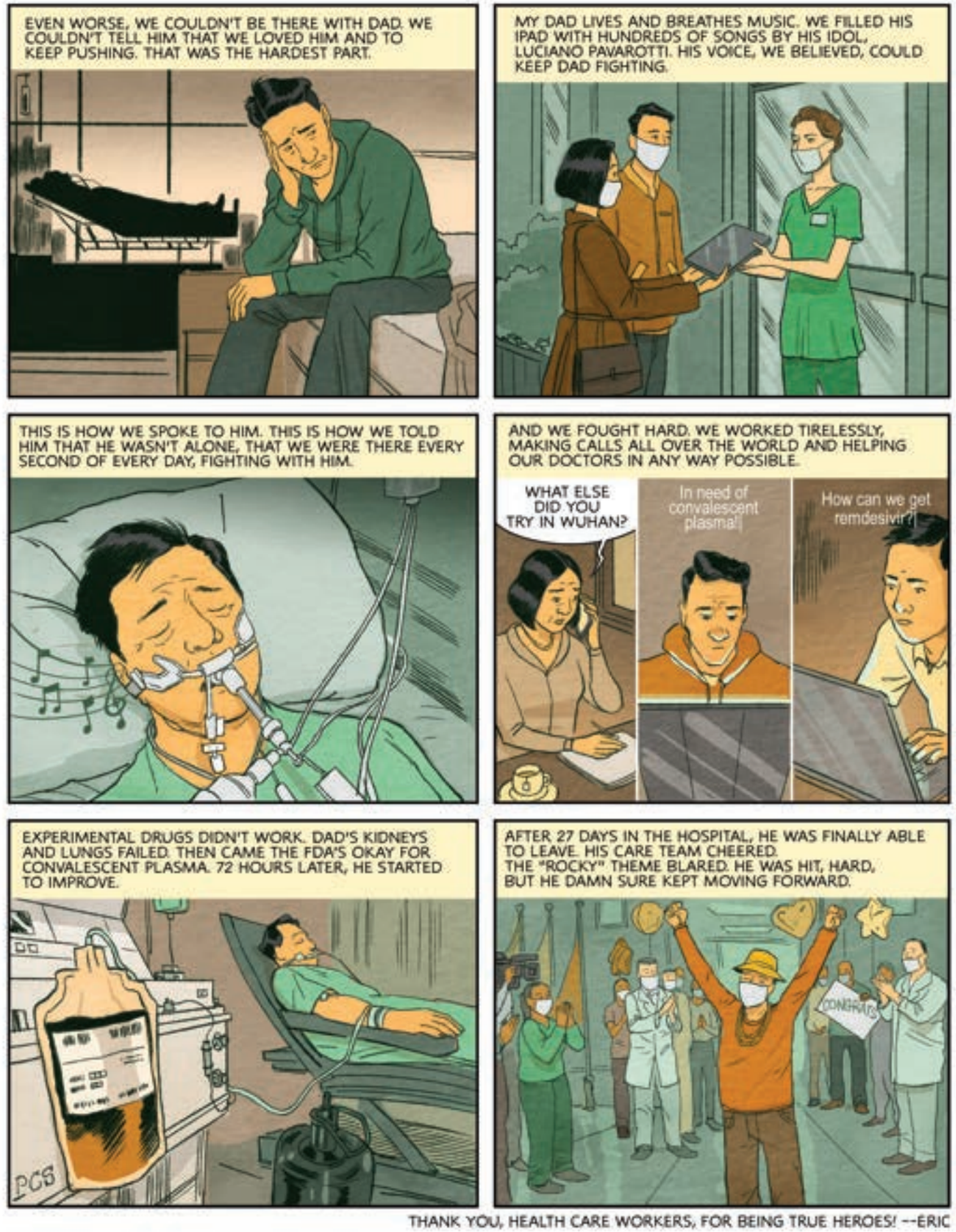
In the near future, Casadevall hopes that his old-school approach will act as a stopgap measure until a vaccine is ready. Longer term, he hopes that his work will reinvigorate convalescent plasma's use for other infectious diseases such as influenza and Ebola.

The work has proved so popular that the American Red Cross has begun testing all donated blood for SARS-CoV-2 antibodies. Blood that has high levels of SARS-CoV-2 antibodies will be shunted to coronavirus treatment. It's a testament to the value of Casadevall's idea that tens of thousands of people have already received convalescent plasma as the world's largest biotech companies (including, ironically, CSL Behring, named in honor of convalescent plasma's first proponent) scramble to find an effective therapy.

In this case, Casadevall's old-school approach may have gotten him across the finish line first. "This is a grassroots movement with no formal coordination. It's amazing to think we can go from idea to treating more than 20,000 patients in under three months," he says.

PHOTOS: WILL KIRK/JOHNS HOPKINS UNIVERSITY


FIGHTING A VIRUS TOGETHER
WRITTEN BY ERIC FEI
ILLUSTRATED BY KOREN SHADMI
I NEVER SAW MY DAD AS OLD. HE DIDN'T LOOK IT, AND HE DIDN'T ACT IT. A PROFESSIONAL OPERA SINGER WITH A GREAT SENSE OF HUMOR, HE WAS ALWAYS THE LIFE OF THE PARTY.
THEN COVID-19 HIT--AND DAD, WITH LUNGS OF STEEL AND THE HEART OF A LION, WAS FIGHTING FOR HIS LIFE AT 61.
I TOOK DAD TO THE HOSPITAL WITH A MILD FEVER AND COUGH. BEFORE I KNEW IT, HE WAS INTUBATED. THREE DAYS LATER, I DROVE MOM TO THE SAME HOSPITAL. SHE HANDED ME SOME FAMILY PAPERS.
YOU HAVE TO BE PREPARED IN CASE I DON'T COME HOME
SHE WAS COVID-FREE, BUT WE STILL HAD TO SELF-ISOLATE AND COMFORT EACH OTHER THROUGH MASKS, WALLS, AND DOORS. NO HUGS OR SHOULDERS TO CRY ON.
DINNER IS READY. EAT IT WHILE IT'S STILL WARM.


EVEN WORSE, WE COULDN'T BE THERE WITH DAD. WE COULDN'T TELL HIM THAT WE LOVED HIM AND TO KEEP PUSHING. THAT WAS THE HARDEST PART.
MY DAD LIVES AND BREATHES MUSIC. WE FILLED HIS IPAD WITH HUNDREDS OF SONGS BY HIS IDOL, LUCIANO PAVAROTTI. HIS VOICE, WE BELIEVED, COULD KEEP DAD FIGHTING.
THIS IS HOW WE SPOKE TO HIM. THIS IS HOW WE TOLD HIM THAT HE WASN'T ALONE, THAT WE WERE THERE EVERY SECOND OF EVERY DAY, FIGHTING WITH HIM.
AND WE FOUGHT HARD. WE WORKED TIRELESSLY, MAKING CALLS ALL OVER THE WORLD AND HELPING OUR DOCTORS IN ANY WAY POSSIBLE.
WHAT ELSE DID YOU TRY IN WUHAN?
In need of convalescent plasma!
How can we get remdesivir?
EXPERIMENTAL DRUGS DIDN'T WORK. DAD'S KIDNEYS AND LUNGS FAILED. THEN CAME THE FDA'S OKAY FOR CONVALESCENT PLASMA. 72 HOURS LATER, HE STARTED TO IMPROVE.
PCS
AFTER 27 DAYS IN THE HOSPITAL, HE WAS FINALLY ABLE TO LEAVE. HIS CARE TEAM CHEERED. THE "ROCKY" THEME BLARED. HE WAS HIT, HARD, BUT HE DAMN SURE KEPT MOVING FORWARD.
CONGRATS
THANK YOU, HEALTH CARE WORKERS, FOR BEING TRUE HEROES! --ERIC

MAKING SENSE OF MYRIAD MODELS

What you need to know about all those COVID-19 predictions.

