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Economic Policy for a Pandemic Age

How the World Must Prepare

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1 Economic policy for a pandemic age: An introduction

Monica de Bolle, Maurice Obstfeld, and Adam S. Posen

A year ago, there were 132,492 confirmed cases of COVID-19 and 4,917 deaths worldwide, of which the United States accounted for 1,586 confirmed cases and 43 deaths. Now, global confirmed cases stand at about 125 million—nearly a quarter of them in the United States—and global deaths are approaching 3 million—about one-fifth of those in the United States.¹ The [world lost 8.3 percent of a year's combined income](#), with the distribution of economic losses mapping largely to where the infection was least controlled, and the poorest in each country suffering the most for the failures of the Group of Twenty (G20)² governments.

As COVID-19 became a pandemic and the world economy plummeted in April 2020, we published a [PIIE Briefing](#) ahead of the meeting of the G20 Finance Ministers and Central Bank Governors. We warned that “Despite...distrust among G20 governments, significant self-harm will result if mutual suspicion dominates countries’ actions. Put simply, in the COVID-19 pandemic, lack of international cooperation will mean that more people will die, not just in the developing world, and many more otherwise viable businesses and jobs will not survive.” The world’s inadequate collective response to the worst pandemic in a century has tragically delivered on that warning.

The global community could have saved lives and livelihoods had it pursued a more cooperative approach, an approach recognizing how a pathogen that spills over national borders cannot be defeated by national action alone. Instead, the US administration chose to withdraw from the World Health Organization (WHO), while export restrictions on key medical supplies imposed by almost all G20 governments disrupted global supply chains and imperiled all nations’ pandemic responses. Strong cooperation in international monetary policy and common ambitions in fiscal policy in 2020 were a helpful counterpoint showing how effective international coordination can and does help materially—and just how costly the failures to cooperate on public health, trade, and emergency development aid were.

We point this out not to draw theoretical lessons for some unspecified future similar outbreak. The global health and economic threats from the COVID-19

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1 Data for a year ago are from March 12, 2020, the date when a national emergency was declared in the United States. See [Our World in Data](#) (accessed on March 26, 2021). The US population is only 4.25 percent of the world’s population. The disproportionate share of pandemic-related deaths in the United States and Western Europe compared with other high-income countries, despite their strong starting point in terms of medical resources, demonstrates just how important policy decisions and cooperation are in such a crisis.

2 The members of the G20 are Argentina, Australia, Brazil, Canada, China, the European Union, France, Germany, Japan, India, Indonesia, Italy, Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, and the United States.

pandemic are not yet behind us. While the development of multiple safe and highly effective vaccines in less than a year is cause for hope, several significant dangers to recovery of global health and income are still clear and present:

- New concerning variants of SARS-CoV-2, the virus that causes COVID-19, continue to emerge at an alarming rate in different parts of the world. They have appeared in Brazil, South Africa, the United Kingdom, and the United States, and may still emerge elsewhere. Although there is much to learn about these variants of concern (VOCs), they can be more transmissible, more lethal, and potentially harder to manage with existing vaccines than the variants that had been circulating before their arrival. It is very likely that due to the nature of SARS-CoV-2, its adaptations to humans, and rate of mutations, vaccines will need to be constantly updated.
- At the same time, vaccine rollouts have been shockingly inefficient even in some rich countries, while much of the developing world waits in line behind them for vaccines to arrive. In this environment, vaccine nationalism and acrimony among countries are escalating. Yet, the threat of new VOCs means that no country can be safe from SARS-CoV-2 until all have achieved a high level of vaccination in their populations. Moreover, periodic revaccinations may continue to be necessary—indefinitely and essentially everywhere—to contain a steady stream of new VOCs.
- While economic recovery in some hard-hit countries has been rapid, in many it has come partly from lockdown fatigue as governments relax business restrictions and individuals tolerate higher risk of infection. With only partial vaccination achieved, the likelihood that more aggressive VOCs spread—and that new ones emerge—increases.

Taken together, these developments raise the real possibility that the current pandemic will persist at a dangerous level for years to come. Moreover, the threat of future zoonotic or human-made pathogens will only rise over time in the absence of international cooperation to understand their origins and to correct the conditions that create them.

The new US administration of President Joseph R. Biden Jr. has rejoined the WHO and articulated a greater appreciation of the global nature of the struggle against COVID-19. These developments are welcome—although, with the United States having purchased [over one billion vaccine doses for a population of 330 million](#), it will have more chances in coming months to match words with actions. The global community, including the United States, though, could do much more to avoid the coordination failures that have marred the world's COVID-19 response so far, while putting in place permanent institutional and infrastructure investments that leverage capacities for countering the current and likely future pandemics. The G20 should now undertake concrete action in these areas.³

This *PIIE Briefing* sets out some key lessons of the current response to COVID-19, along with policy recommendations to help prepare for the real

3 Both the [Group of Seven \(G7\) countries](#) and a large [group of world leaders](#) from both richer and less prosperous countries have floated the idea of an international treaty obligating countries to coordinate on the many aspects of global disease response requiring cooperation and collective action. Taking up this proposal would be an obvious first step for the G20. (The G7 countries are Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.)

possibility of a pandemic age. These innovations include multilateral projects as well as coordinated actions by individual countries, all making the world more resilient to a slow ebb of the current pandemic and to future pandemics. The *Briefing* covers 11 policy areas in which cooperative forward-looking policy action will materially improve our chances of truly escaping today's plague and making future plagues less costly.

WHAT A DIFFERENCE A YEAR MAKES

Over the past year, countries throughout the world have gone through multiple lockdowns and controlled their borders in attempts to contain the spread of SARS-CoV-2. Success in these efforts has varied widely across countries and regions. Initial hopes for quick and decisive global containment of the virus, followed by an early return to economic normality, have been bitterly dashed.

The welcome arrival of vaccines coincided with the detection of new VOCs at an alarmingly rapid pace. Even where previous infection rates are high, the hope of “herd immunity” has been shattered by the reality that when a substantial minority of the population remains susceptible to infection, selection pressures may actually promote the emergence of more transmissible, and possibly more deadly, VOCs. And these have proven able to propagate quickly across the world, easily defying national borders.

Two introductory chapters, one by [Monica de Bolle](#) and the other by [Chad P. Bown, Monica de Bolle, and Maurice Obstfeld](#), make the case that we should prepare now for a chronic COVID-19 pandemic, as well as for likely future pandemics. We may have entered a pandemic age. They raise a main theme of this *Briefing*: that the pandemic is not under control anywhere unless it is under control everywhere. A global threat requires a global response. Accordingly, they offer specific steps for what that global response should entail, not just a plea for solidarity.

Nowhere are the policy implications of the pandemic age more evident than in the area of vaccine distribution. In every past global health emergency, affluent countries have been first in line to achieve life-saving medical treatments and innovations, while the developing world has lagged badly. This time is no different. The Kaiser Family Foundation [reported](#) in mid-March that while the world had produced enough vaccine doses to cover more than four-fifths of adults globally, rich countries had purchased enough doses to vaccinate their adults more than twice over, whereas poorer countries had purchased enough to cover only about a third of adults.

Domestic politics may demand an “us first” approach to vaccine distribution by rich countries, but the science says otherwise, and political leaders must have the courage to explain the facts to their citizens. A starkly unbalanced rollout of vaccines across the world will prolong the pandemic, to everyone's detriment. The G20 is the right venue for coordinating more aggressive global vaccine distribution to emerging-market and developing economies, as it brings to the table major players with significant manufacturing capability, including China, the European Union, India, Russia, and the United States. These countries will need to maintain vaccine manufacturing capacity past the present demand, allowing a more rapid response to emergent threats. The G20 should also help coordinate other essential aspects of global health response, needed now

and into the future, such as systematic and geographically comprehensive genomic surveillance.

Beyond these actions, a range of investments and reforms would have mitigated the devastation from COVID-19 had they been made before 2020. Their value should now be evident for a world in which pandemics are likely to remain an enduring threat.

PREPARE TO VACCINATE THE WORLD QUICKLY

Individuals who choose to be vaccinated not only benefit personally but also confer an additional external benefit on society. As a result, the market prices on which drug companies base the profits they expect from vaccine development underestimate societal benefits. This divergence helps to motivate industrial policies like the United States' Operation Warp Speed, which accelerated the development of successful vaccines for COVID-19.

A government's perceived *domestic* social benefit from subsidizing vaccine development, however, likewise underestimates the *global* benefit, because continuing disease abroad can undermine containment efforts at home. This further divergence supports the case for countries to cooperate in creating a global vaccine infrastructure, thereby attaining their potential mutual gains and avoiding self-defeating vaccine nationalism. It is in the joint interest of G20 countries to endorse more active and institutionalized global cooperation on vaccines. This *Briefing* offers several ideas for how to do so.

In their chapter, [Chad P. Bown and Thomas J. Bollyky](#) propose a COVID-19 Vaccine Investment and Trade Agreement (CVITA) to facilitate the rapid and efficient deployment of global resources, for production of both vaccines and the many inputs needed at earlier stages of the vaccine supply chain.⁴ Under such an agreement, signatories would provide centralized oversight of the vaccine supply chain while subsidizing investments in the entire global vaccine supply chain. They would also promise to avoid the types of export restrictions on medical supplies that have continued to bedevil the world's pandemic response. The result would be a resilient supply chain that can be scaled up rapidly when the need arises—a key element in effectively responding to any disease outbreak. Vaccines would be distributed equitably among parties to the CVITA, which would draw financial resources from an investment fund supported by national contributions based on national income.

Being able to scale up vaccine manufacturing and distribution quickly is one key element in pandemic preparedness, but the process of developing new treatments and vaccines also needs to be accelerated. The new messenger RNA (mRNA) vaccine platforms developed in the current pandemic will be helpful against future viruses, but further challenges will surely arise. International cooperation in the research and innovation domain can help too. In her chapter, [Reinhilde Veugelers](#) suggests that major countries and regions set up their own improved versions of the United States' Biomedical Advanced Research and Development Authority (BARDA), linking them into a single global innovation platform that could share knowledge, costs, and risks. This platform could

4 A CVITA would be a key component of the broader proposed "international pandemic treaty" referenced in footnote 3.

partner with existing global alliances for delivering and developing vaccines, which were hampered in the initial stage of the COVID-19 pandemic by lack of US participation.

The scale of the work to be done, even at the national or regional level, is illustrated by Europe's halting vaccine rollout. Before plugging into a global framework for biomedical preparedness, the European Union must appropriate dedicated joint resources for both scaling up vaccine manufacturing capacity quickly and supporting vaccine development in its early stages (see [Jacob Funk Kirkegaard's](#) chapter).

GUARD AGAINST INEQUITIES IN DISEASE INCIDENCE

As in wartime, the fight against a disease will run most smoothly if governments can draw on citizens' trust and a sense of shared sacrifice. Systematic inequity in health outcomes undermines both. One vital element in the pandemic response—going far beyond social solidarity—is a strong public health infrastructure, as stressed by [David Wilcox](#) in his chapter. Stronger public health systems could better address long-haul COVID-19 consequences, mental health problems owing to the pandemic, and the need for systematic ongoing testing, among other needs. There would also be global benefits.

Even within rich countries, the pandemic has exposed substantial inequities, including in the distribution of vaccines. In his chapter, Wilcox documents that, despite the United States having a relatively successful vaccine rollout in terms of average population coverage, certain demographic groups are lagging, notably including communities of color and immigrants. Often these people are front-line workers. Part of the problem is vaccine hesitancy, which is relatively high in these high-risk communities but is receding—though it is even higher among those, many of them white, who are ideologically inclined toward distrust of government and government action.

One key element driving inequities in vaccine distribution in the United States—and by extension, in other countries—is internet access. In their chapter, [Mary Lovely and David Xu](#) document not only that fixed residential internet service is unevenly available in the United States but also that internet service is least common in counties where health vulnerabilities are the greatest. This unfortunate correlation compounds health risks, while also worsening nonmedical aspects of the pandemic, such as the challenges of remote schooling. Providing universal broadband access is valuable for many reasons, but its absence can be especially destructive in a pandemic. In this area, many countries, notably the United States, need to redouble their efforts.

In the United States and several other advanced economies, including Canada, Italy, and Japan, the pandemic has had a negative effect on women's labor force participation, threatening gains made over the past decades. [Simeon Djankov, Pinelopi Koujianou Goldberg, Marie Hyland, and Eva Zhang](#) document this effect in their chapter. To prevent permanent detachment of women from the labor force as the current pandemic continues, as well as similar dangers in future pandemics, governments should enhance women's ability to work while caring for children and implement a range of labor-market protections.

The WHO's International Health Regulations (IHRs) oblige members to develop specified core capacities for health emergencies, but many countries

remain out of compliance. Better implementation requires not only monitoring of WHO members' capacities but also some provision of financial assistance from rich countries. The G20 should call for stricter implementation of the IHRs as well as for enhanced assistance to low-income countries that wish to strengthen their health systems. G20 members should also commit to counter inequities that the pandemic has exacerbated and work toward equitable domestic vaccine distribution.

MITIGATE THE AGGREGATE ECONOMIC COSTS OF PANDEMICS

Nonpharmaceutical interventions (NPIs) to control pandemics will remain critical to the public health response while vaccines are developed and distributed, at least until most people have been vaccinated. Inevitably, these interventions harm the economy, especially sectors where face-to-face contact is important. Big output losses during the COVID-19 pandemic testify to the importance of designing NPIs to minimize cumulative economic losses, and the feasibility of containing a pathogen at relatively low economic cost depends on capacities for early detection, rapid quarantine of infected individuals, and widespread testing. Otherwise, lockdowns become inevitable, possibly in multiple phases, as we have seen in the United States and Europe. This prospect underscores again that in a pandemic age, public health systems must be up to the challenges that surely will arise.