BY MICHAEL EISENSTEIN

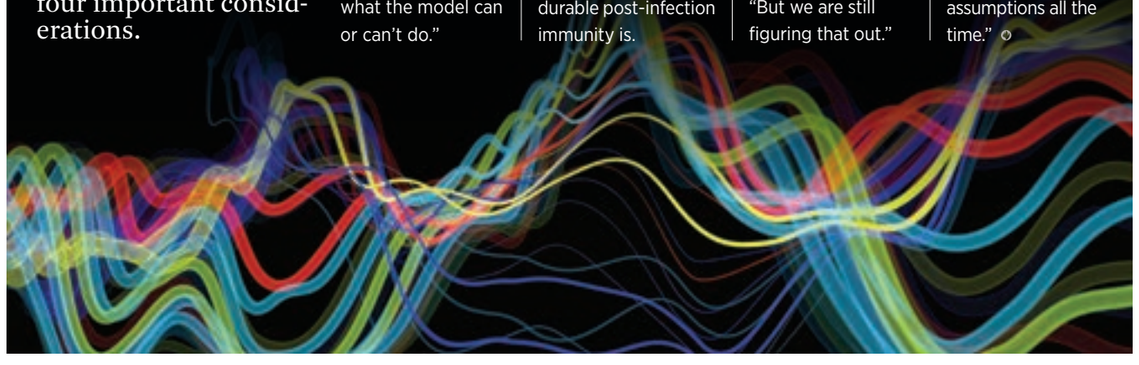
Four months ago, it was unimaginable that the public would be routinely grappling with terms like "R0" or contemplating logarithmic curves. But epidemiological models and their predictions are now regular fodder for the news and social media debates. These models can be confusing for nonexperts, so Justin Lessler and Elizabeth Lee of the Bloomberg School's Infectious Disease Dynamics group clarify things by highlighting four important considerations.

Different models make different assumptions. Modeling explores questions ranging from how long infected individuals are contagious to the effectiveness of stay-at-home orders. In each case, one must define the current situation and likely future conditions before making projections. For example, a model of viral spread might assume that a community mostly stays continuously sequestered—a reasonable short-term assumption that starts falling apart as months pass. Lee thinks modelers must be clear about the "ground rules" they're following: "There needs to be more of an upfront statement about what assumptions are being made and what the model can or can't do."

Models are built on incomplete information. Lessler sees a Catch-22 in pandemic modeling: "Models are most useful when we have the least data on which to base our decisions," he says, "but that's also when the models are the least well-informed." With SARS-CoV-2, scientists have had to learn on the fly about fundamentals like how the coronavirus is transmitted or persists in different environments. Along the way, they have gained clarity on things like the infection fatality rate—estimated between 0.5% and 1% of infections—and the role of superspreading events. These insights are helpful for gaming things out, but researchers still lack critical information, including how widespread and durable post-infection immunity is.

Insights may not be broadly generalizable. Researchers initially leaned heavily on early findings from China and Italy. But the resulting models may not be directly comparable to other regions. Lee cites differences in pandemic countermeasures and health care systems—including patient treatment protocols and access to testing—as important confounders. Many other factors shape public health as well. Lessler notes, for example, that it remains unclear why New York City experienced such a severe crisis relative to other U.S. cities. "Maybe the disease isn't as transmissible in less dense areas as [it is] in denser areas, or maybe there's a big effect of climate," he says. "But we are still figuring that out."

Predictions are not prophecies. Nonscientists may be confused by the idea that "good" models often fail to predict actual outcomes. The reason is that these models are also guiding policy; for example, efforts to flatten the curve have helped prevent worst-case forecasts of infection and mortality from transpiring. "We did the things that the model suggested we should do to avoid this fate," says Lessler. Similarly, models whose predictions shift greatly over time may be misperceived as unreliable, but Lee points out that this is simply a matter of evolution as new knowledge comes to light. "It's a very iterative process," she says. "You're going to have to revise the model's structure and assumptions all the time."



ALEXEY BRIN/GETTY IMAGES

COPING WITH COVID-19

A global approach to universal psychological responses.

INTERVIEW BY JACKIE POWDER

Anxiety. Depression. Fear. These common responses to the coronavirus pandemic can affect people in any setting, whether it's an American city or a rural community in Zambia.

While psychological responses to COVID-19 may be universal, effective and accessible mental health care is not—particularly in low- and middle-income countries. To that end, the Bloomberg School's Global Mental Health Program is adapting its programs in LMICs to help people cope in a public health crisis.

Judith Bass, PhD '04, MPH, associate professor in Mental Health, and Laura Murray, PhD, MA, senior scientist in Mental Health and International Health, explain the program's COVID-19 response.

Broadly, how have your programs adapted to the pandemic?

LM: In many programs, we were at the point of scaling up services. In response to the pandemic, we've shifted to a disaster mental health model to focus on prevention efforts and mitigating more serious problems.

The first level is prevention—getting information out about COVID-19 and teaching skills to use in stressful situations, like getting sleep, reaching out to support systems, and keeping a schedule. We also have a triage-like system to identify people not dealing well with the stress of the pandemic and to screen for more serious problems.

What does this approach look like on the ground?

LM: In Zambia we engaged with people we know in communities to be "focal points" or "connectors"—similar to community-based health workers—to take the pulse of the community and be a resource for information and a connector to more help. They're getting messages out about COVID-19 and coping skills, mainly through pamphlets, direct communication, and videos that can be viewed on phones.

The connectors are linked to our trained CETA [Common Elements Treatment Approach] providers—who are trained in telephone-based therapy—and can enlist their help for urgent issues like suicide ideation and interpersonal violence. [CETA is a community-based intervention for multiple mental health problems in a single model, and is suitable for scale-up in LMICs.]

Are pandemic responses tailored to different sites?

JB: In Myanmar, we work in a camp for internally displaced populations. Literacy is relatively high in Myanmar, so we distribute written materials, and we're also using loudspeaker audio files and phone-based videos to reinforce messages around stress and coping.

LM: In Ukraine [where GMH works with veterans], where there is more capacity for technology, CETA providers use video platforms like Zoom or Skype. We are also offering single-element CETA sessions in group format as a skill-building and engagement approach.

How is your COVID-19 work in LMICs influencing mental health services in the U.S.?

LM: I partnered with New York University's McSilver Institute for Poverty, Policy and Research to offer a webinar and resources for social workers on suicide safety assessment via telephone, based on the clear steps and guidelines in our CETA model.

We also are working with rural and underserved communities where there are few mental health professionals and a need for an evidence-based treatment that deals with not just *one* problem but several, like depression, trauma, anxiety, violence, and substance use.

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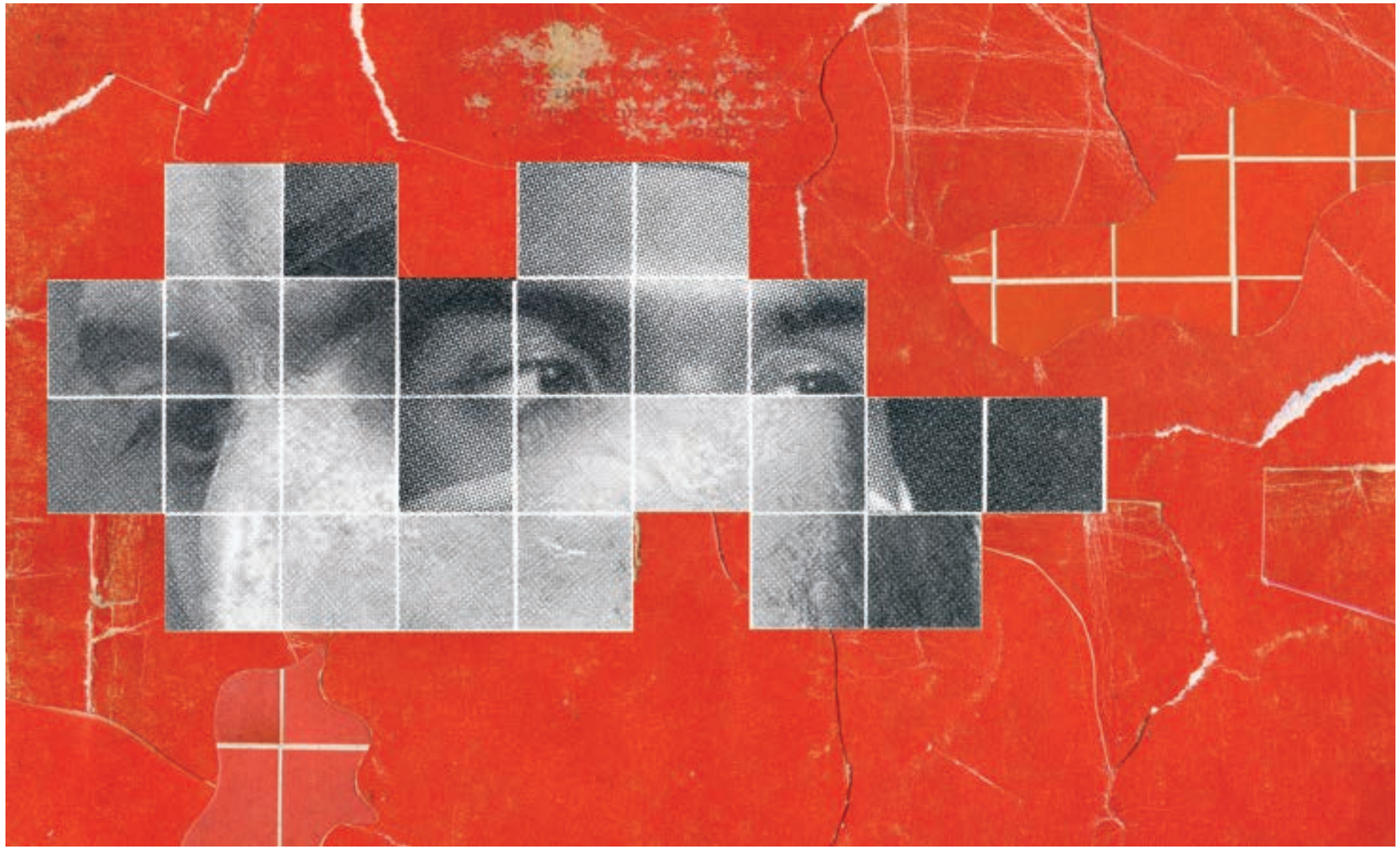


ANTHONY GERACE

A CRISIS WITHIN A CRISIS

The pandemic has created a convergence of suicide risk factors that also need a public health response.

BY CHRISTEN BROWNLEE

Their circumstances and stories could not have been more different: An emergency department physician from New York. A German finance official. A farmer in Hyderabad, India. A teen in California and another in England. But according to their family and friends, they each experienced significant stress related to the COVID-19 crisis before ending their own lives.

The longer the pandemic rages on, the more these types of stories become more commonplace, says Paul Nestadt, MD, an assistant professor in Mental Health at the Bloomberg School and Psychiatry and Behavioral Sciences at the Johns Hopkins School of Medicine. He and other experts warn that secondary effects of the pandemic and strategies to mitigate it could spark an uptick in suicides in the U.S., accelerating a trend that's been growing over the past two decades.

"We've really got the perfect storm to put individuals and certain populations at higher risk of suicide," he says.

Some groups that had an elevated risk before the pandemic could now be even more endangered. For example, health care workers like the emergency room physician in New York—who are already suffering from burnout and are stretched thin at the best of times—are often being pushed beyond their limits. When facing unemployment, middle-aged white men, the group with the highest rate of suicide in the U.S., could experience increased economic stress, a known risk factor for suicide. And people over age 85, who have the second-highest suicide rate, could be particularly hard hit by the social distancing needed to tamp down the disease's spread.

"Even people with no history of mental health vulnerabilities can be severely impacted by these aspects of the pandemic," says Nestadt. "These stressors can bring about new psychiatric issues or can lead to impulsive suicidal acts even in the absence of a classical depression."

A sharp uptick in gun sales linked to the pandemic could make suicide attempts significantly more successful, he adds. In March 2020, Americans bought nearly 2 million guns, making it the second-busiest month for gun sales on record. Although more than a million people attempt suicide in the U.S. every year, more than half of the more than 47,000 completed suicides are by firearm, says Nestadt, whose research focuses on practical factors, such as access to firearms, in suicide deaths. "When there's a gun in the house, the chance of death by suicide more than triples," he adds.

Aliya Jones, MD, MBA, deputy secretary of the Behavioral Health Administration at the Maryland Department of Health, says that significantly more people have been accessing mental health crisis services recently. From February to March, there was a 45% increase in calls to the Maryland Helpline, the state's crisis hotline. Compared to March 2019, March 2020 had an 842% increase in texts to the same service.

"The number of text conversations in March 2020 equals the number for the entire fiscal year for 2019," Jones says. "It's a clear indicator that people are experiencing more stress."

A variety of measures could help mitigate this strain and potentially help decrease the risk of suicide, says Holly Wilcox, PhD '03, MA, an associate professor in Mental Health. Several states have relaxed patient privacy and billing restrictions to give patients easier access to mental health care providers with technologies such as FaceTime or Google Duo. Peer-led support groups, such as bereavement groups and Alcoholics Anonymous, have moved online to platforms such as Zoom. Hospitals and other health care organizations are providing mental health services for frontline providers to ease the anxiety and anguish of providing care during this pandemic.

Wilcox says she believes care could be further improved while reducing strain on providers by expanding the current mental health workforce with paraprofessionals and peer providers—health care providers who aren't licensed but are trained to deal with specific mental health issues and often have shared experience with those they care for.

"Having providers doing outreach and check-ins with patients at risk of suicide would be really ideal right now, but most psychologists, psychiatrists, and social workers don't have the bandwidth," Wilcox says. Such services aren't currently billable to Medicare and Medicaid in Maryland, she adds—a scenario she's hoping to change in the future by working with state legislators.

In the meantime, individuals can make a difference by staying in close touch with their friends and neighbors, even when social distance doesn't allow us to be physically close, says Michael Friedman, MSW, a retired social worker, administrator, government official, and social advocate who taught at the Columbia School of Social Work. He's participating in the development of the Baltimore Neighbors Network, a program for volunteers to call isolated seniors and keep them feeling connected. The program also provides professional mental health backup just in case it's needed.