The comparatively good experience in East Asia and the Pacific shows what may be possible, as [Martin Chorzempa and Tianlei Huang](#) discuss in their chapter. The densely populated and globally connected economies in the region were generally able to return quickly to high levels of economic activity without sacrificing public health objectives. Even in China, where the novel coronavirus likely originated, accomplished this feat after initial stumbles. The main ingredients were general acceptance of masking, widespread testing, rigorous contact tracing, systematic quarantine of individuals likely infected, restriction on internal movement and border crossing, and clear, consistent communication from public officials. Not all components of this approach will be equally enforceable in all countries, as some societies will be more averse to elements seen to limit civil liberties. Yet, it would be wise for policymakers the world over to study the East Asia and Pacific playbook, understand how various political systems in the region were able to modify it, and make conscious decisions—before the next pandemic strikes—about how far they are willing to trade off public health objectives against other considerations. One lesson is that communications technology is likely to play a large role in an effective approach—again underlying the importance of digital infrastructure and internet access in combating the spread of disease.

Through restrictions on international mobility, an enduring COVID-19 scenario is likely to result in a long-term increase in foreign trade costs. This will have negative implications for productivity, as [Olivier Blanchard and Jean Pisani-Ferry](#) point out in their chapter. Future large-scale pandemics likely will also result in movement restrictions. For countries that cannot sufficiently emulate the success of countries like those in East Asia and the Pacific, recurrent lockdowns may become a fact of life, inflicting long-term scarring on workers and destroying businesses. Governments will need to devise mitigating strategies. Blanchard and Pisani-Ferry show that in Europe, successive lockdowns have come with lower

costs. To some degree this reflects learning, which will help governments in the future, but to some extent also it may reflect a greater willingness over time to tolerate higher risks of contagion in order to avoid greater economic pain.

Emerging-market and developing economies have not escaped the pandemic, of course, but the worst consequences of capital-flow reversal—which seemed likely in April 2020—have not materialized, in large part owing to highly accommodative monetary policies by the Federal Reserve and the European Central Bank. That could change if the current pandemic endures, with more liquidity problems arising for emerging-market and developing economies and more of those liquidity problems becoming solvency problems for the worst-hit countries, leading to a need for debt restructuring. In his chapter, [Adnan Mazarei](#), argues that the global financial safety net, centered on the International Monetary Fund (IMF), needs strengthening to cope with the threat of future pandemics and a slow resolution of the current one. The IMF should reconsider the creation of a lending instrument specialized for pandemic support. The IMF could also deploy further resources to support vaccine distribution to developing countries, taking advantage of the planned \$650 billion [allocation](#) of special drawing rights and possible gold sales. Finally, the G20 Common Framework for debt restructuring will be most effective if it requires equal treatment of all creditors, including private-sector creditors and China.

ONLY INTERNATIONAL COOPERATION CAN MANAGE THE PANDEMIC AGE

A year ago, ahead of the first G20 Finance Ministers and Central Bank Governors meeting of the pandemic, we offered an agenda for international cooperation on economic and health policy. Where the leaders acted in line with our recommendations, notably in the international financial and fiscal sphere, cooperative policy improved outcomes and preempted potential conflicts. Where the leaders failed even to attempt significant collective action, notably in vaccine production and distribution, lives and livelihoods were indeed unnecessarily lost. Agreements on transparent common standards of behavior, all governments pulling in the same direction or forswearing the same bad actions simultaneously, matter ([Obstfeld and Posen 2020](#)).

We need to ready the capacity for economic policy responses in light of the potential recurrence and persistence of pandemics. If the current pandemic not only persists but reasserts its hold, or (possibly and) another pandemic hits the world soon, the policy response could worsen, absent repair. The trading system in general and especially in medical supplies is already fractured by distrust. Fiscal and monetary policy space will be insufficient to respond on a scale similar to that implemented this time. The hardest hit sectors, such as tourism, hospitality, and in-person retail, would have to restructure for a lastingly different normal, rather than be bridged to a return to business as usual. Unjust differences in access to vaccines and exposure to disease today could lead to breakdowns in governance and inability to undertake needed lockdowns or provide essential front-line services tomorrow.

Therefore, we call on the G20 governments to treat the crisis of the last year as the start of a pandemic age, not something we are putting behind us. In such an age, global economic and health policy cooperation is not a luxury or an idealistic dream. It is a necessity.

2 Novel viral variants: Why the world should prepare for chronic pandemics

Monica de Bolle

Even with the alarming spread of variants of SARS-CoV-2, the virus that causes COVID-19 (short for coronavirus disease 2019), most economists, most policymakers, and perhaps most people have been assuming that at some point the pandemic will end, and life will resume as before. But what if it does not? Experience with HIV/AIDS and other precedents indicates that these disease events can turn from acute to chronic without going away. The reason lies in the extraordinary mix of virus characteristics, medical science, an interdependent global population, ease of global travel, social behavior, and political missteps and miscalculations—a mix that also caused SARS-CoV-2 to spread so quickly in our globalized era.

COVID-19 is only the latest example of an unexpected, novel, and devastating pandemic disease. Down the road, new threats will surely emerge. One can conclude from the world's ongoing experience that [we have entered a pandemic era](#). To prepare for the pandemic age, world leaders must cooperate to invest more in research in infectious diseases, as well as vaccine development; create and coordinate genomic surveillance efforts; and set up robust public health infrastructures.

ON VIRUSES

Viruses and the diseases that they cause cannot be directly compared. Although nonexperts generally tend to do that, viruses differ greatly in transmissibility, the severity of disease they cause (also known as pathogenicity), the way they may attack or evade our immune responses, as well as many other factors.

SARS-CoV-2 (or severe acute respiratory syndrome coronavirus 2) is similar to SARS-CoV, which caused the SARS epidemic of 2002–03. That earlier epidemic was never classified as a pandemic because it did not spread widely from the places of temperate climate where it originated.⁵ Though highly pathogenic—killing 10 percent of those infected—it was contained because

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5 According to the [World Health Organization](#) (WHO), a pandemic is defined as “an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people.” An outbreak is called an epidemic when there is a sudden increase in cases in some region of the world, or in a particular country. The WHO further notes that this traditional definition of a pandemic has nothing to say about demographics and potential existing levels of population immunity, the nature of the infectious agent, or the pathogen that causes disease, or even the severity of disease caused by the pathogen. Following the WHO's definition, pandemics can be said to occur annually in each of the temperate southern and northern hemispheres, given that seasonal epidemics, like the flu, cross international boundaries and affect a large number of people. However, seasonal epidemics are not typically considered pandemics.

countries affected by it, mainly China and other East Asian countries, took [intense mitigation measures](#) such as lockdowns and other steps to stop chains of transmission. It was also not very contagious compared with other respiratory viruses like those that cause the flu. Similarly, the virus that causes Middle Eastern respiratory syndrome (MERS), MERS-CoV, was also contained by intense mitigation measures aided by its low levels of contagiousness, despite its high level of lethality. Like SARS-CoV-2, SARS-CoV and MERS-CoV are coronaviruses.

Every new pathogen can raise unique challenges. The human immunodeficiency virus (HIV), the pathogen responsible for acquired immunodeficiency syndrome (AIDS), is not a coronavirus, and the disease that it causes is very different. It is a virus that mutates much more rapidly than the three coronaviruses listed above, but since it transmits via bodily fluids, it is less contagious than respiratory viruses. The literature on why [AIDS became a pandemic](#)—a disease that spread to many countries and affected millions of people—is vast.

Like HIV, MERS-CoV, and SARS-CoV, SARS-CoV-2 is zoonotic—i.e., capable of jumping from one animal species to another, eventually reaching the human population. For decades, [virologists and epidemiologists](#) have been warning that a global pandemic would hit because of the existence and abundance of zoonotic viruses, increasing human encroachment on animal habitats, and the speed and ease with which germs travel when people travel. Their prophecy was fulfilled when SARS-CoV-2 was first detected in Wuhan, China, at the end of 2019, spreading within days or weeks to other parts of China and then the globe. Unlike SARS-CoV in 2002–03, the spread of SARS-CoV-2 globally was not contained fast enough in 2019–20, and in the current environment, we cannot rely on rapid containment in the future.

In this regard, the AIDS pandemic illustrates an important point: social and political factors that impede a quick response and the difficulty of finding a vaccine quickly. HIV, which if left untreated leads to AIDS, mutates very quickly, [rendering vaccines difficult to develop](#). Indeed, an HIV vaccine still does not exist. Moreover, in the early stages, AIDS also [stigmatized](#) those afflicted, delaying political responses and the deployment of funding for research into potential treatments. SARS-CoV-2 is [very different](#) from HIV, but as with HIV, social, economic, and political factors came together with the virus's high transmissibility to drive the COVID-19 pandemic.

[Global experience clearly shows](#) that countries that moved quickly to isolate cases of infected individuals, lock down communities and certain regions, and invest heavily in contact tracing were able to control the virus reasonably well. That has been the case in Japan, New Zealand, and Australia. Island countries aside, South Korea, Thailand, and Vietnam were also very successful. European countries that adopted lockdowns often moved too late, hampering their efforts to stem the tide. With the exception of Uruguay and Costa Rica in Latin America, two countries that quickly adopted lockdowns and contact tracing, as well as widespread mask wearing and adherence to social restrictions, the rest of the region has fared poorly. The experience in India has been mixed, as in African countries, which, in addition, fared relatively better due to demographics, namely [younger populations](#).

WHY VARIANTS OF SARS-COV-2 ARE OF MOUNTING CONCERN

Figuring out the exact nature of SARS-CoV-2, and what it portends for future epidemics and pandemics, poses a significant challenge. What little we know is worrisome. First, it may never be known what animal species this virus came from—whether a bat or some other species that transmitted the virus zoonotically to humans in Wuhan. A safe assumption is that zoonotic viruses will inevitably recur, given the nature of the global economy and population shifts.

Another concern is that it is unknown how lethal and transmissible future viruses will be. Only a few months ago, scientists and public health officials generally assumed that SARS-CoV-2 seemed to mutate slowly, more slowly than the viruses associated with the flu, or even HIV. The resulting complacency has now been replaced by alarm [among some specialists](#), just as vaccines are starting to roll out. With uncontrolled epidemics continuing in different parts of the globe, the virus has started to undergo what doctors call selective pressure. Selective pressure occurs when a virus that is spreading and replicating widely in a population develops mutations advantageous to making it more transmissible and/or better able to escape our natural immune responses. Often, these mutations may lead to similar features arising independently of each other in different locations, a phenomenon known as convergent evolution.

At the end of 2020, novel variants of SARS-CoV-2 with concerning mutations arose independently in the United Kingdom, South Africa, and Brazil. These so-called variants of concern (VOCs) share a number of characteristics that may make them more transmissible or likely to evade a person's prior immunity. They may also be associated with increased disease severity. The independent emergence of these VOCs at around the same time strongly suggests that convergent evolution of SARS-CoV-2 is taking place as viral spread continues unabated in many different countries. The VOC that emerged in the United Kingdom—the [most widely studied to date](#)—has been associated with higher transmissibility, greater viral loads in infected individuals, and possibly also with immune evasion. Higher transmissibility and viral loads may place health systems under severe pressure. In response, many European countries where the UK VOC was identified [renewed strict lockdowns](#) in late 2020 and early 2021 even though these countries had already begun their immunization campaigns.

The UK VOC has been identified in over 100 countries including the United States. The South African and Brazilian VOCs have not yet spread as widely, but there is mounting [concern within the scientific community](#) that they may be more dangerous. It is entirely possible that many other unknown VOCs are circulating in different parts of the world right now—unknown because countries in general have ignored the need for well-structured genomic surveillance systems. The slow development of surveillance capacity was not of much concern when the prevalent view was that SARS-CoV-2 was a slowly mutating virus. VOCs have now shattered that view.

GENOMIC SURVEILLANCE IS CRUCIAL

A first priority now is to build up genomic surveillance—the ability to genetically sequence a very large number of viral samples in the population in order to identify concerning mutations and thus take action before viruses with those mutations become a threat to the community. Genomic surveillance involves

substantial domestic coordination and resources, as exemplified by the [COVID-19 Genomic UK Consortium](#), a network of UK public health agencies and academic institutions created in April 2020 to collect, sequence, and analyze genomes of SARS-CoV-2 as part of the COVID-19 pandemic response. The network is currently the best system in the world collecting information on the various viral variants circulating both in the United Kingdom, as well as in other countries. It is also the only network doing this type of work systematically.

Genomic surveillance systems in the United States and other parts of the globe lack the geographical coverage to trace and monitor where VOCs might be circulating within the country, a crucial piece of information for epidemiological control. No global coordination on genomic surveillance efforts exists either, [despite an appeal](#) by the scientific community to create one.

Viruses cannot be eradicated at home while they rage elsewhere

The uncertainties stemming from the mutating of SARS-CoV-2 mean that policymakers must absorb the lesson that [unless the virus is controlled everywhere, it cannot be under control anywhere](#). To paraphrase Benjamin Franklin, we must all hang together, or the virus will hang us all separately. Disparate vaccination campaigns across the globe and the absence of sufficient doses in many countries will inevitably provide greater opportunities for selective viral pressure and the emergence of other novel VOCs that may be potentially vaccine-resistant. Current vaccines themselves provide the opportunity to learn more, as they all protect against suffering hospitalization or death from the disease, but some vaccinated people experience lesser symptoms and may still be able to infect others. As long as the virus continues to have ample opportunities to replicate, selective pressure and convergent evolution will keep the world in a chronic state of alarm.

In other words, even as caseloads and death tolls subside due to vaccines and public health measures, the world may well transition from an acute to a chronic pandemic. Policymakers everywhere should focus on preparing for a chronic pandemic now rather than wasting valuable time speculating over its unknowable end point. Those preparations can also help in containing future outbreaks of new diseases. A key measure in all these efforts will be a much more effective global framework for fighting deadly contagious diseases wherever they occur.