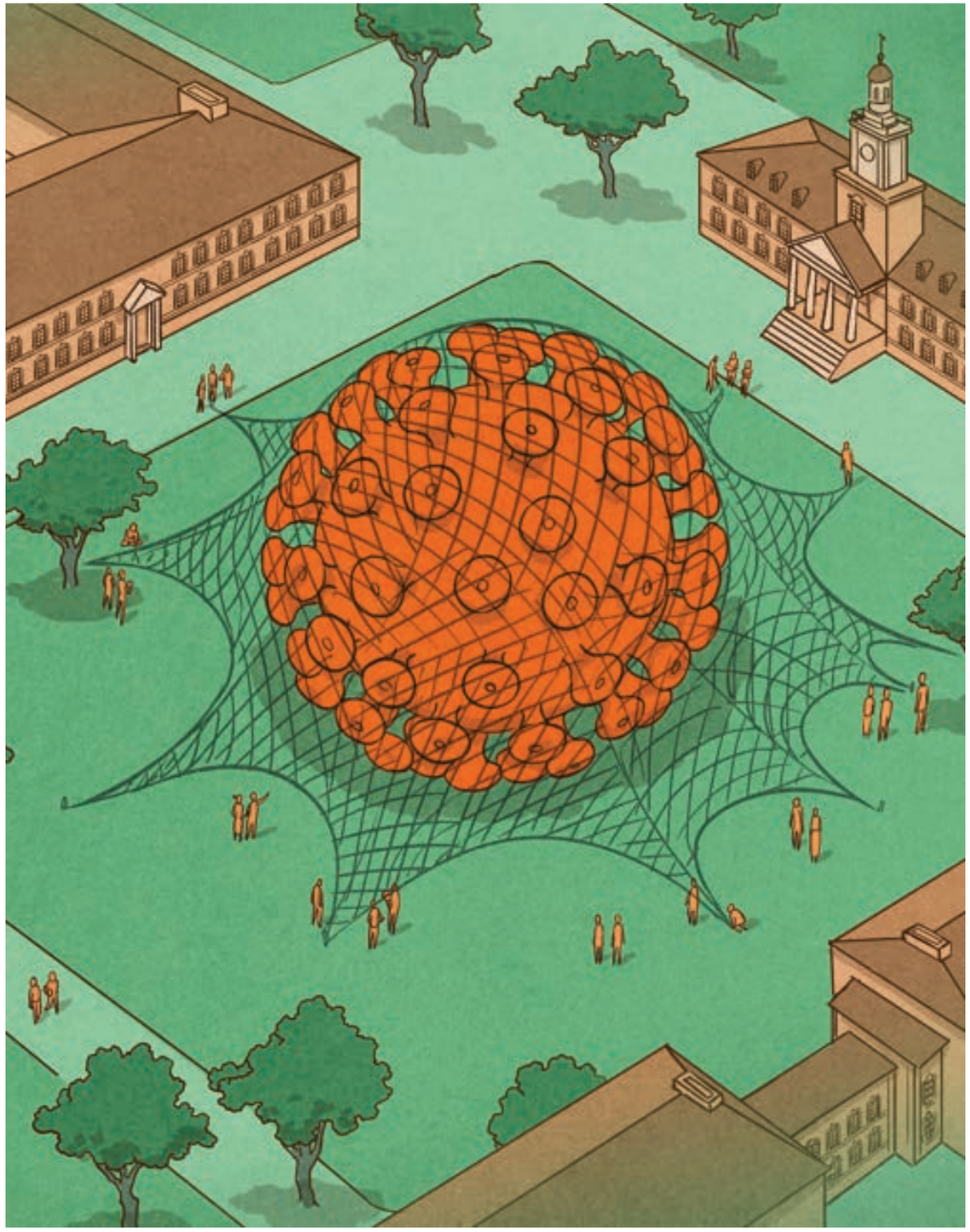
He also believes that all of us should call isolated people we know. "Human interaction is even more important now," he says.

the future

A GROWING CONCERN

Like it or not, we will probably share the near future with SARS-CoV-2. Vaccines, treatments, and knowledge will blunt its impact, but until then Ramazan, 9, is busy selling masks that his mother makes in Islamabad, Pakistan. The going rate on April 26 was 30 rupees, less than 20 cents.

SHEHZAD NOORANI



KOREN SHADMI

A VITAL MISSION

Universities responded to the pandemic with sound science and advice. We can still do more.

BY RONALD J. DANIELS

In 1915, a year before the Johns Hopkins School of Hygiene and Public Health launched, William T. Sedgwick—one of Hopkins' earliest PhDs and an elder statesman of epidemiology—wrote that if the new school was to distinguish itself in the firmament of higher education and public health, it had to "keep in vital contact with the traditions, customs and spirit of American Democracy."

Three years later, Johns Hopkins—and other universities like it—got their chance to make good on this aspiration. When a deadly flu pandemic overwhelmed the world, academic researchers and clinicians chased the virus down in laboratories, treated it in army camps and cities, and advised health officials at all levels of government. The modern research university had truly made contact with democratic life in ways that advanced human flourishing.

Now, as we confront a pandemic on a scale not experienced since the 1918 flu, universities are once again playing the role of a trusted agent in combating this crisis. Around the world, they are conducting and sharing essential research into the nature of COVID-19, reporting data about its spread and impact, and coordinating with governments to shape policies that will spare lives and hasten economic recovery. They are training their research, clinical service, and policy analysis on staunching the tragic human loss.

Johns Hopkins is at the heart of these efforts. At the same moment that our University made the difficult decision to suspend all but essential in-person activities, Hopkins researchers launched an emergency, cross-divisional COVID-19 research program to investigate a broad range of issues from the underlying biology and treatment of the disease to its community impacts. In addition, the Bloomberg School has been partnering with faculty across the institution to shape debate around the efficacy and ethics of digital contact tracing and illuminate the health disparities faced by marginalized communities that are, once more, being exposed by this virus. And through the University-wide effort embodied in the Johns Hopkins Coronavirus Resource Center website—alongside numerous briefings on Capitol Hill and at city halls—we have ensured that the public and policymakers are apprised in real time of the spread of the virus, testing, and tracing.

All of this work has been instrumental in stemming the tide of the virus and saving lives. But American universities cannot—and should not—take a victory lap just yet.

> Sometimes, our best facts and most earnest recommendations simply aren't heeded or believed. The answer to these difficulties is not to retreat from our mission to create and disseminate knowledge but to recommit to those obligations in a spirit of humility and persistence.

Despite the evidence that we have provided sound data and advice to guide the global response to this virus, we continue to see among the public a troubling distrust of institutions of higher education, one fueled by the same forces of partisanship and polarization that have been renting our polity for more than a generation. Sometimes our best facts and most earnest recommendations simply aren't heeded or believed.

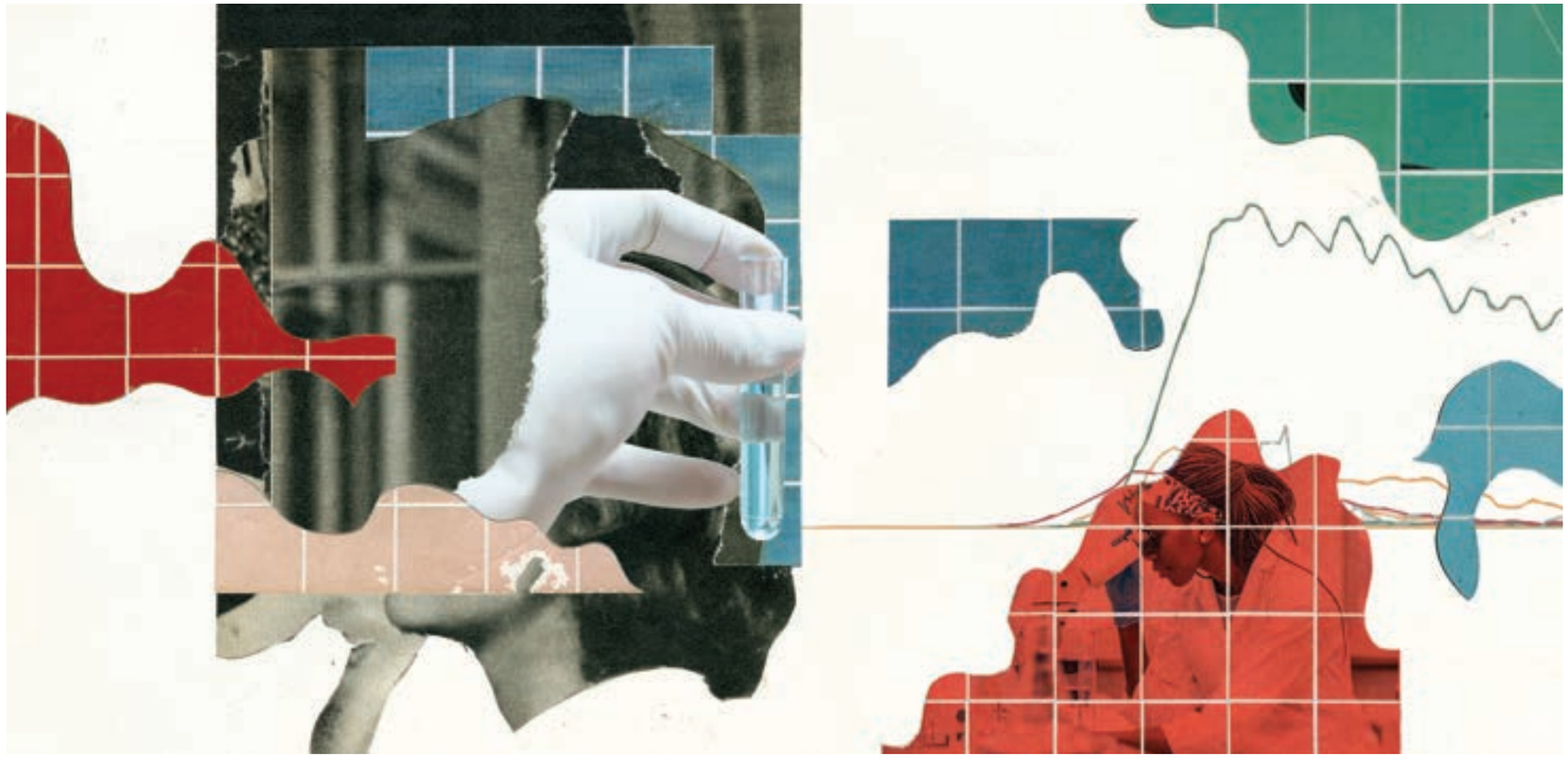
The answer to these difficulties is not, however, to resile from our core obligations nor to retreat from our mission to create and disseminate knowledge but to recommit to those obligations in a spirit of humility and persistence, and continue the hard work we have always done.

To do this, however, we must also carry forward the lessons of this moment.

The first is to engage more closely with policymakers and communicate our best insights to citizens and to the media in a clear and accessible manner in order to ensure that our research is informing democratic life and governance. The second is to redouble our commitment to our educational obligations and vest the next generation of thinkers, researchers, and democratic citizens with the ability to discern truth from fiction and the desire to use their knowledge for the benefit of their fellow humans and the sustenance of more resilient, safer, and more just societies.

We must, in short, maintain that "vital contact" with the spirit of democracy that has for so long been at the core of our enterprise.

» *Ronald J. Daniels, LLM, JD, is the 14th president of Johns Hopkins University.*



ANTHONY GERACE

FAST SCIENCE

COVID-19 research is happening at lightning speed—sometimes at the expense of sound science.

BY KAREN BLUM

The findings were startling. In an April 30 paper, Stanford researchers estimated that the actual number of COVID-19 cases in Santa Clara County, California, was 50 to 85 times higher than the number of confirmed cases. Eager to share the results as the novel coronavirus rampaged across the U.S., the authors posted the study before peer review on medRxiv, a preprint website, where it attracted media attention but also was widely panned on social media for questionable scientific methods.

The Stanford paper was just one of thousands about the SARS-CoV-2 virus—of varying degrees of quality—that flooded preprint servers this spring as the COVID-19 epidemic was declared a pandemic. Such platforms make it possible for researchers to post papers as "preprints" before the work undergoes the rigorous peer review process of respected scientific journals.

In an effort to curate and bring a measure of quality control to the avalanche of coronavirus research, faculty at the Bloomberg School formed the Novel Coronavirus Research Compendium to rapidly assess emerging COVID-19 research published in journals and on preprint servers.

Its verdict on the Stanford preprint? The NCRC reviewers agreed that the study did not have sufficient evidence to assert such dramatic underreporting of COVID-19 cases.

Preprint servers have served as a communication medium between scientists in the basic sciences and fields like physics and economics for about 30 years. More recently, medical and public health researchers have joined in, uploading work to new servers launched in the past few years, typically to seek early feedback from other scientists. However, in the midst of the pandemic, the public and the media have also been looking to preprints as sources for the latest news—in some cases reporting on work that is incomplete or even inaccurate.

"The media has been reasonably responsible in saying 'this is not yet a peer-reviewed study,' but I'm not sure that the average person really knows what that means," says Matthew Fox, DSc, MPH, a professor of Epidemiology and Global Health at Boston University School of Public Health. Even if they do, Fox says, they may still make decisions based on media reports.

What we're seeing now "is an ocean of research of variable reliability," adds Steven Goodman, MD, PhD '89, MHS '87, associate dean of Clinical and Translational Research and professor of Epidemiology and Population Health and Medicine at Stanford School of Medicine.

"A lot of the COVID research is public-facing," he says. "Preprint servers are now read not just by other scientists but by the public as well. The pandemic has added a sense of urgency. Both scientists and the public are so intensely interested in these findings that we feel we need to get them out as quickly as possible. But speed has a price."

In response, some journals have sped up their review process, perhaps beyond what is healthy, Goodman says. It's unclear whether the phenomenon is good or bad, he adds, but in early June, two high-profile papers on COVID-19 treatments were retracted from the *Lancet* and *The New England Journal of Medicine* because of questions on the integrity of their data, which Goodman calls "worrisome signs." Early notice has been moderately important for some papers, helping get the word out quickly on therapeutics like remdesivir, for example, but there is much unreliable information out there as well. "We're probably in a situation where the balance right now is net positive, but it's a close call and could change," he says.

The concept of the NCRC emerged in April when Elizabeth Stuart, PhD, associate dean for Education and a professor in Mental Health, and colleagues became concerned by the rapid pace of coronavirus and COVID-19 research.

"There wasn't a place to vet the research, signal its strengths and weaknesses, and also curate and summarize it," Stuart says.

Recognizing the need for trusted high-level summaries of rapidly released COVID-19 studies, Stuart reached out to Kate Grabowski, PhD '14, ScM '07, assistant professor of Pathology at the School of Medicine and in Epidemiology at the Bloomberg School, and Emily Gurley, PhD '12, MPH, an associate scientist in Epidemiology, to head up the effort. Now, more than 50 faculty and students contribute to the project, curating new studies on a weekly basis.

Reviewing teams evaluate studies in eight topic areas including diagnostics, modeling, epidemiology, and vaccines. As of June 7, the site had posted nearly 200 reviews, and garnered 29,449 page views from 7,902 users.

In selecting work for review, the NCRC focuses on empirical research and the generation of new knowledge. The reviewers ask: Will this study be important for a global public health audience? Is this need-to-know information? Does it add anything new to what we already know? They also review papers that attract media attention but may have significant limitations.

The NCRC tackled one study from China, for example, that reported that the drug remdesivir was not effective in later stages of COVID-19, while an NIH press release distributed the same day indicated the opposite was true. The NCRC's take was that the Chinese study's conclusions should be viewed cautiously because the study was terminated for insufficient enrollment, the timing of treatment relative to symptom onset was inconsistent, and the tests used to measure viral clearance were not ideal for the task.

Gurley anticipates a continuing need for the NCRC.

"There's still so much we don't know about this virus," she says. "We don't yet have good examples of places where transmission has been stopped and everything is over. Until we get through that, I think there's going to be a need."

As for whether the use of preprints will continue to grow in the post-pandemic era, time will tell, says Goodman.

"It has created a new pipeline in the non-basic sciences that public health and clinical researchers had not used much before," he says. "I think the inclination will still be to use mainly the journal system once the sense of crisis—and that even immature information has value—passes. … But I don't think we'll go back to the baseline we had before."

THE VACCINE CHALLENGE

A return to normal requires a vaccine for SARS-CoV-2. What will it take to create one and get it to those who need it most?

BY JULIE SCHARPER

PART 1: THE PREVENTION PIPELINE

As reopening measures begin across the U.S. and the world, it becomes increasingly clear that the road to normal—a time without social distancing, masks, and quarantines—will be a long one. Barring the discovery of an effective treatment, only a readily available and easily administered vaccine will allow a return to former ways of life.

The good news is that more than 125 vaccines are currently in development, according to the WHO. But most of these vaccines won't make it to clinical trials, and many of those that do won't be effective or safe enough to achieve licensure, says Peter Hotez, MD, PhD, dean of the National School of Tropical Medicine at Baylor College of Medicine. He adds that predictions that a vaccine could be ready by the fall are unrealistic. "We won't see our first COVID-19 vaccines until late 2021 at the earliest," he says.