3 The pandemic is not under control anywhere unless it is controlled everywhere

Chad P. Bown, Monica de Bolle, and Maurice Obstfeld

COVID-19 vaccine doses remain scarce globally, with some countries accumulating more doses than they need. The United Kingdom has yet to export any doses, and the United States has sent abroad only a [paltry](#) number. The main suppliers to the world thus far, the [European Union](#) and [India](#), are moving to restrict their exports through actions that are symptomatic of a bigger problem: Every country that is manufacturing vaccines is unilaterally prioritizing its own domestic population over the needs of the rest of the world. This approach may be politically understandable. But vaccine-manufacturing countries are deluding themselves if they think they can eradicate COVID-19 at home and speed their economic recoveries while the pandemic rages elsewhere, especially in developing economies. Epidemics anywhere threaten immunization efforts everywhere—not least because new viral variants are emerging around the globe.

Because a globally cooperative and better coordinated effort is needed, the manufacturing countries must stop their infighting and hoarding and make every effort to get more vaccine doses to the world's hotspots as soon as possible.⁶

Recently, both the [Group of Seven \(G7\) countries](#) and a group of more than [two dozen world political leaders](#) have raised the important idea of a global health treaty that could potentially enhance international cooperation on the full range of public health issues of common concern, including vaccine manufacturing and distribution. The signs that such cooperation is in the offing are not good, however. Echoing last year's [restrictions](#) on personal protective equipment and other medical supplies, European countries have already restricted some vaccine exports, and [tensions](#) continue to escalate, threatening trade [relations](#) and Europe's vaccine [supply chains](#) with the United Kingdom and other countries. The Biden administration has pledged to [lend](#) only 4 million doses to Mexico and Canada, mostly continuing the Trump administration's "America first" export deterrence [policy](#) "to ensure Americans have priority access to free, safe, and effective COVID-19 vaccines." But the increasing risk of viral mutations around the world brings uncertainty and blunts consumption, investment, and ultimately growth. Rich countries need to confront a health and economic crisis that is global in scope. They remain vulnerable until the coronavirus is defeated worldwide.

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6 According to the [Our World in Data](#) website (accessed on March 28, 2021), of the COVID-19 vaccine doses administered by March 26, 2021, 25.9 percent had gone to the United States, 12.7 percent to the European Union, and 6.2 percent to the United Kingdom. In contrast, all of South America accounted for only 6.3 percent of global doses, and a mere 1.8 percent had gone to Africa (which has 17 percent of the world's population).

The economic threat is clear. One recent [study](#) estimates that international supply chains and demand linkages guarantee that diseases in poor countries will spill across borders to rich countries, inflicting big economic costs even if the latter fully vaccinate their populations. The economic costs in rich countries could exceed the cost of helping poor countries get fully vaccinated by 10 to 100 times. Even these striking estimates are overoptimistic in assuming that rich countries can eliminate COVID-19 domestically while allowing it to continue to spread abroad.

However, hoarding vaccines is also likely to prolong the public health crisis within rich countries, even with full domestic vaccine coverage. In the interest of their own citizens' health, rich countries must invest [to scale up global vaccine production and distribution](#) capacity that can respond flexibly to emerging threats. And, despite the obvious political realities, all countries would be better off if vaccine-manufacturing countries found ways to share existing vaccine supplies with those that cannot produce vaccines themselves.

COVID-19 SCIENCE 101

The origin of novel [variants](#) of SARS-CoV-2, the virus that causes COVID-19, has now been documented in such disparate places as the United Kingdom, South Africa, the states of [California](#) and [New York](#), and the city of Manaus in Brazil. Their almost simultaneous eruption at the end of 2020 carried similar mutations likely associated with greater viral transmissibility, as well as greater capacity to evade immune responses and potentially cause reinfection in recovered patients. Some variants could become vaccine resistant, with deadlier consequences than the disease that has already caused more than 2 million deaths worldwide, a huge share of which was in rich countries. Health systems are in danger of becoming overwhelmed again.

SARS-CoV-2 has recently accumulated potentially relevant mutations at an alarming pace. Scientists do not yet know why this is happening, but such changes were expected and may continue while the pandemic persists. A larger pool of infected people in countries where the pandemic remains uncontrolled provides a larger "laboratory" for viral variants vying for genetic dominance.

THE CAUTIONARY TALE FROM BRAZIL

Manaus, a city on the Amazon River of more than 2 million, illustrates the dangers of complacency. During the first wave of the pandemic, Manaus was one of the worst-hit locations in the world. Tests in spring 2020 showed that over 60 percent of the population carried antibodies to SARS-CoV-2. Some policymakers speculated that "herd immunity"—the theory that infection rates fall after large population shares have been infected—had been attained. That belief was a mirage. A [resurgence](#) flared less than eight months later, flooding hospitals suffering from shortages of oxygen and other medical supplies. The pandemic's second wave left more dead than the first.

Scientists discovered a novel variant in this second wave that went beyond the mutations identified in the United Kingdom and South Africa. This new variant, denominated P.1, has since turned up in the United States, Japan, and Germany. Scientists speculate that a high prevalence of antibodies in the first

wave may have helped a more aggressive variant to propagate. The hopes for widespread herd immunity may be [dashed](#) by the emergence of more infectious virus variants.

Since the outbreak in Manaus in January 2021, P.1 has now spread throughout Brazil. The variant is much more transmissible than those that had been circulating previously in the country. High transmissibility and the absence of measures and behaviors to stem the dissemination of the virus have led to the [worst health system collapse](#) in Brazilian history. The country has been on the front pages of major news outlets around the world not only due to the dramatic situation that is currently unfolding but also because of the global threat posed by a major country with an uncontrolled epidemic.

THE POLICY RESPONSE THUS FAR

Almost from the beginning of the pandemic, it was clear that relying on markets and private incentives would not solve the COVID-19 vaccine problem, even in rich countries. Governments had to play a leadership role. The European Union offered [subsidies](#) for vaccine development, as did the United States through [Operation Warp Speed](#). Scientists proceeded amazingly fast at inventing vaccines, sending them through expensive clinical trials, and gaining regulatory approval. Their efforts and successes should not be trivialized. Development teams of high repute—e.g., at [Merck](#), [Sanofi/GSK](#), and [CSL/University of Queensland](#)—also tried and failed.⁷

But thus far, most vaccine doses are going to rich countries.

In anticipation of this problem, a trio of international organizations coordinated in an attempt to create a solution. By mid-2020, the Coalition for Epidemic Preparedness Innovations (CEPI) and Gavi (the Vaccine Alliance), both independent organizations, joined with the World Health Organization (WHO) to create a framework for vaccine acquisition and distribution called COVAX. [CEPI](#) established relationships and provided seed funding to a variety of pharmaceutical companies and researchers to create a diversified portfolio of vaccine candidates. The [WHO](#) provided regulatory oversight and quality control on safety and effectiveness. And [Gavi](#) networked to sign up customers around the world. COVAX was committed to procuring vaccines and distributing them equitably to 2 billion people worldwide by the end of 2021, an estimated 20 percent of each participating country's population, including front-line health care workers and some of the most vulnerable.

The problem with COVAX was not its institutional design but that most of the rich countries where the vaccines would be manufactured refused to use it to secure their own allocations. Instead, the United States, United Kingdom, European Union, and others signed advance purchase agreements directly with vaccine manufacturers. Though these contracts may have accelerated some vaccine development by assuring manufacturers of large markets, CEPI's collaborative efforts provided an alternative model for promoting the same sort of progress. The important unintended consequence of those rich-country

⁷ While all vaccines protect against the disease, none was designed specifically to protect against infection.

advance orders for today is distributional: Vaccine deliveries to COVAX and thus most developing economies, including current COVID-19 hotspots, have been pushed much later into 2021, after the rich countries have first taken their share.

Out of frustration with the global vaccine shortage and feelings of unequal access to vaccines, some developing countries have alleged that excessively strict rules around the protection of pharmaceutical companies' intellectual property are holding back global manufacturing. If only patents for vaccines were waived, the argument goes, more manufacturing would take place. To tackle the issue, India and South Africa have proposed to the World Trade Organization (WTO) that intellectual property rights protection should be [waived](#) for COVID-19-related products, including vaccines, until the pandemic is under control. (In February, over 60 of the least developed countries in Africa and elsewhere [signed on](#) to the proposal.) While the frustration with excessive patent protection may be justifiable for certain drugs, vaccines are a different product and loosening patent protections could create serious public health risks.

Vaccines are notoriously complex to manufacture and regulate, as evidence from the COVID-19 pandemic has made clear. AstraZeneca offers a cautionary example. Despite being an experienced global pharmaceuticals company, it has run into myriad troubles. On the regulatory side, problems began during its clinical trials in the fall of 2020, which delayed authorization of its vaccine for months in the [United States](#) and some other important markets. (That, coupled with the secondary discovery of rare side effects, led many European countries to [halt](#) its use temporarily.) Separately, AstraZeneca has also faced challenges scaling up its production facilities in Europe—apparently both in [Belgium](#) and the [Netherlands](#)—creating distribution bottlenecks. Finally, the Serum Institute of India—one of the largest vaccine manufacturers in the world, and a company licensed to manufacture the AstraZeneca vaccine (itself evidence that intellectual property sharing is not the binding constraint)—recently had to scale back its production plans owing to a [fire](#) at one of its plants as it rushed to increase production. These hiccups show just how hard it is to expand vaccine production quickly. Allowing inexperienced or underregulated new manufacturers to produce COVID-19 vaccines could lead to more failures, resulting in more vaccine hesitancy across the world.

ADAPTING MANUFACTURING AND DISTRIBUTION IN RESPONSE TO GENOMIC SURVEILLANCE

There is increasing evidence that rich countries may face the prospect of new virus mutations developing faster than science can adapt vaccines. More adaptive approaches to manufacturing and distributing vaccines are needed than those currently in use, approaches more informed by a global perspective on public health and by enhanced genomic surveillance.

Unfortunately, the United States, European Union, and others have compounded this problem through their unwillingness to assure trading partners that they would not impose export limits on vaccines manufactured within their borders.

Each of the major vaccine-manufacturing economies is currently imposing export restrictions, albeit in different forms. To much public derision, the European Union has erected a formal export authorization [scheme](#); in March,

Italy used the new regulations to block a shipment of 250,000 doses of the AstraZeneca vaccine to Australia.⁸ Europe's main concern appears to have been over problems with the AstraZeneca vaccine, on which it had placed a large bet for its vaccination rollout. Other countries are also imposing vaccine export restrictions but have received less criticism than the European Union because theirs are more opaque. The United Kingdom is administering to its citizens all of the vaccine doses being manufactured on its shores, and not exporting. The same is mostly true of the United States. Both countries argue that they are prioritizing their domestic populations but also that they are not imposing export restrictions as a form of policy. Disingenuously, they point out that it is simply that their [contracts](#) with manufacturers give their governments procurement priorities. Finally, the Serum Institute of India—a major supplier for less affluent countries with the capacity to generate hundreds of millions of doses annually—has also announced a [delay](#) in its overseas shipments, as the Indian government is directing it to prioritize its domestic population of 1.4 billion.⁹ Delayed AstraZeneca shipments through COVAX will compound the shortage.

In its first week in office, the Biden administration took a positive first step by promising to [support](#) COVAX financially. A few weeks later, it [pledged](#) to donate \$4 billion over 2021 and 2022. But the United States and other rich countries must do much [more](#) than simply committing to finance the COVAX distributional goals, which have little practical impact if the facility has too few vials to allocate.

Now that effective vaccines have emerged, governments must coordinate and devote more resources to scale up vaccine manufacturing capacity in more places around the world. And as more vaccine candidates—with different pluses and minuses—gain regulatory approval, policymakers need to set priorities cooperatively on how much and what to manufacture where. Countries must share information on production capabilities and supplies but also cooperate to adjust their priorities based on the latest scientific evidence and experience on the ground. All the more reason why smoothly functioning medical supply chains are vital.

The emergence of variants creates a mandate for policymakers to focus on the demands of global, and not just local, public health. And as the science continues to evolve, so must the distribution model.

Some vaccines may lead to better health outcomes, or fewer side effects, for one subpopulation relative to others, and some may be more practical than others for certain populations. For example, the messenger RNA (mRNA) vaccines of [Moderna](#) and [Pfizer/BioNTech](#) have been more effective than others thus far, but they also require high levels of refrigeration, making them more complicated and costly to store and transport. Candidates from [AstraZeneca/Oxford](#) and [Novavax](#), which are awaiting US regulatory approval, look cheaper to manufacture and transport, as well as are more robust to storage conditions. The Janssen/Johnson & Johnson vaccine, in addition to sharing those advantages,

8 To its credit, the European Union has [exported](#) tens of millions of doses of vaccines to other countries, including over nine million to the United Kingdom and one million to the United States.

9 India has already exported or donated more than [60 million doses](#) as part of its vaccine diplomacy efforts, including [28 million](#) COVISHIELD (AstraZeneca) doses to COVAX from the [Serum Institute of India](#).

is also the only [single-dose](#) vaccine available. A single-dose vaccine can provide coverage more quickly while making fewer demands on vaccination infrastructure.

Finally, shifting events on the ground means countries must also now prioritize collaboration on the genomic surveillance needed to trace novel variants that could affect vaccine effectiveness. For example, at the national level, the COVID-19 Genomics UK Consortium (COG-UK) has been able to track novel variants emerging in the United Kingdom, informing public health policy. But many countries lack a similarly well-established surveillance network. Policymakers need to help poor countries develop networks of their own and create a global information clearinghouse to ultimately facilitate adaptation of the underlying vaccines, their manufacturing, and their distribution. The WHO has a major role to play in coordinating these efforts, notably in assembling a genomic surveillance network to monitor the emergence of new variants.

CONCLUSION

The considerable benefits of a multilateral approach should compel the United States, European Union, and other rich countries to commit to vaccine distribution based on global public health. Yet, overcoming the collective action problem will not be possible unless it includes most or all of the major economies, especially those with manufacturing capacity.

The Group of Twenty (G20) may, therefore, be the right venue for coordinating global policymaking. The G20 would bring not only China and potentially Russia to the table with the United States and the European Union but also, more importantly, India.

As for the need for rich countries to spend more resources on vaccine deliveries to the world's hotspots, that may demand some tough political decisions and honesty with their citizens. But the truth is that the pandemic is not under control anywhere unless it is under control everywhere.