To make a vaccine, scientists must first understand the structure of the virus, how rapidly the virus mutates, and whether those mutations affect the immune response, says the Center for Immunization Research's Kawsar Talaat, MD, an assistant professor in International Health. A potential vaccine must then undergo rigorous testing. The quickest a vaccine has been developed to combat a novel pathogen is four years.

Vaccines work by teaching the immune system to identify and destroy a pathogen. Some contain proteins from the outside of a virus, such as the spiky protrusions that give the coronavirus its name. Almost all of the COVID-19 vaccines, including one Hotez's lab is developing, work by inducing neutralizing antibodies against the spike protein. Others use a weakened live virus, or an unrelated virus that delivers genes into cells (a viral vector). A more recently discovered technique uses mRNA from the pathogen to prompt the creation of antibodies; while promising, this technique has not yet been used to make a licensed vaccine.

Prospective vaccines typically undergo several rounds of testing: first in animals, then in about a dozen people, and then in hundreds, and, finally, in thousands. Each of these stages generally takes months to years. Some scientists have proposed expediting the process by combining the second and third stages of testing.

While vaccine makers hope to speed through testing in record time, assessment of safety is also a critical part of these clinical trials, says Ruth Karron, MD, a professor in International Health and founding director of the Johns Hopkins Vaccine Initiative. "It's important that the vaccine induce the right kind of protective immune response," she says.

As clinical trials move forward, we will learn more about the kind of immunity needed to protect against severe COVID-19 and how long protection lasts. We'll also learn whether revaccination will be necessary, which may depend on the length of protection and how much the virus mutates over time. If it mutates rapidly, people might need to get vaccinated for the virus each year, much as we do for the flu. Fortunately, preliminary studies indicate that SARS-CoV-2 mutates slowly.

That so many vaccines are in the pipeline is a hopeful sign, says Talaat. "It's good to have many candidates entering the field so we can choose the ones that will be most effective and safest," she says.

PART 2: PROTECTION FOR ALL

At some point in the coming months or years, one or more vaccines will be proven to safely protect against the novel coronavirus. The next step may be even more difficult: ensuring that at least 70% of the world's 7.8 billion people receive the vaccine (or develop immunity through infection) in order to establish immunity levels needed to keep the virus in check.

How the vaccine is distributed is an important question for policymakers, public health experts, and ethicists to explore, says William Moss, MD, MPH, executive director of the International Vaccine Access Center. "We'll certainly have a period—it may be measured in months or years—where we won't have enough vaccine for everyone who needs it," says Moss, an Epidemiology professor.

Will the vaccine belong to all nations and be administered first to those who most need it? Or will countries that produce vaccines keep them for their own citizens? It depends whether the approved vaccines are created by international partnerships or by countries that are working on their own, says Ruth Faden, PhD, MPH, a professor in Health Policy and Management and founder of the Johns Hopkins Berman Institute of Bioethics.

> "If you think the ventilator wars in this country ... were bad, that was just a taste of things to come at the global level.

Faden points to the words of UN Secretary-General Antonio Guterres, who said in May that vaccines "must be treated as global public goods available and affordable for all." Guterres was addressing a global conference, convened by the European Union, which raised $8 billion for the development of a vaccine. Forty countries agreed to work together at the conference, though the U.S. did not send a representative.

If the vaccine is indeed treated as a global public good, Faden says, it will be administered first to the people most at risk in the countries where the virus poses the greatest danger. However, Moss adds, there is a no international governing body poised to oversee this. The WHO can make recommendations, but has no enforcement power.

Without a global mechanism for the equitable allocation of COVID-19 vaccines worldwide, rich countries will outbid poor countries and monopolize the supply, says Gavin Yamey, MD, MPH, MA, director of Duke University's Center for Policy Impact in Global Health. "If you think the ventilator wars in this country, where states were pitted against each other to get necessary equipment, were bad, that was just a taste of things to come at the global level," he says.

Once countries obtain vaccines, they will need to prioritize the types of people who get the vaccine, says Moss. "You would imagine that people will want to target those who are most at risk and most vulnerable: health care workers, first responders, the elderly, and those with compromised immune systems," he says.

One key to vaccinating people as quickly as possible is to start manufacturing several vaccines before their efficacy and safety have been tested. This practice, called "manufacturing at risk," is costly, Yamey says. Countries, nonprofits, or drug companies will have to invest in the equipment, raw materials, and labor to produce a vaccine with the understanding that the finished product would be discarded if it is faulty. It is likely, Moss says, that several vaccines will prove safe and effective and that different vaccines will be administered in different parts of the world.

The global collaborations already underway offer some hope that world leaders could find a way to get at least some vaccine first to those who need it most, says Faden. "If we can pull off anything approximating that, it will be a first," she says. "It will be stunning. It will absolutely be the right thing to do ethically."

MECALEHA/AMGUY/GETTY IMAGES

ENVISIONING A POST-PANDEMIC WORLD

How COVID-19 has reset the present and the future.

BY JACKIE POWDER

The repercussions of the coronavirus pandemic will shape our lives for the foreseeable future and beyond. Life as we knew it, in the days before constant handwashing, social distancing, and masking, is gone. The future may bring immunity passports, reconfigured public spaces, a transformed health system—and what else?

Five Bloomberg School faculty from diverse fields look ahead to potential impacts of the crisis in key areas, from the food system to digital health to transportation policy.

REROOTING THE FOOD SYSTEM

COVID-19 HAS PROFOUNDLY SHAKEN MOST ASPECTS OF THE U.S. food system and food security, highlighting threats to food workers, vulnerable supply chains, and inadequate planning for resilience. Food insecurity rates are soaring. Response activities are being adapted and created at a scale and pace I have never before seen. We must keep providing food and resources. But that's not enough.

Both pre- and post-pandemic, the root causes of food insecurity lie substantially outside the food system. We need large-scale social investments to provide jobs and income, and we must come together to address deep-rooted inequities. The billions of dollars and great energy mobilized during this pandemic suggest we have long had the resources needed to create a more resilient and just food system.

NARVKIK/GETTY IMAGES

» *Roni Neff, PhD '06, ScM, is an associate professor in Environmental Health and Engineering and a program director with the Center for a Livable Future.*

> Both pre- and post-pandemic, the root causes of food insecurity lie substantially outside the food system.

MIND, BODY, AND PHONE

WITH MORE MOBILE PHONES THAN humans on this planet, the opportunity for digital health innovation and use has not been missed as the COVID-19 pandemic has unfolded.

Smartphone apps and chatbots have helped triage possible COVID-19 patients based on symptoms. Many countries have launched apps to help track—confidentially—interpersonal encounters to speed up contact tracing. Several governments have used digital technologies to keep the public informed and even ensure quarantine compliance.

Social distancing and limitations on elective clinical visits have pushed telemedicine into mainstream use. One can hope that the adoption and popularity of telemedicine increase even after the pandemic subsides. Remote access to health care could lower burdens and costs—from postsurgical checkups to mental health counseling—and, combined with home-based biometric monitoring technologies, possibly improve outcomes.

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» *Alain Labrique, PhD '07, MHS '99, MS, is a professor in International Health and director of the Johns Hopkins Global mHealth Initiative.*

ROADS TO HEALTH

ONE UNEXPECTED BENEFIT OF STAY-AT-HOME ORDERS IS that some city streets are being closed to traffic, and speed limits are being reduced to ensure access to safe outdoor spaces for walking, bicycling, play, and exercise. Transportation policy is finally being viewed as health policy in a real way.

In many cities, these changes to streets will end once things are "back to normal." [But] there is tremendous opportunity to do better than normal and reimagine how streets are designed and used. Infrastructure changes that support more walking and biking for all people—regardless of race, ethnicity, income, and ability—is possible. Long term, I hope that city leaders will work together to make safe streets the norm, and healthy, safe, and equitable communities a reality.

» *Keshia Pollack Porter, PhD '06, MPH, is a professor in Health Policy and Management and associate dean for faculty.*

> In many cities ... there is tremendous opportunity to do better than normal and reimagine how streets are designed and used.