4 US vaccine rollout must solve challenges of equity and hesitancy

David Wilcox

Note: A postscript at the end of this chapter notes how information evolved between the original publication on March 9, 2021 and March 30, 2021.

The effort to immunize the US population against COVID-19 as quickly as possible is one of the most complex logistical undertakings ever attempted in this country. Four obstacles have hobbled health authorities' efforts thus far: The supply of doses from the manufacturers has been limited; bottlenecks have disrupted the pipeline from manufacturers to recipients; too many people are hesitant to accept the vaccines; and the distribution of doses across the population has been grossly inequitable. Recently, however, supply has been increasing, bottlenecks are being worked out, and hesitancy has receded.

But more effort must be invested to persuade people of the value of the vaccines and to reach all segments of society, particularly communities of color, immigrants, and those least able to bear the costs of the disease. These steps are all the more urgent because pandemics are on their way to becoming a [chronic aspect](#) of the US and global landscapes.

INITIAL STUMBLER

As might be expected with such a massive and complex effort, many aspects have been chaotic, frustrating, and inefficient. More planning went into the development and manufacture of vaccines than into their distribution. State health authorities reportedly failed to move aggressively in thinking through the complicated steps that would be involved in reaching all corners of their populations. They rightfully complained that the federal government provided shifting and late guidance on the number of doses they would be allotted. Hospitals and other elements of the health system already overwhelmed with caring for desperately ill patients struggled to divert personnel and other resources to the task of injecting shots into arms.

Initially, capacity for manufacturing the vaccine was limited. Even by the end of January, the federal government had delivered only 50 million doses to state and other similar authorities. Given that two doses were required of the vaccines that had been granted Emergency Use Authorization, that amount represented less than 8 percent of the doses required to immunize the US population. Over the second half of January, only about 1.3 million doses per day were being delivered by the Centers for Disease Control and Prevention (CDC). If that pace had been maintained, the states would not have received enough doses to immunize the entire US population until the end of April 2022.

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THE DISTRIBUTION EFFORT GAINS TRACTION

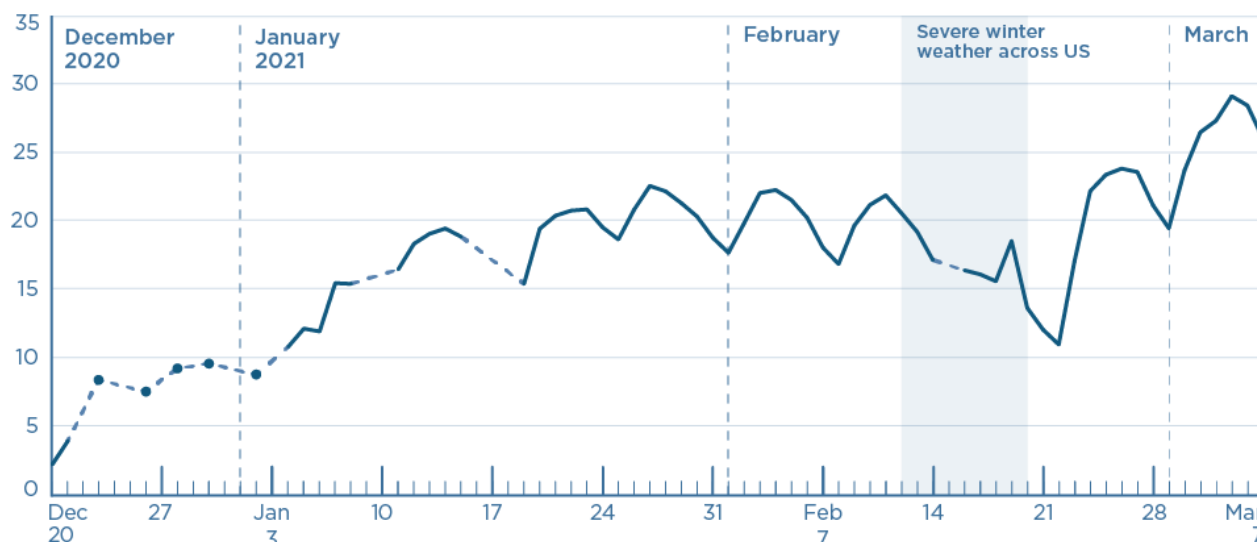
Since then, the supply outlook has improved. As of March 7, more than 116 million doses had been delivered to the states, and the average pace of shipments over the week ending March 7 picked up to 2.9 million doses a day. Moreover, a third vaccine (the one from Johnson & Johnson) has been granted Emergency Use Authorization. This vaccine has the considerable advantages of requiring only one injection rather than two and of being storable for up to three months at normal refrigerator temperatures and up to two years at essentially the temperature of a standard freezer. Although only a few million doses of the J&J vaccine were ready to be shipped when the Emergency Use Authorization was granted, J&J has committed to providing 100 million doses by the end of June—enough to vaccinate 30 percent of the population—and should meet that commitment even earlier under an agreement that will have Merck help make the J&J vaccine. On March 2, President Joseph R. Biden Jr. announced that the United States should have enough doses by the end of May for every adult in the country.

During the early weeks of the distribution effort, state and local health authorities could not keep pace even with the limited flow of doses from manufacturers; in addition, some states and localities may have continued withholding second doses even after the federal government gave up on that strategy. For whatever reason, fewer doses were being injected into people's arms each day, on average, than were being shipped to the states. As a result, the backlog of doses that had been shipped but not injected increased rapidly. By the second week of January, this backlog had moved above 15 million doses (see figure 1).¹⁰ Since then, as states and localities have increased their capacity to administer the vaccines, and perhaps as they stopped holding back second doses, the backlog has mostly trended sideways. Some of the fluctuations in the size of the backlog during mid- and late February may have been due to the harsh winter weather that disrupted both shipments and injections for several days. During the first week of March, more than 2.1 million doses were administered on average per day—the fastest daily pace yet, but still not as fast as the stepped-up pace of delivery. As a result, the backlog moved above 25 million doses in the first week of March.

¹⁰ The backlog calculated here represents the difference between (a) the number of doses reported as having been delivered by the federal government to state and other similar authorities, and (b) the number of doses reported as having been injected into people's arms. The backlog, calculated in this way, may differ from the number of doses that states have available for future administration due to a couple of considerations: First, to the extent that doses have been lost due to spoilage or other issues, the remaining available number of doses will be smaller than the number reported here. It is clear that some spoilage has occurred; for example, in Memphis, TN, the top [health official resigned](#) following revelations that 2,400 doses had been allowed to expire. Second, there may be discrepancies between the number of doses reported as having been distributed versus administered due to issues related to how many doses were contained in each vial of vaccine. At some point, the realization was made that if especially efficient syringes were used, six doses could be extracted from each vial rather than the originally advertised five. However, efficient syringes were not universally available. It is not apparent from public reporting whether the manufacturers have been claiming six doses per vial, and it is not apparent how many doses per vial have been extracted in practice. These data-related issues could be solved if states tallied directly the number of doses remaining in inventory and available for future administration, but no such data are publicly available.

Figure 1
Backlogged vaccine inventory exceeds 25 million doses

Vaccine doses delivered but not injected, as of March 7, 2021, millions



Note: Dotted lines denote unavailable data. The shaded area marks the approximate period of severe winter weather across a substantial portion of the US. The marked period begins on Friday, February 12, the day when snow fell in Houston, and ends on Saturday, February 20, the day when the high temperature in Houston reached 60 degrees Fahrenheit and the low temperature reached 32 degrees Fahrenheit.

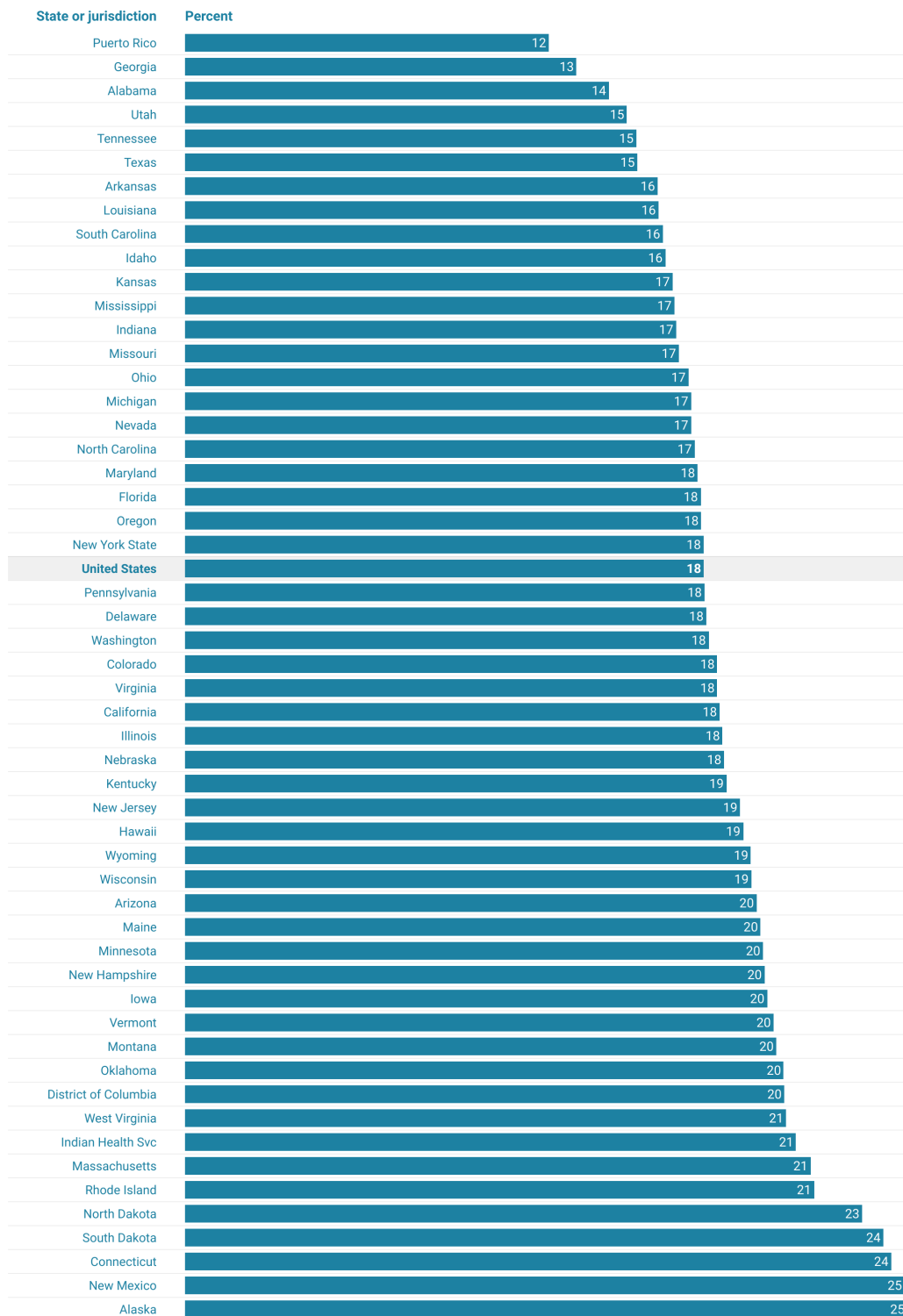
Sources: Centers for Disease Control and Prevention via Our World in Data; Reuters; APM Research Lab; Precision Vaccines.

Performance in administering the vaccine has varied widely across the states. One metric of state-level performance is the share of the state's population that has received at least one dose of vaccine. As can be seen in figure 2, as of March 7, the worst-performing six jurisdictions had all administered a first dose to less than 16 percent of their populations. By contrast, the best-performing five states all had administered a first dose to more than 23 percent of their populations. Across the country as a whole, nearly 18 percent of the population had received at least a first dose.

No compelling explanation has yet emerged for why some states have gotten vaccine into arms so much faster than others. William Galston and Elaine Kamarck [examined](#) a number of possible explanations, including that having a small population might help, or that having more vaccination sites per capita might be a plus, or that higher-income states might do better. None of these potential explanations does a very good job of explaining the differences in performance. States and localities have thus far been left to figure out the retail piece of this operation on their own, and it could be that the best explanation for differences in performance is that competence in state and local administration matters.

Figure 2
Vaccine administration performance has varied widely across states and jurisdictions

Share of population that had received at least one COVID-19 vaccination dose as of March 7, 2021, by state/jurisdiction



Source: Centers for Disease Control and Prevention via Our World in Data. Created with Datawrapper.

REMAINING CHALLENGES

With the supply situation clearly moving in the right direction and the kinks slowly being worked out of the distribution system, one critically important remaining challenge is that the distribution of doses thus far has been deeply inequitable. Although Black and Hispanic persons have died at far *higher* rates relative to white persons, Black and Hispanic persons have been vaccinated at much *lower* rates relative to whites.¹¹ If vaccine doses were administered in proportion to the incidence of hospitalization or death, the pattern of inoculation would be reversed, with whites receiving a much smaller proportion of total doses than either Blacks or Hispanics.¹²

A wide variety of issues could explain the many gross inequities that are evident in data on vaccination rates. Lower-income individuals may not have the same ease of access to the internet (crucial for registering for a vaccination) as higher-income people or may be more concerned about data charges associated with filling out an online form. Immigrants may be concerned about providing personal identifying information if they are in this country in an undocumented status. Pharmacies and hospitals may be scarcer in areas where minority populations are concentrated, and options for transportation to vaccination sites may be limited or inconvenient and may intrinsically involve heightened exposure to other potential carriers of the disease. Anecdotal reports suggest that even when local authorities set up vaccination sites in areas easily accessible to high-vulnerability minority communities, privileged whites in some cases have travelled to those sites, snapped up available slots, and thereby effectively denied doses to some of those for whom they were intended.¹³

11 According to a [CDC analysis](#) of data through January 30, 2021, Black persons had died at 1.9 times the rate of white persons after adjusting for differences in the age structure of the two populations. Similarly, Hispanic persons had died at 2.3 times the rate of white persons on an age-adjusted basis, and American Indians and Alaska Natives had died at 2.4 times the rate of white persons. By contrast, Asian persons had died at the same age-adjusted rate of white persons. For each of Blacks, Hispanics, and American Indians or Alaska Natives, hospitalization multiples were even higher than the death multiples. An [analysis from the Kaiser Family Foundation](#) (accessed on March 7, 2021) found that, in the 36 jurisdictions (35 states plus the District of Columbia) that provide information on the race and ethnicity of people receiving a first dose of the vaccine, 13 percent of white persons (as of March 1, 2021) had received a first dose, compared with 7 percent of Black persons, 5 percent of Hispanic persons, and 11 percent of Asian persons. In other words, white persons had received first doses at nearly twice the rate of Black persons and more than twice the rate of Hispanic persons. In five states (Pennsylvania, North Dakota, Utah, Wisconsin, and Arizona) the vaccination rate for white persons was at least 2½ times the rate for Black persons. Among these 36 jurisdictions, only Alaska reported a higher vaccination rate for Black persons than for white persons. For Hispanic persons, the comparable figures are even worse: Ten states (Georgia, Pennsylvania, Colorado, North Carolina, South Carolina, Indiana, Nebraska, Wisconsin, Arizona, and Oklahoma) reported vaccination rates for white persons that were 3½ times or more the rate for Hispanic persons. No state reported a vaccination rate for Hispanics that was as high as the rate for whites.

12 Inequities in the availability of vaccine clearly continue even now. For example, the [Miami Herald](#) reported on February 25 that in Florida, only 5.6 percent of vaccinations administered had gone to Black people, even though they constitute 17 percent of the state's population. Similarly, the [Washington Post](#) reported on March 4 that in Maryland, Hispanics have received only 3.7 percent of doses administered thus far despite constituting 10 percent of the state's population, and Blacks have received only 16 percent of doses despite representing 31 percent of the population.

13 Again, see the report from the [Miami Herald](#) cited earlier.

One final issue clearly has played a role thus far in impeding the rollout of the vaccine and may come to play a larger role as the supply of doses begins to catch up with demand: Hesitancy. Roughly one-third of members of the military have refused to take the vaccine. In the first month of the rollout of the vaccine at skilled nursing facilities, three-fourths of residents were inoculated but only a little more than one-third of staff chose to take a jab.

A series of surveys conducted by the Kaiser Family Foundation has shown that overall hesitancy has receded somewhat. In February, Kaiser found that 44 percent of adults surveyed either would “wait and see” whether to get a vaccine, would do so “only if required,” or would “definitely not” get a vaccine. This share was down from 63 percent in December and 51 percent in January, but it remained high enough to potentially impede the overall effort to disrupt community transmission of the disease.

Hesitancy may have played a role in generating disparities in vaccination rates across races and ethnicities. In mid-February (the time of the most recent Kaiser survey), the share of respondents saying they would either “wait and see” whether to get a vaccine, would do so “only if required,” or would “definitely not” get the vaccine was 57 percent for Black adults, 48 percent for Hispanic adults, and 37 percent for white adults. Although these percentages have declined since December for all three groups, they remain high and the differences across groups remain wide.¹⁴ Hesitancy is difficult to measure, however, and different surveys have found different levels of it among different groups. A Civiqs survey from March 8 found vaccine hesitancy is higher among white Republicans than any other demographic group with little change over several months.

But there are, unfortunately, compelling reasons for some of that hesitancy among Blacks. Vanessa Northington Gamble argues that too much attention has been paid to the distrust of African Americans for the medical system and not enough to the failure of the medical system to earn their trust. “The relationship of the African American community with the medical and public health communities did not begin or end with the syphilis study. There has been hundreds of years of mistreatment of African Americans within the health care system.”¹⁵

Whatever the underlying reasons, as the overall supply of vaccines continues to increase and the bulk of the willing population is vaccinated in the next few months, hesitancy could become a key stumbling block on the road to inoculating enough people to decisively suppress the community spread of the virus and slow the development of new variants.

LESSONS FOR THE PANDEMIC AGE

Given the probability that pandemics will become chronic in the United States and around the world, decisive steps must be taken to address all four of the issues that have hobbled the rollout of COVID-19 vaccines thus far in the United States.

14 One indication that vaccine receptiveness may continue to improve is that Kaiser survey participants with closer connections to someone who had already been vaccinated were more likely to say they would get vaccinated as soon as possible. See figure 11 in [KFF COVID-19 Vaccine Monitor: February 2021](#).

15 The mention of the syphilis study is a reference to the notorious Tuskegee study in which African American men were told they were being given free health care but were not and in fact were being observed for long-term effects of untreated syphilis.

- To ensure that adequate capacity exists for the manufacture of COVID-19-related vaccines over the longer term, the federal government may need to pay substantial sums of money to motivate manufacturers to mothball (but not to decommission) spare capacity. Maintenance of manufacturing capacity may be less of an issue (or not an issue at all) if COVID-19 remains a present threat, requiring regular revaccination.
- To ensure sufficient capacity for administering massive numbers of injections, the federal government should invest in dramatically expanding domestic public health infrastructure. This effort will need to be undertaken in collaboration with state and local governments.
- To reverse the grotesque inequities in the distribution of this and future vaccines, countless barriers will have to be dismantled. The need here is particularly urgent in light of the life-and-death consequences of the inequitable status quo.
- To overcome hesitancy, broad public trust will need to be restored in science, evidence, experts, governments, and other institutions. Key messages will have to be delivered in ways that are tailored to many different segments of the population. Most fundamentally, the government will need to demonstrate that it deserves the trust of its citizens—even those who, for generations, have been mistreated and had every reason to withdraw that trust.

POSTSCRIPT AS OF MARCH 30, 2021

Since the original publication of this essay on March 9, 2021, some progress has been made against three of the four challenges described above. As of late March 2021, the average daily pace of doses administered has increased from 2.2 million to 2.8 million, and the supply of doses to the states and other jurisdictions has stepped up to 3.4 million per day (Centers for Disease Control and Prevention, via [Our World in Data](#)). Because the supply of doses has continued to outrun utilization, the implied backlog of doses in inventory has moved up into the range between 35 million and 40 million. Experts have voiced optimism about further improvements in supply in the next month or two.¹⁶ Hesitancy, as [measured by the Kaiser Family Foundation](#) (accessed on March 30, 2021), has continued to recede in the overall population: The share of respondents who replied they would either “wait and see” whether to get a vaccine, would do so “only if required,” or would “definitely not” get a vaccine declined from 44 percent in February to 37 percent in March. Encouragingly, the differentials in hesitancy between Blacks, Hispanics, and whites collapsed in March, according to Kaiser, with 41 percent of Blacks putting themselves in the “wait and see,” “only if required,” or “definitely not” category, compared with 36 percent of Hispanics and 36 percent of whites. (These differentials were much higher in February.) However, hesitancy by this measure remains markedly higher among Republicans (54 percent) than in the overall population. Particularly worrisome is that the share of Republicans reporting they will “definitely not” get the vaccine has actually edged up in the past two months.

A challenge where little progress has been made is the distribution of vaccinations by race and ethnicity, which remained grossly inequitable in March. As of March 15, according to [data compiled by the Kaiser Family Foundation](#) and covering 39 states (accessed on March 28, 2021), 19 percent of whites had been vaccinated, compared with 11 percent of Blacks, 9 percent of Hispanics, and 16 percent of Asian Americans. Kaiser noted that the ratios of the vaccination rate for whites relative to the vaccination rates for the other groups had narrowed but cautioned against reading too much into the narrowing.¹⁷

16 For example, “‘We really should expect over the course of the next month or so a very substantial increase in supply’ in the U.S., said Eric Toner, senior scholar with the Johns Hopkins Center for Health Security.” Quoted in the [Wall Street Journal](#), March 22, 2021.

17 Regarding the reasons for caution, Kaiser wrote as follows: “These changes may reflect some improvements in vaccinations reaching Black and Hispanic people. However, in most cases these changes were small. Moreover, they may also reflect changes in the reporting of race/ethnicity data, such as, decreases in the share of people reporting “other” race. Some states have also made adjustments to how they report their race/ethnicity data. Continuing to monitor the data over time will be important for obtaining better insight into whether disparities are persisting and widening or narrowing and how this pattern may vary across states.”

5 The European Union's troubled COVID-19 vaccine rollout

Jacob Funk Kirkegaard

The European Union and its citizens have long benefited from generally well-funded government health systems and an advanced pharmaceutical sector. Why, then, has Europe found it so hard to quickly immunize its population and reduce the level of COVID-19 infections and hospitalizations? This critical failure stems partly from the institutional set-up of the European Union, which hampered efforts to obtain vaccines, and partly from the different healthcare practices among EU member states, which slowed coordination of the best rollout practices.

Faced with the prospect of a prolonged pandemic and the emergence of new viral variants, the European Union has to do better. It should strengthen its proposed Health Emergency Preparedness and Response Authority (HERA) by requiring the mobilization of common fiscal resources for vaccine development and production. The authority needs to be able to take appropriate financial risks in supporting early-stage vaccine development and scaling up production capacity on behalf of the entire EU population. External leadership with in-depth private sector experience in drug development processes should be recruited to oversee any risky deployment of large sums of EU taxpayers' money.

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STRUCTURAL IMPEDIMENTS AND SOLUTIONS TO EU VACCINE PROCUREMENT

The swift global COVID-19 vaccine development in the second half of 2020 and the second wave of infections in Europe and North America have combined to produce a global scramble among governments to secure scarce vaccines. Initial European government contacts with global pharmaceutical companies by an ad hoc [Inclusive Vaccine Alliance](#)—consisting only of Germany, France, Italy, and the Netherlands—ended with the decision in mid-June 2020 to task the European Commission with negotiating vaccine procurement on behalf of all of the EU27 (plus Norway).

This decision preserved the political cohesion of the European Union and provided the smaller and poorer member states with improved access to vaccines in early 2021. Yet the institutional shortcomings of the European Commission posed significant obstacles for EU vaccine purchases. The Commission was at a disadvantage compared with sovereign governments (especially those with their own advanced domestic pharmaceutical sectors like the United States or the United Kingdom) that carry their own direct taxing powers.

Vaccine development is inherently risky, and expedited large human trials are very expensive. Achieving production capacity at an unprecedented scale is costly and time consuming, too. The United States' approach acknowledged this reality. Following months of negotiations led by the US Biomedical Advanced

Research and Development Authority (BARDA), the interagency [Operation Warp Speed](#) was launched on May 15, 2020 with an initial budget of \$10 billion ([increased by October 2020 to as much as \\$18 billion](#)). Over the following months, Operation Warp Speed signed vaccine research and development (R&D) support and production contracts [worth the full budget](#) with seven global pharmaceutical companies.

By contrast, the European Commission, acting on behalf of an adult population roughly 43 percent larger than that of the United States,¹⁸ was a month behind and fell far short of the commitment of the US government. On June 17, 2020, Brussels launched a €2.7 billion vaccine [Emergency Support Instrument](#) (ESI). The ESI provided EU members and Norway the option to purchase an agreed upon amount of vaccines within a given timeframe at an agreed price. In return, it supported part of the upfront costs incurred by vaccine suppliers and operated as a “downpayment” on vaccines ultimately procured by member states themselves. The size of the ESI will ultimately be surpassed by payments from national governments for the vaccines received, but the Commission’s structural lack of financial firepower and inability to promptly take major fiscal risks in the pandemic severely hampered its early actions. The Commission struck initial vaccine supply deals with AstraZeneca on [August 14](#), Sanofi-GSK on [September 18](#), Johnson & Johnson’s (J&J) Janssen Pharmaceutica NV on [October 8](#), BioNTech/Pfizer on [November 11](#), CureVac on [November 17](#), and Moderna on [November 25](#).¹⁹

A degree of bad luck has hit the Commission’s choices. Its first contract with AstraZeneca has been plagued by well publicized [supply-chain problems](#) cutting 2021Q1 and Q2 scheduled deliveries by more than 50 percent. Meanwhile the Sanofi-GSK vaccine has been delayed in development. Instead, vaccines from BioNTech/Pfizer and Moderna, based on the new messenger RNA (mRNA) vaccine technology, were the first ones approved by the European Medicines Agency (EMA), in late December 2020 and early January 2021, respectively. The mRNA vaccines, however, require cooling to ultra-low temperatures and are hence more logistically challenging and expensive for many member states to handle upon receipt. Accordingly, many member states favored the viral vector vaccines from AstraZeneca and J&J/Janssen in their national vaccine rollouts. The reduced deliveries of AstraZeneca vaccines in 2021Q1 and Q2 hit some EU members particularly hard.

Other obstacles have slowed widespread vaccination. Large numbers of people in France, Germany, and other member states were at least initially skeptical about the safety of COVID-19 vaccines. Their concerns caused problems for the Commission in negotiating product liability issues if new vaccines cause unforeseen side effects among some groups. Without its own adequate financial capacity or agreement among the 27 members and Norway to absorb such

18 Roughly 255 million US population 18 years and older versus 365 million in the EU27 plus Norway.

19 Exploratory talks have been concluded with [Novavax on December 17, 2020](#), and [Valneva on January 12, 2021](#).

liabilities (the United States does so via the PREP Act²⁰), the Commission had a hard time persuading pharmaceutical companies to retain this liability. The negotiations caused additional delays in vaccine supply agreements. A further complication was the Commission's willingness to consider pharmaceutical companies' commitment to vaccine delivery at cost and the companies' willingness to participate in the global [COVAX initiative](#), when deciding on their possible indemnity protections. The negotiations led to companies signing advance purchase agreements with the European Union that provided them a degree of indemnity protection by agreeing to help the European Union secure cheap vaccines for the global vaccination drive.