DE-STRESS TEST

WE ARE FACING A MENTAL HEALTH CRISIS AS A RESULT OF COVID-19. UP TO half of people in affected regions are reporting psychological distress. Health care workers are facing exceptional stress from the risk of becoming infected and infecting their families, extreme workloads, difficult decisions, and patient deaths. They risk accelerated burnout, PTSD, and even suicide.

Johns Hopkins has fared relatively well due to capacity to support staff and deliver psychological first aid through the RISE (Resilience in Stressful Events) peer-support program, which has coordinated closely with other resources. In the near future, institutions should plan to build up their organizational resilience and mental health support. Training to improve crisis communications and provide staff support will help us respond effectively to the next disaster.

» *Albert W. Wu, MD, MPH, is a professor of Health Policy and Management and codirector of the RISE peer-support program for Johns Hopkins Hospital.*

WANTED: EXPERT OPINIONS

AMERICAN PUBLIC HEALTH EXPERTS have recently found themselves in conflict with leaders who dismiss inconvenient facts. For example, officials have dismissed global warming as a conspiracy; promoted unproven therapies as viable treatments for disease; fired experts who published findings with which they disagree; and claimed that COVID-19 deaths are over-counted.

But the public is beginning to understand the importance of reliable evidence in its battle against this horrific pandemic. The public is focusing its attention on the facts—as inconvenient as they might be.

If the American people continue to face their reality head-on, COVID-19, as deadly as it has been, will come with a silver lining for the future of our society and the public's health. Public health research and practice will receive the public support needed to protect health and save lives, millions at a time.

» *Scott Zeger, PhD, MS, is the John C. Malone Professor of Biostatistics.*

> The public is focusing its attention on the facts—as inconvenient as they might be.

SCIENCE VS. VIRUS

Virologist Andy Pekosz surveys some of the strategies in the works to stop SARS-CoV-2.

BY BRIAN W. SIMPSON

INFOGRAPHIC BY JENNIFER FAIRMAN

Call it humanity's revenge. The novel coronavirus—known for viciously exploiting victims' weaknesses like hypertension and diabetes—is now having its own weaknesses targeted relentlessly. Andy Pekosz, PhD, a professor in Molecular Microbiology and Immunology, is investigating the virus to search out its vulnerabilities. An enthusiastic and precise scientist, Pekosz has deep research experience in how viruses like SARS and influenza interact with the respiratory epithelium—cells lining the upper airways that protect against dust particles, viruses, and other invaders. Here, he discusses the virus's lifecycle, researchers' strategies, and six targets. Spoiler alert: He's optimistic.

Infection
The virus enters the body through the nose, mouth, or eyes. It attaches to cells in the airway by binding to a protein called ACE-2.

Lipid membrane

Spike proteins

Viral RNA

Internalization
Binding to ACE-2 allows the virus to enter the cell via endocytosis.

Protease Processing
Cell enzymes called proteases cause changes to the virus's spike protein so it is able to deliver viral RNA into the cell.

Membrane Fusion & Release of Viral RNA
Viral RNA is released into the cell's cytoplasm after the virus fuses membranes with the cell. The virus then uses the cell's own machinery to begin the replicating process.

Translation & RNA Replication
The infected cell reads the virus RNA and begins making proteins that will keep the immune system at bay and help make new copies of the virus.

Packaging & Assembly
New copies of the virus are assembled at sites inside the cell.

Exocytosis & Release
Each infected cell can release hundreds of new viruses before the cell finally dies. The viruses may infect nearby cells or end up in droplets that are sent into the environment.

LIFECYCLE

TMPRSS2

ACE-2

Viral RNA

Host cell cytoplasm

Replication complex

Ribosome

RNA

RDRP

Protease

Proteins

TARGETS

1 Antibodies

Blood serum

2 Chloroquine

Hydroxychloroquine

3 Spike bound to host cell

ACE-2

Camostat mesylate

TMPRSS2

4 Host cell main protease

Lopinavir (Protease inhibitor)

5 RNA-Dependent RNA Polymerase (RDRP)

Favipiravir

RNA

Remdesivir

6 SARS-CoV-2 Vaccine

Vaccine

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Monoclonal antibodies & convalescent plasma
Recovered patients have antibodies to SARS-CoV-2 in their blood plasma. Giving these antibodies to patients with active COVID-19 may be effective against the infection. They block the virus from binding to cells and may have other effects as well. They're not a long-term fix, but they may help for a few weeks. Several companies are developing monoclonal antibodies for this same purpose.

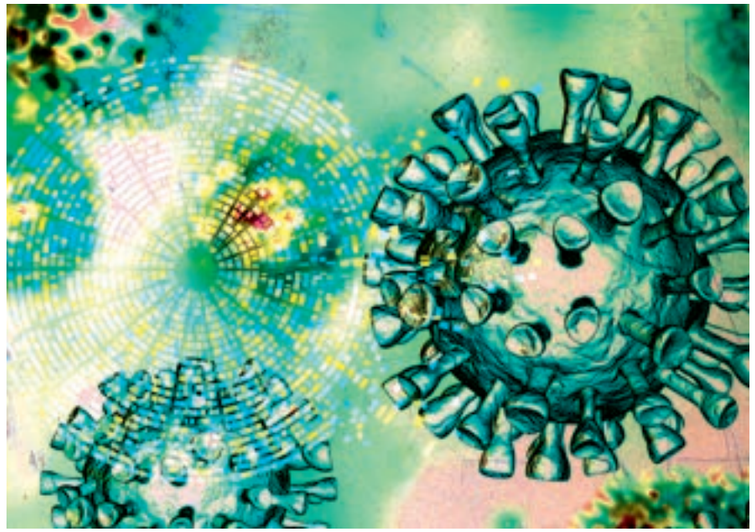
Chloroquine & Hydroxychloroquine
These drugs appear to offer no significant benefits—but have increased risk. They were shown to have great efficacy in laboratory settings, but that hasn't translated to an effective drug for humans. That's something that happens a lot, actually. Plus, drug trials have shown there is a risk for heart arrhythmia and other heart issues.

ACE-2 inhibitors
The advantage or disadvantage of drugs called ACE-2 inhibitors is not entirely clear for COVID-19 infections. Targeting the ACE-2 with antibodies or using "decoy" ACE-2 molecules has the potential to inhibit virus entry in ways similar to antibodies.

Inhibit protease activity
It may be that the best antiviral drugs will come from drugs that target the virus's proteases, but they are a long-term project. Proteases are enzymes that perform essential functions for the virus, so if you stop them, you stop the virus. Medicinal chemists love these because they work all the time and have lots of spaces that drugs can be designed to target.

Inhibiting RNA polymerase
RNA polymerase is another enzyme that SARS-CoV-2 needs to replicate. The drug favipiravir has been shown to be effective in shortening and clearing the infection, as has the better-known remdesivir. Both have been tested extensively in humans because they have activity against multiple classes of viruses, not just coronaviruses.

Vaccines
Vaccines could be the ultimate solution to COVID-19. A future vaccine will help the body generate antibodies that target the SARS-CoV-2 virus and prevent it from infecting human cells. More than 100 different candidates are in the works. Vaccines should come on board faster than we've ever seen before, but they still have to go through all the safety testing and efficacy trials.



TETIANA LAZUNOVA/ROMOLOTAVANI/GETTY IMAGES

CLUES TO COVID-19 SEVERITY MAY LIE IN OUR GENES

Some epidemiologists believe human genetics plays a role in who gets sick and how sick they get.

BY CARRIE ARNOLD

In her hunt for what makes the novel coronavirus so deadly, Priya Duggal is looking in a most unusual place: human DNA.

Historically, researchers have focused on pathogens to understand the diseases they cause. But the pathogens themselves can't always explain why two people with the same disease can have very different outcomes. Take COVID-19. While potentially half of all those infected don't have any symptoms, 20% of all cases need hospital care. Around 1% to 3% of all symptomatic patients will die, according to data from the CDC on early U.S. coronavirus cases. Many of the sickest patients are older and have multiple underlying conditions, such as hypertension, diabetes, and cancer—exactly who you'd expect to have a more severe illness. But a small number of patients who die are young and healthy, with no known risk factors.