At a time of global vaccine supply constraints, a zero-sum game inevitably emerged among the governments of advanced economies around the world. The European Commission's constraint of the preexisting 2020 budget limits on the ESI²¹ hindered its ability to negotiate adequate and timely vaccine supplies for delivery in early 2021. Political circumstances aggravated this financial incapacity. From May to July, EU member states were preoccupied with trying to agree on an ambitious expansion of the overall EU budget and common pandemic fiscal response. As they struggled, the second pandemic wave crept up on them. It was not (yet) understood that successful vaccine development, however expensive to support, would cost far less than the coming macroeconomic costs from prolonged lockdowns.

The Commission and EU member states have been among the largest global supporters of the COVAX initiative, aimed at supplying cheap effective vaccines for 92 low- and middle-income countries. They have offered a [contribution of €2.2 billion](#), a commendable effort that should be praised along with the European Union's hesitancy to pursue outright export restrictions on vaccines. This stands in contrast to the [de facto ban on exports from the United States](#)²² and the United Kingdom²³ until all Americans have been offered a vaccine.

Yet, the Commission has also made serious mistakes. Targeted by political criticism from member state political leaders, especially Germany (Commission President Ursula von der Leyen is German), the Commission in January 2021

20 The Public Readiness and Emergency Preparedness (PREP) Act enables the secretary of the US Department of Health and Human Services to issue a "PREP Act declaration," providing immunity from liability (except for willful misconduct) to entities and individuals involved in the development, manufacture, testing, distribution, administration, and use of countermeasures to identified diseases. See details [here](#).

21 If ESI funds were found to be inadequate, a minimum of four member states had the opportunity to voluntarily contribute additional funds to it on a "pay-to-play" basis and enable the Commission to enter into additional advance purchase agreements only on their behalf. This option was, however, never utilized despite individual national leaders' subsequent grievances about inadequate Commission purchases. See [Com \(2020\) 4192 final](#).

22 President Trump issued his Executive Order on December 8, 2020, stating, "After ensuring the ability to meet the vaccination needs of the American people, it is in the interest of the United States to facilitate international access to United States Government COVID-19 Vaccines." The Biden administration to date has not changed this policy, though its success in increasing US vaccine supply has brought forward the date at which enough vaccines are available for the entire US population to [May 2021](#). The [Biden administration](#) has similarly stepped up US financial support for COVAX with an immediate \$2 billion contribution in February 2021 and an additional \$2 billion over the next two years.

23 The UK government contract with AstraZeneca, the only major vaccine producer located in the United Kingdom [essentially specifies](#) that the company cannot supply to other clients until it has delivered all the vaccines ordered by London. Consequently, [the United Kingdom has not exported](#) any vaccines to anyone during the pandemic.

needlessly escalated a contractual dispute with AstraZeneca over the company's failure to meet early vaccine supply commitments. Starting in January 2021, the Commission required all the pharmaceutical firms that signed advanced purchase agreements to apply for an export certification ahead of shipping any vaccines outside the European Union. This demand is superfluous and counterproductive. Vaccine export data are available from regular EU customs declaration processes, so rather than providing more "vaccine export transparency," the Commission merely provided member states with the opportunity to block vaccine exports by denying permission. Fortunately, the Commission and EU members have to date been very reluctant to actually use this tool, and so far only one AstraZeneca shipment to Australia has been blocked.²⁴ Instead, the European Union has in fact remained the main global vaccine exporter, shipping more than 34 million doses around the world from February 1 to March 9,²⁵ despite its own acute vaccine shortages. This shows a commendable political respect for pharmaceutical companies' commercial contracts with other (mainly) advanced-economy governments, while highlighting the continued need for global political support for COVAX provision of vaccines to developing countries. By enabling the continued export of vaccines, the European Union will undoubtedly, at the cost of European lives, have helped save others elsewhere, strengthened global vaccine production supply chains, and enabled a more rapid and resilient expansion of future EU vaccine supply.

The Commission's new Health Emergency Preparedness and Response Authority (HERA) initiative is aimed at enabling the European Union to better detect and address new variants of SARS-CoV-2, the virus that causes COVID-19, and future pandemics more broadly. If properly designed, HERA will help avert a repeat of past pandemic coordination failures among member states on vaccine development and pandemic lockdown restrictions.

Nonetheless, the European Union has still not addressed the structural impediment to adequate and timely vaccine procurement, namely the inability to obtain sufficient financial resources without cumbersome approval from 27 member states. To plan for future pandemics, the Commission should have an appropriately sized and preapproved credit line at its immediate disposal, backed by member states. Given the success of the US Operation Warp Speed (approximately \$18 billion), the European Union's larger population suggests EU members should preapprove at least €20 billion in state-backed debt, earmarked for urgent vaccine development and production and under the control of a specially appointed entity within the Commission. This funding should be linked to external objective health metrics, such as a declaration of emergency by the World Health Organization, like the one [on January 30, 2020](#), and perhaps should

24 In early March, the Italian government blocked a shipment of 250,000 doses of the AstraZeneca vaccine [bound for Australia](#). Since Italy at the time had 1 million to 2 million vaccines in storage, the reason was not "lack of vaccines in Italy," but it was done overwhelmingly to cater to the domestic political needs of new prime minister Mario Draghi to satisfy the nationalist elements in his broad coalition government.

25 Data from the [New York Times](#) and [Bloomberg](#) show that during this period the European Union exported 9.1 million doses to the United Kingdom, 3.9 million and 3.1 million, respectively, to US neighbors Canada and Mexico, 2.7 million to Japan, 1.4 million to Saudi Arabia, 1.3 million to Hong Kong, 1 million to Singapore, 1 million to the United States, 1 million to Chile, and 0.8 million to Malaysia.

apply only to diseases that threaten a significant number of EU residents.²⁶ Because of the extraordinary and infrequent nature of such emergencies, the €20 billion EU pandemic fund should be overseen by an externally appointed individual with recent relevant healthcare sector management and/or investment experience.

CHALLENGES AND IMPROVEMENTS TO NATIONAL EU VACCINE ROLLOUTS

The EU Treaty bestows only “supportive competences” to the European Union in healthcare. As a result, national healthcare systems, which remain responsible for implementation of vaccine rollouts, will continue to differ in their responses to the pandemic. Even if there is a fully funded EU-level bio-preparedness entity in charge of development, procurement, and production of vaccines, EU member states will continue to play the largest role in future vaccination drives.

The capacity of governments to enlist pharmacies or other qualified quasi-health care providers to administer vaccines differs across the European Union, hampering efforts in some member states. Even basic “best practices” are spreading too slowly across the European Union; not everyone is delivering the maximum number of vaccine jabs from delivered vials, for example.

Given these ongoing impediments, the possibility of freer movement of already vaccinated Europeans with a European-level “vaccine passport” is reasonable. It’s true that imposing temporary restrictions on people not yet vaccinated, which would generally affect younger Europeans the most, would be costly. But the costs would be outweighed by the economic benefits, especially to many small and medium-sized businesses, of expediting reopenings and allowing certifiably vaccinated customers to return to in-person interactions. In the longer run, it is also likely that a vaccine passport would deny conscious vaccine refusers access to some services, such as public transportation. As a result, this group of Europeans would at least partly bear the costs of their refusal to participate in the public good of getting everyone vaccinated. The Commission’s intention to pursue such a [Digital Green Pass](#) is welcome.

National health authorities are certainly free to administer individual vaccines according to their own preferences and priorities. That’s what initially occurred in some member states that have given the single-dose AstraZeneca vaccine only to individuals under 65. Yet, the public expression of skepticism of the efficacy of this vaccine by senior EU politicians, [including French president Emmanuel Macron](#), represents a major communication mistake that will inflame public vaccine skepticism and is likely to slow the vaccine rollout.

The unfortunate public clash between the Commission and AstraZeneca over the company’s failure to deliver the expected and contractually specified number of vaccines in 2021Q1 and Q2 has had damaging repercussions. At the same time, while BioNTech/Pfizer and Moderna have also suffered short production delays, both firms recently confirmed in [public testimony in the European Parliament](#) that they will deliver the pledged number of vaccines by the end of 2021Q1 and

26 There have been [six public health emergencies](#) of international concern declared between 2007 and 2020: the 2009 H1N1 influenza pandemic, Ebola (West African outbreak 2013-15, outbreak in the Democratic Republic of the Congo 2018-20), poliomyelitis (2014 to present), Zika (2016), and COVID-19 (2020 to present). Of these, only COVID-19 would have unlocked the funds proposed here.

Q2. This relative reliability of supply suggests that it is a mistake for individual member states to be excessively cautious about rolling out these two-jab vaccines. With a possible third wave looming, too few vulnerable Europeans are being quickly immunized due to the decision of some member states to keep the second jab in reserve simply to ensure that it can be administered within the vaccine protocol's specified time limit. Maintaining an excessively large "strategic national vaccine reserve" beyond a few days' requirements will have the same negative effect. As (at least non-AstraZeneca) supply now appears to be reliable, EU member states should consistently administer the vaccine doses they have and rely on future deliveries for the required second jabs.

The COVID-19 crisis in Europe has produced obvious destructive policies, including temporary EU trade restrictions on pandemic-related goods and prolonged lockdowns. But on the positive side, the European Union has rallied to support the largest common fiscal stimulus in its history, and the Commission has taken charge of negotiating vaccine supply for all Europeans. Crucially, the European Union's adoption of a common vaccine procurement approach has averted the worst case of early vaccine supply constraints metastasizing into deeper political splits between richer and poorer or smaller and larger member states.

The uncertain nature of the pandemic underlines the need to strengthen forward-looking and coordinated bio-preparedness in the European Union. The early vaccine supply constraints facing EU member states highlight the importance of taking large early fiscal risks in support of vaccine development and production the next time. Facing a future in which it is likely that the world will experience more frequent pandemics, it is critically important for Europe's economic and political resilience that EU leaders provide European institutions with these stronger financial capacities.

6 Lessons from East Asia and Pacific on taming the pandemic

Martin Chorzempa and Tianlei Huang

The East Asia and Pacific region is one of the few global bright spots in the fight against the COVID-19 pandemic. Its success provides many lessons on containing infectious diseases at a low cost to the economy in an era of chronic pandemics. The experience in East Asia and Pacific varies among countries with diverse cultures, geographies, and political systems, but one thing is clear: rigorous masking requirements, testing, contact tracing, selective quarantines, border closings, and clear public health communication all helped to avoid the overwhelming economic dislocations that occurred in the West. The ability and readiness to deploy these tools, and to secure political support and compliance with public health measures, allowed both democratic and authoritarian countries in East Asia and Pacific to emerge from the pandemic with some of the lowest COVID-19 mortality rates in the world.

COVID-19 mortality rates vary substantially, but one of the most striking contrasts is between East Asia and Pacific and the United States and Europe (see map). Deaths from COVID-19 per million people reported by East Asian jurisdictions are much lower than in most Western countries, even though East Asia and Pacific is one of the most densely populated and globally connected regions on earth. A case in point is China. Despite the initial failure in containing the local outbreak and undergoing a costly lockdown, quick virtual eradication of COVID-19 in China made it the only major economy to grow in 2020— notwithstanding only a modest economic policy stimulus compared with the United States, Europe, and Japan.

East Asia and Pacific's success in keeping COVID-19 caseloads low for an extended period while maintaining or quickly restoring high economic activity levels suggests that the often-suggested dichotomy between pandemic control and maintaining economic health is a false one. Bloomberg News' [COVID Resilience Rankings](#) evaluate success in handling the pandemic while minimizing the impact on business and society. An astounding ten of the top 15 countries and territories are in East Asia and Pacific. Top performers vary enormously in size, wealth, and political institutions, from small, wealthy, democratic islands like Taiwan and New Zealand to large, middle-income countries under one-party rule like mainland China and Vietnam. Core to their exemplary performance was the use of targeted and less costly mitigation measures that do not require an economic freeze. This strategy is worth emulating as the pandemic drags on and novel viral variants emerge.

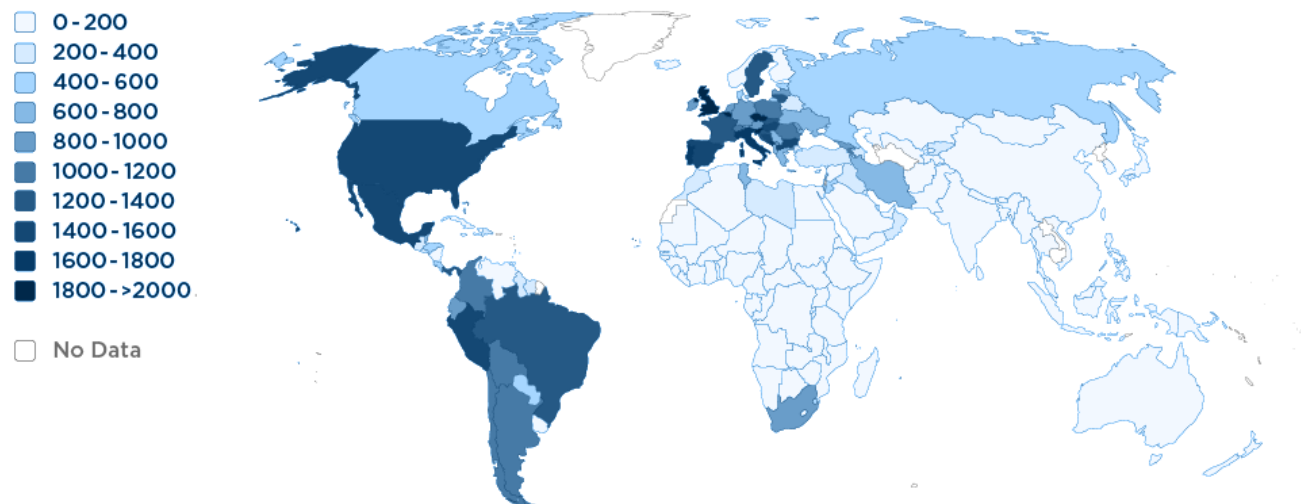
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Map

There is a striking contrast in levels of COVID-19 deaths between East Asia and Pacific and the West

Cumulative confirmed COVID-19 deaths per million population through March 3, 2021



Source: Johns Hopkins University CSSE COVID-19 Data via Our World in Data. See Ensheng Dong, Hongru Du, and Lauren Gardner, "An interactive web-based dashboard to track COVID-19 in real time," *The Lancet Infectious Diseases*, volume 20, issue 5, pp. 533-34.

POLICY RESPONSE OF EAST ASIA AND PACIFIC IS OF GLOBAL RELEVANCE

Our colleague Cullen S. Hendrix has [found](#) that some countries previously rated as prepared for a pandemic failed to live up to their billing: The United States was ranked at the top in preparedness before the pandemic by a Global Health Security Index; by contrast, Vietnam ranked 50th. The study showed that a strong predictor of an effective COVID-19 response was having recently faced an outbreak of similar infectious diseases, such as severe acute respiratory syndrome (SARS) and Middle Eastern respiratory syndrome (MERS), both of which had erupted previously in East Asia. This finding suggests that countries can learn from that experience and that factors like geography and culture, while far from negligible, may be less relevant. Most countries in the West were unready to handle COVID-19 despite earlier warnings from outbreaks of H1N1, Ebola, and Zika. That failure has devastated human lives and economic activity. But if Western countries now take to heart the lessons from COVID-19, as East Asia and Pacific did from SARS and MERS, they may be better prepared for future pandemics.

Most governments in East Asia and Pacific had already established extensive public health infrastructures for dealing with epidemics, drawing on their earlier brushes with those diseases. Learning from these experiences that demonstrated the seriousness of respiratory pandemics to all of society strengthened cultural norms toward adhering to public health measures like

mask wearing, social distancing, and contact tracing. Arguments about deep-seated cultural differences between East and West making East Asia's experience less applicable to the West oversimplify a more complex reality. China's authoritarian government has the tools to coerce private behavior. But a survey by the global communications firm [Edelman](#) in 2020 showed that public trust in government dropped, in light of the Chinese government's initial coverup and failures in containing the outbreak—particularly at the time of the death of whistleblowing doctor Li Wenliang. Yet the populace rallied to contain the virus once the government and society were clear about the threat the virus posed. South Korea, a robust democracy, is near the bottom of trust in government, yet its leaders [managed](#) to rally its populace through clear communication and demonstrated effective action, such as bringing Koreans abroad back home (to quarantine facilities first) and containing the first cluster of cases.

The immediate policy responses to the COVID-19 outbreaks were heterogenous across jurisdictions in East Asia and Pacific. While aggressive lockdowns were adopted in China, Australia, and Vietnam after the initial outbreaks, Taiwan and South Korea avoided the pain of a nationwide lockdown by relying more on preventative measures such as mass masking, social distancing, systematic quarantines, and border management. Despite these differences, the ways in which East Asia and Pacific maintained an extreme low case load over an extended period of time do have much in common—and are therefore of global relevance to combating recurrent pandemics, including those caused by novel variants of SARS-CoV-2.

- *Mass masking.* After previous outbreaks, the social norm of wearing a mask in public places, whether during a pandemic or whenever one feels cold or flu symptoms, became well established in East Asia. In contrast, wearing masks has long been stigmatized in the West. Governments in East Asia and Pacific worked hard to ensure sufficient supplies of masks, taking control of distribution to avoid hoarding. For example, the authorities in Taiwan [developed](#) a phone application to help balance surgical mask supply and demand and started to [provide](#) universal access to surgical masks for all residents as early as February 2020.
- *Widespread testing.* One of the most crucial advantages in the early days of a pandemic is testing capacity, which helps identify both individuals to quarantine and where to focus further testing. The contrast between the United States and South Korea, for example, is instructive. Drawing on memories from the MERS outbreak in 2015, South Korean officials pushed for quick approvals of promising tests from multiple manufacturers even before their effectiveness could be rigorously proven. The US Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) required lengthy processes that limited testing supply, blinding their officials to the pathogen's spread. By March 2020, South Korea had [tested](#) 31 times more people per capita than the United States, allowing it to catch many more cases and nip transmission chains in the bud.
- *Extensive contact tracing.* Most governments in East Asia and Pacific took a rigorous approach to contact tracing early in the outbreak. Intensive manual contact tracing, supported by digital technologies in some jurisdictions, has

been highly effective in identifying and isolating existing and potential cases quickly. Authorities sometimes collect information about infected people's movements through data-surveillance techniques and post it online to inform others of potential virus exposure. To decide if individuals are contagion risks requiring quarantine, the Chinese government [used](#) a color-based "Health Code" system that draws on individuals' travel, contact, and biometric data, obtained via smartphone.

- *Systematic quarantine.* Even beyond those identified as infected, in East Asia close contacts of confirmed and suspected cases identified during tracing are usually required to self-quarantine or sent to designated quarantine facilities. In Taiwan, an electronic fence [system](#) helps enforce the rules by tracking people's locations during mandatory quarantine. This practice is in contrast to most Western countries, where quarantine and self-isolation after possible exposure to the virus and international travel are not enforced. In some [cases](#), knowingly infected individuals have continued socializing, certainly contributing to the continued spread of the disease.
- *Border and movement restrictions.* Most economies in East Asia and Pacific introduced border restrictions for nonresidents early in their outbreaks. They went beyond simple travel bans from certain regions to requiring tests for COVID-19 prior to departure and compulsory quarantine at home or in government-designated facilities for two weeks upon arrival. Vietnam required visitors to quarantine for two weeks in [camps](#) run by the army. In China, even some provinces and cities have border management restrictions in place that require mandatory quarantine or otherwise restrict inbound travelers from other Chinese provinces and cities. Australia also imposed internal mobility restrictions until it could get the pandemic under control.
- *Clear and timely public health communication.* In many parts of East Asia and Pacific, the authorities regularly communicate with residents to provide timely information on COVID-19 while debunking misinformation and disinformation. In Taiwan, the government did this in an [innovative](#) way through "humor over rumor," using more engaging modes of fact checking that are more likely to "go viral" on social media than the usually dry communication strategies most governments follow. Meanwhile, in some Western countries, prominent political figures, including government officials, undermined messaging around masks and disease severity by spreading misinformation.

WEIGHING TRADEOFFS BETWEEN PUBLIC HEALTH AND PERSONAL LIBERTIES

The stringent public health measures adopted in East Asia and Pacific should not be blindly accepted in their entirety, however. Along with many citizens of these countries, we see some of the measures undertaken as excessively intrusive as well as unnecessary. While the tradeoff between controlling pandemics and economic health is illusory, public health measures at times trampled on personal liberties.

In China, for example, zealous local authorities [welded shut](#) some people's doors, an unsafe and draconian way to enforce quarantines. Authorities' measures, especially personal data surveillance for contact tracing purposes, appear excessive to many in the West, though even open, democratic societies like South Korea and Taiwan used them to great benefit. In China, South Korea, and Taiwan, after detecting cases of community transmission, the authorities published detailed movement logs along with an amount of personal information—including gender, age, and sometimes even occupation—that likely is more than necessary for the public to identify their possible exposure and has proven [controversial](#) in South Korea. Moreover, poor cybersecurity in government platforms has allowed [leaks](#) of individuals' sensitive health data in China, leading to harassment.

Fortunately, there may be ways to gain most of the benefits of the approaches in East Asia and Pacific without giving much ground on civil liberties. For example, governments could stand ready to provide voluntary quarantine facilities for individuals who test positive or were exposed to the virus, where their health can be more effectively monitored. This option would especially reduce spread among low-income households in crowded housing, which suffered disproportionately from COVID-19 because they could not safely quarantine at home. Short of posting detailed data online, there may be quicker ways for contact tracers to unearth critical data needed to trace the path of an outbreak than manually compiling contacts through phone calls.

South Korea, for example, created special pandemic [exceptions](#) to its stringent privacy laws after its poor performance with MERS, which allowed authorities to quickly access data like mobile phone location, credit card transactions, use of public transport, and closed circuit television (CCTV) footage on confirmed cases. These data were not only useful to find close contacts and control the outbreak in South Korea. They also made it possible to complete exhaustively detailed studies like [this one](#), which provided evidence with important global implications that COVID-19 could spread indoors with airborne transmission beyond 2 meters. These systems or similar exemptions can be designed now to be ready for future pandemics or new SARS-CoV-2 variants without necessarily enshrining a long-term expansion of government surveillance. Indeed, even some local governments in China have been [forced to abandon](#) plans to make the Health Code system permanent after citizens voiced concerns about privacy in online protests.

Every society needs to weigh tradeoffs between public health and personal liberties according to its values and capabilities. Nevertheless, the lessons from East Asia and Pacific are clear: More targeted data gathering can identify individuals reasonably suspected to be infectious and allow for the enforcement of strict quarantines on those individuals or travelers only. This approach offers a much more promising outcome than the alternative: Letting the epidemic rage out of control and then attempting to lock down entire populations under stay-at-home orders, as occurred in much of Europe and the United States.

Ultimately, the success of East Asia and Pacific in getting the COVID-19 pandemic under control was mainly a result of specific strong government programs, credibly sustained and enforced. These programs were maintained in the face of some popular opposition, both in democratic and authoritarian societies, using strong political will but eventually winning over the public with

results. It must be noted that not everything in these programs, notably some of the largest violations of privacy, was necessary to carry this out successfully. At the same time, governments sticking to a policy program and enforcing it in an emergency until results appear is hardly the sole province of supposedly disciplined or docile societies—as the contentious democracies examined here, as well as Australia, Israel, and New Zealand, demonstrate. This combination of lessons is not an unattainable product of supposedly different cultures. That experience should be emulated to the extent possible and consistent with local values to lessen the devastating damage to health and economic prosperity from the recurrent pandemics the world is all but certain to experience in the years ahead.

7 Persistent COVID-19: Exploring potential economic implications

Olivier Blanchard and Jean Pisani-Ferry

When the COVID-19 crisis spread in early 2020, many economists who stepped forward with projections of its impact assumed that a one-time shock would be followed eventually by a return close to the status quo. Views have differed since then regarding both the time it would take to produce vaccines and the extent of potential economic scarring, but, until the last few months, few outside the public health community seriously contemplated the possibility that the pandemic could persist on a significant scale.

The emergence of new variants of SARS-CoV-2, the virus that causes COVID-19, has made this assumption questionable. While not the most likely outcome, worse scenarios can no longer be excluded. (For various adverse scenarios along these lines, see, for example, figure 3 in [Bosetti et al. 2021](#).) As our colleagues Chad P. Bown, Monica de Bolle, and Maurice Obstfeld explain in [chapter 3](#) in this Briefing, the periodic emergence of new, potentially dangerous variants will remain a serious threat so long as parts of the world lack access to effective vaccines.

If COVID-19 persists and keeps threatening lives, two scenarios then seem possible. The first is recurrent waves of infection, leading governments to oscillate between imposing and lifting sanitary measures in response to the ups and downs of the disease. The second is a “zero COVID” scenario: sharp and sustained containment policies at the start, followed by milder sanitary measures combined with systematic tracing and testing to maintain a very low infection level thereafter. While the evidence suggests that this second scenario would lead to lower long-term human and economic costs, geographic, human, and political realities within and across countries make it less likely to happen, at least in the case of densely populated, open, tightly integrated economies such as those of Europe. For this reason, this essay focuses on the implications of the first scenario.

We see three main economic implications of a scenario of recurrent outbreaks. The first is lasting border restrictions, as countries try to protect themselves from infections elsewhere. The second is the likelihood of repeated confinements. The third is enduring effects on the composition of both supply and demand. We now explore each of these implications in turn.

1. LASTING BORDER CLOSURES

Cross-border air transportation of passengers declined by more than 90 percent in April-May 2020 and was still 64 percent below the normal level in December, according to [the International Civil Aviation Organization \(ICAO\)](#), a specialized UN agency. In January 2021, further border closures were announced, especially in Europe. The [United Kingdom](#), for example, has banned entry from more than

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30 countries and imposes a 10-day self-isolation period on anyone arriving from any country other than Ireland.

Suppose these travel restrictions persist. How costly, in economic terms, are they likely to be?

Some effects (on foreign tourism, airline companies) are obvious and substantial. [International tourism](#), which raked in \$1.7 trillion in 2019, or 1.9 percent of world GDP, [dropped](#) by 74 percent in 2020. This does not translate one for one into a loss of economic activity, as nationals, now forced to stay at home, may offset some of the hit, but only in part (French nationals may not want to visit the Eiffel Tower again). Consequences are likely to be very bad in places like the Maldives or the Bahamas, where the tourism sector accounts for more than 50 percent of GDP, and severe in countries such as Greece, Italy, or Spain where it accounts for more than 10 percent of GDP and employment (and where foreign tourism [declined](#) by 70 to 80 percent in 2020). But, even for a highly diversified country like France, foreign tourism accounts, directly and indirectly, for about 3 percent of GDP.²⁷

Restrictions on seasonal migrants, especially in agriculture, can also have a substantial effect. Travel restrictions will both disrupt crop harvesting (in host countries) and affect remittances (to home countries).

Some effects are more difficult to assess but may be deeper. One major issue is how travel restrictions would affect the organization of global value chains, trade in goods, non-tourism services, and productivity.

By itself, the transportation of containers implies minimal in-person contacts. Once procurement or export contracts have been signed, the impact of air travel restrictions on people is minimal. But the mobility of persons does matter for the establishment of a value chain. More precisely, multinational production networks are subject to three types of frictions ([Head and Mayer 2019](#)): trade costs, marketing costs, and production coordination costs. Restrictions on travel do not affect the first one, but they do affect the other two. [Delpeuch et al. \(2020\)](#) develop and apply a model along these lines to the car industry and find that a 20 percent increase in all cross-border costs would typically reduce consumer real income by about 4 percent.

Some evidence on the economic impact of decreased passenger travel can also be gathered from various natural experiments. [Bernard, Moxnes, and Saito \(2019\)](#) have shown that the opening in 2004 of a passengers-only high-speed train line to southern Japan broadened the available set of suppliers and sourcing locations, producing significant effects on firm-level performance. This suggests that face-to-face interaction between individuals matters for productivity.