This variability isn't just in age, either. Scientists are seeing a lot of heterogeneity in terms of symptoms, severity, and recovery time in people infected with COVID-19. Part of that difference could be caused by genetics, says Duggal, PhD '03, MPH '98, an associate professor in Epidemiology.

To understand these differences, Duggal and colleagues at sites around the U.S. are conducting an initial snapshot analysis of 500 young adults hospitalized for COVID-19 who don't have other underlying conditions and 500 nonhospitalized controls who were infected with SARS-CoV-2 but didn't develop symptoms. By studying the young and otherwise healthy, she hopes to increase her odds of identifying genes that might make someone more likely to develop life-threatening illness. She hopes her efforts will help scientists better understand the biology of SARS-CoV-2 infection and leverage these insights to develop therapeutics that target the proteins made by the host genes she identifies.

This approach has been used before: HIV scientists discovered mutations in a gene called CCR5 that could make someone immune to HIV. They used this discovery to develop an antiretroviral drug, maraviroc, that blocked the interaction between HIV and CCR5. When Duggal learned about this strategy as an MPH student at the Bloomberg School in 1997, she wanted to do something similar for other infectious diseases. Using a long-term study on individuals with hepatitis C, Duggal began to search for genetic variants associated with the ability to clear the virus before infection became chronic. She also began investigating the 10% of impoverished Bangladeshi children who escaped infection by *Entamoeba histolytica* that caused repeated diarrheal disease in the other 90%.

Advances in genetic sequencing technology have allowed Duggal to comb through genetic markers across the entire genome rather than confining her search to a specific region. In both her work on hepatitis C and on diarrheal disease, Duggal was able to identify key genes that impacted a person's chances of getting sick, although these findings haven't yet led to new treatments. Now, she wants to take this same approach to understand COVID-19.

Duggal is focusing her efforts on young adults hospitalized with COVID-19, as she believes that these individuals are more likely to be genetically susceptible to the virus. Duggal believes that certain genetic variants might help explain why some individuals get so sick even without any risk factors.

"We don't have clinical answers for [these] things, and we're hoping genetics offers answers to some of these questions," Duggal says.

CHRIS GRANGER

OUR PANDEMIC FUTURE

John M. Barry, author of *The Great Influenza*, reconsiders science, leadership, and society.

INTERVIEW BY BRIAN W. SIMPSON

John M. Barry takes the long view. For seven years, he immersed himself in the 1918 flu pandemic that killed more than 50 million people. In *The Great Influenza* (2004), he chronicles the virus's global devastation, its personal toll that saw entire families dying together, and scientists' struggles to understand the swiftly moving virus. The book, which has returned as a bestseller on Amazon, has made Barry a sought-after source for history's pandemic lessons and insights on our future. Barry, an advisory committee member of the Bloomberg School's Center for Humanitarian Health, uncovers the pandemic's impact on science and leaders—and what he's watching for now.

Based on what happened in 1918, do you expect that this pandemic will lead to major transformations in science and how science gets done?

That remains to be seen. Right now, clearly there is much more cooperation than probably there has ever been. I'm in a Google group of more than 200 scientists from more than 30 countries. There's talk among competitors of collaborating on this, on that—you know, trying to swap information, trying to figure something out—[by] people who've never collaborated before.

So, there is a coming together to solve a common problem. That is, to me as an observer, very gratifying. And hopefully, of course, they will reach a solution sooner rather than later. In 1918, there was a real spur to science. I think that will happen again.

And for the scientists themselves?

I think science is going to attract very talented, very smart young people. A few years ago, maybe they would have gone to Wall Street. But I think some of those people will be very much taken with the intellectual challenge—and really the excitement—of science.

Are you surprised that science itself isn't further along than it is—that vaccines take years to develop and new drug therapies aren't that much quicker?

If you're talking about the sclerotic structure for routine progress, yes. Obviously now it's moving with amazing speed. Of course, we don't have a solution at this point. In six weeks, maybe we'll know quite a bit more about therapeutics and possibly a vaccine as well. They've already begun trials in both areas. That's extraordinary.

One of your book's main lessons is the need for leaders to communicate clearly and honestly. In late January, President Trump said this about the coronavirus: "We have it under control. It's one person coming in from China. It's going to be fine." What are the costs of the U.S. president saying things like that?

> Transparency is written into the federal plan, and it is written into every one of the state plans funded by that legislation. But you still have to have someone to do it.

Well, it makes it much more difficult to get people to take it seriously. It's created compliance problems. By questioning the severity of this outbreak from the very beginning and continuing to do so for months, it sort of imprinted into the mind, not only of people who support him but other people as well. That makes compliance with guidance much more difficult.

What are the lessons here? How does a country get the kind of leadership that it needs in a pandemic?

It elects the right people. [Laughs] When it comes to leadership, that is a function of personality. George W. Bush passed multibillion-dollar legislation, much of it invested in vaccine technology, a national stockpile, and plans for a pandemic. I was part of that planning process. I always advocated for telling the truth, and nobody really disputed that. Transparency is written into the federal plan, and it is written into every one of the state plans funded by that legislation. But you still have to have someone to do it. Plans can say "be transparent" all you want, but somebody's got to go out there and be transparent. And that is always a function of personality.

Why is it that leaders seem to perceive honesty as an accelerant to panic?

I'm not sure I agree with your premise. In Singapore, South Korea, Germany, and elsewhere, I believe leadership was quite forthright and candid.

There are examples of Trump and Bolsonaro and others who do go that other route.

Oh, yeah. Certainly. There is a tendency to hold information close or think you know better than somebody else, or you don't want to scare people and so forth. I think that's a wrong approach. I think most experts in risk communication—a phrase which I don't like very much because it implies managing the truth and I don't think you manage the truth; you tell the truth—but I think most experts in that field agree that transparency is better. People can deal with reality. And reality can be pretty frightening sometimes. But it's a lot easier to deal with reality than what your imagination can conjure up.

Once there is a vaccine and therapies available, what will COVID-19's long-term impact on society be?

With this pandemic, there's going to be a lot more—at least in the medium term—impacts than in 1918. They will be possibly permanent, depending on how effective the vaccines or therapeutics and how soon we get them. If we have a vaccine like measles that's basically 100% effective and lasts for decades and it comes quick, then maybe two years from now, life will be exactly like it was before. But if the vaccine doesn't arrive for a while, or if it's like an influenza vaccine—certainly worth getting but has a lot of weaknesses—then you're going to have some very long-term and maybe permanent changes in people's behavior.

What will you especially be watching for over the next few months?

It's clearly how well we comply with public health guidance. I believe that will determine how badly we get hit or how well we do. That's also a function of getting the testing and the contact tracing in place.

» Ed. Note: This Q&A has been edited for length and clarity.

BY BRIAN W. SIMPSON, MPH '13, EDITOR-IN-CHIEF

REALITY AND HOPE

COVID-19 brought us horror. Science gives us possibilities.

"It's all a bunch of hype."

An older man shared that bit of COVID-19 insight with me in early March. I'd just finished a workout at the local YMCA, and we had a brief conversation in the locker room. It ended when I responded, "We'll see in a few weeks."

Well, we have seen the globe-sweeping reality of SARS-CoV-2 (and learned that denial is not a strategy). Early in the pandemic, every day offered fresh horrors: the loss of more lives, the stories of overwhelmed hospitals, and the images of shuttered businesses and food lines miles long.

But we also found hope in the work of Bloomberg School faculty, students, and alumni—and that of many others. Their ideas, research, discoveries, and projects are expanding knowledge and possibilities.

The novel coronavirus will be with us for a long time. It's not hype. It's real, but so is the promise of the many solutions.

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PAUSING IN GRATITUDE

A nurse practitioner snaps a photo on April 8 in Apache County, Arizona—the middle of the Navajo Nation. Beside her, a handmade sign thanks local hospital staff during the pandemic.

NINA MAYER RITCHIE