[Umana-Dajud \(2019\)](#) uses another natural experiment: the introduction by the Schengen area of visa requirements for citizens of Ecuador (in 2003) and Bolivia (in 2007). He finds in both cases a significantly large negative effect on trade with Spain (the country most affected by the change in visa status), especially in differentiated products.²⁸ These findings are echoed by [Coscia, Neffke, and Hausmann \(2020\)](#), who look at the impact of business travel on the

27 In France, tourism accounts directly for 7 percent of GDP and indirectly for about 10 percent of GDP. Foreign tourism accounts for 30 percent of total tourism.

28 We are grateful to Thomas Chaney and Thierry Mayer for directing us to these papers.

dissemination of what they call tacit knowledge (the kind of knowledge that is difficult to transfer to another person by writing it down or verbalizing it). They suggest that, through this channel, lasting impediments to cross-border mobility would have detrimental effects on growth. Countries that depend more on foreign trade would be affected more, especially those exporting services.

Constraints on studying abroad—the suspension of the Erasmus program in Europe, for example, or the decrease in foreign students and faculty in US colleges and universities—would gradually reduce cross-border cooperation in research. Universities and colleges that cater largely to foreign students might not survive. More fuzzily, but importantly, students would lose precious knowledge of other cultures.²⁹

Can one put a number on these costs? Not easily. Restrictions lasting a year or two might not have much effect. Longer-lasting impediments could, however, have a substantial effect on global value chains, trade, and overall efficiency.

2. RECURRING CONFINEMENTS

Under a scenario of recurrent outbreaks, governments are likely to implement stop-and-go measures, with confinements of varying intensity followed by relaxation. How costly, in terms of economic activity, might these measures be?

Several factors should make future confinements less costly than the initial set of confinements in the spring of 2020. There has been learning: Shortages of masks and protective equipment have largely disappeared, production sites have been restructured to contain contamination, working from home is better organized, and click-and-collect retail sales have developed. Governments have a better, although still surprisingly limited, sense of the specific channels of transmission among different groups and can do more surgical interventions and closures.

At the same time, however, there have been clear signs of confinement fatigue, leading people to be less respectful of rules and less careful about their behavior.

To get a sense of whether there was progress, we focused on seven European countries that had two clear confinements in 2020, one in the spring and the other in the fall. The countries are Austria, Denmark, France, Germany, Italy, Portugal, and Spain.

For each of the two confinements, we looked at the period starting with the highest value of the COVID-19 effective reproduction rate, R , and ending with its lowest value.³⁰ This period typically coincided closely (differing by a couple of weeks at most) with the official confinement period and with a sharp increase in the [Blavatnik stringency index](#), an index aimed at measuring the intensity of

29 For an estimate of some of the costs of a related measure, see Sherman Robinson, Marcus Noland, Egor Gornostay, and Soyoung Han, 2020, *The Short- and Long-Term Costs to the United States of the Trump Administration's Attempt to Deport Foreign Students*, PIIE Working Paper 20-11.

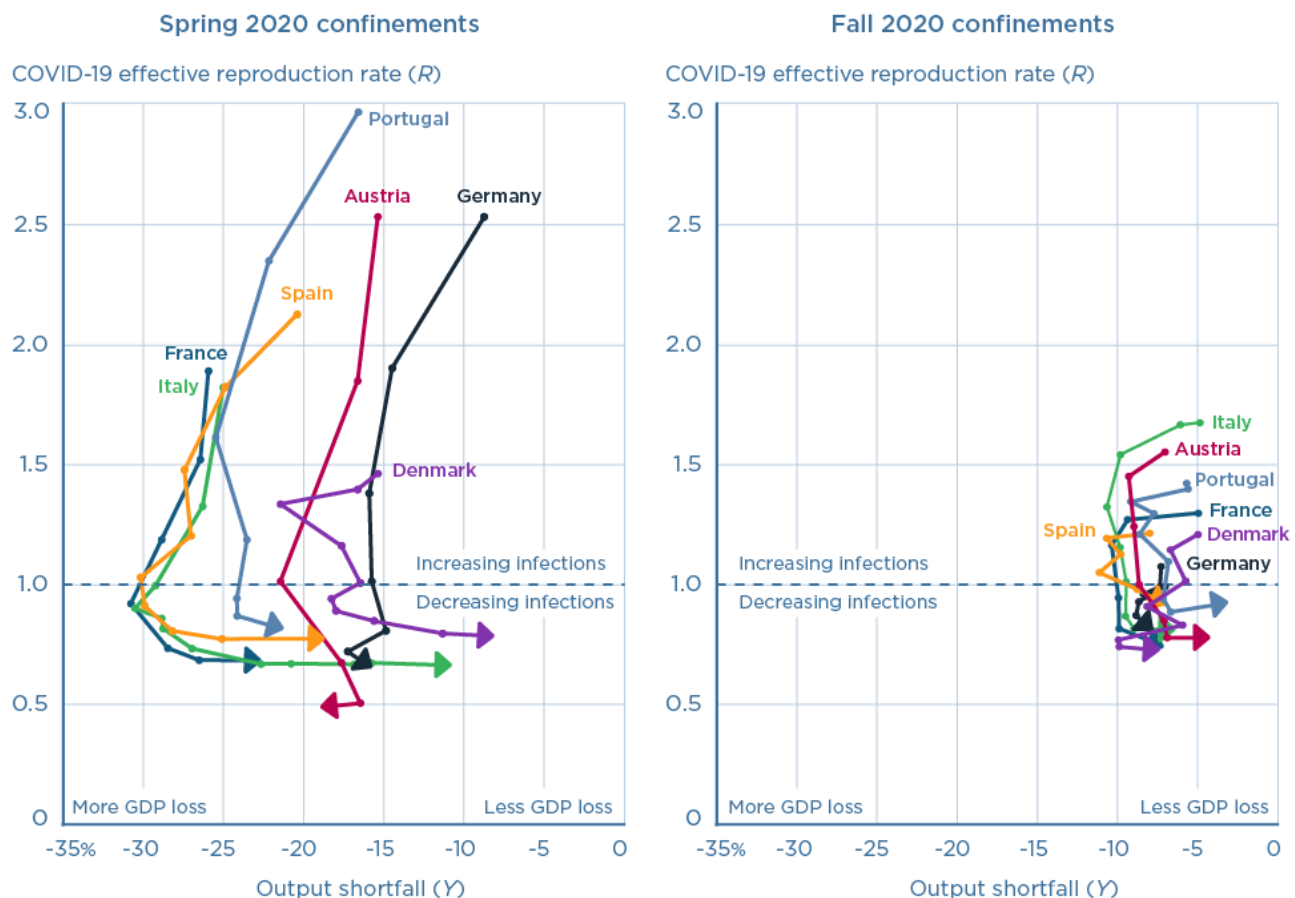
30 Explanation of the time course of an epidemic can be partly achieved by estimating the effective reproduction number, $R(t)$, defined as the actual average number of secondary cases per primary case at calendar time t (for $t > 0$). $R(t)$ shows time-dependent variation due to the decline in susceptible individuals (intrinsic factors) and the implementation of control measures (extrinsic factors). If $R(t) < 1$, it suggests that the epidemic is in decline and may be regarded as being *under control* at time t (vice versa if $R(t) > 1$).

confinement measures. The period lasted between six and nine weeks across episodes and countries.

Figure

Second wave confinements caused much less economic damage than the first and brought transmission down to similar levels

Weekly COVID-19 effective reproduction rate (R) vs. economic output shortfall (Y)



Note: Confinements refer to the period starting with the highest weekly value of the effective reproduction rate, R , and ending with its lowest weekly value. Economic output shortfall refers to year-on-year variation in weekly GDP.

Source: Authors' calculations based on data from Arroyo-Marioli et al., *Tracking R of COVID-19: A new real-time estimation using the Kalman filter*, PLoS ONE 16, no. 1 (2021), www.globalrt.live; and the Weekly Tracker of economic activity from the Organization for Economic Cooperation and Development.

As a measure of the effect on infection, we looked at the change in R , as constructed by [Arroyo-Marioli et al. \(2021\)](#).³¹ As is well known, a value of R above 1 means an increase in infections, and a value below 1 means a decrease in infections. Not surprisingly, all episodes started with a value of R above 1 and ended with a value below 1.³²

As a measure of the effect on the economy's output, Y , we used the [Weekly Tracker of economic activity](#) constructed by the Organization for Economic Cooperation and Development (OECD).³³ Given the definition of the tracker, a value of 0 in the graph means that the estimate of GDP in a given week is equal to its value for the corresponding week a year earlier (thus eliminating issues of seasonality). A negative value means that the estimate of GDP is lower than the value for the corresponding week a year earlier.

The evolution of R and Y for each of the seven European countries and each of the two confinement episodes is shown in the two panels of the figure. The left panel shows the outcome in the first confinement episode (spring 2020), the right panel the outcome in the second confinement episode (fall 2020). In each case, the movement is counterclockwise, starting from the top. Summary statistics are given in the table.

Table

Minimum effective reproduction rate (R) and average GDP shortfall (Spring and Fall 2020 confinements) in the seven European countries covered in this analysis

Confinement episode	Austria	Denmark	France	Germany	Italy	Portugal	Spain
Minimum R , 1st episode (Spring 2020)	0.49	0.79	0.68	0.68	0.66	0.82	0.77
Minimum R , 2nd episode (Fall 2020)	0.78	0.73	0.76	0.84	0.81	0.91	0.94
Average GDP shortfall, 1st episode (Spring 2020), percent	-17.7	-16.0	-27.2	-14.8	-23.6	-22.6	-25.9
Average GDP shortfall, 2nd episode (Fall 2020), percent	-7.6	-7.5	-8.7	-8.0	-8.5	-6.8	-9.4

Note: A value of R below 1 means infections are decreasing. Minimum R shown in the table is the end value reached in each country at the end of the episode. Average GDP shortfall is average decline in weekly GDP compared with corresponding period a year earlier.

Source: Authors' calculations based on data from [Arroyo-Marioli et al. \(2021\)](#) and the [Weekly Tracker of economic activity](#) from the Organization for Economic Cooperation and Development.

31 Alternatively, we have used changes in hospitalizations as a lagged indicator of R . Results are qualitatively similar.

32 We converted the R data into a weekly series, so that the frequency matches that of the data from OECD's Weekly GDP Tracker.

33 The GDP tracker gives the estimated value of weekly output relative to the same value a year earlier, implicitly taking the earlier value as the normal level of output. It can be thought of as eliminating issues of seasonality.

The figure and the table suggest the following conclusions:

- The movements in R and Y were substantially larger in the first than in the second confinement. R started higher, and the output cost throughout the decline in R was much larger. The end value of R was also a bit higher in the second than in the first confinement, suggesting that governments were under pressure to lift restrictions on social life before their public health objectives were fully achieved.
- The first confinement was characterized by a large heterogeneity of outcomes across countries. Germany ended with the same low value of R as France but at roughly half of the output cost. The second confinement, in contrast, was much more homogenous, with most countries ending with roughly similar values of R at roughly the same output cost.
- More important for our purposes, the output cost associated with reaching the same value for R was substantially smaller during the second confinement, between 1/2 and 1/3 of the cost during the first confinement. Looking at it another way—by comparing the corresponding trajectories of R from, for example, 1.5 to 0.7 in both panels—the output cost per week was far smaller in the second confinement, roughly 7 to 10 percent of weekly GDP.

This is clearly only a rough first pass at the data. The evidence, however, is clear that these countries were able to contain contagion at a lower output cost during the second confinement. As more is learned and policies can be better targeted, an even better tradeoff may be achieved if new confinements are needed. But for now, the economic cost of the second rather than the first confinement should be taken as a starting point.

3. CHANGES IN BOTH DEMAND AND SUPPLY

Under a scenario of recurrent outbreaks, people are likely to change behavior even outside of formal confinement episodes. The notion of a post-COVID-19 world where we can ignore the virus and go back to the way life was will no longer be a given. The perceived risk of infection, even if one has been vaccinated, infected in the past, or both, will remain. People will continue to be reluctant to go to restaurants, theaters, stadiums, and other public places regardless of formal confinement policies—as they were in spring 2020 when some US states decided to reopen nonessential businesses amid the pandemic wave.³⁴ These contact-intensive sectors will suffer all year long, whether or not they are subject to legal restrictions.

In France, for example, highly affected companies (i.e., companies whose turnover was at least 50 percent below normal) accounted for 7.5 percent of private employment at the end of 2020, according to the [ACEMO survey](#). They were heavily concentrated in a few sectors. In a persistent COVID-19 scenario, temporary support schemes may fail to provide a solution and many of these companies may end up closing, with severe consequences for employment. If so, significant labor reallocation and reskilling will have to take place.

³⁴ [Chetty et al. \(2020\)](#) provide compelling evidence that state-ordered reopenings had modest effects on consumer spending and economic activity.

Even if most companies adapt and survive, lasting restrictions on economic activity will result in significant damage. Evidence so far is that liquidity support has been effective and corporate bankruptcies, at least so far, have diminished. But as corporate debt increases, insolvency cases are bound to multiply. Part of the cost will be passed on to public finances, through writeoffs, at a substantial budgetary cost.

Saving and investment may also be substantially affected. A common hypothesis has been that there might be an exuberant post-COVID-19 phase, with pent-up demand, reflecting the large accumulated excess savings together with the desire to make up for the tough pandemic episode. Buoyant growth would follow. This is less likely to occur if there is no clear post-COVID-19 phase. People may continue to save, as a precaution against an uncertain future. Many firms have been hit severely. With profits down and uncertainty still pervasive, they may be reluctant to invest and may keep hoarding liquidity in case times become tough again. This will be detrimental to both potential output and aggregate demand. The government may not only have to protect people and firms but also sustain demand to maintain the economy at (diminished) potential. This again may come at a substantial budgetary cost.

An old theme in macroeconomics is hysteresis: long-lasting effects of temporary shocks. The evidence from past recessions remains mixed ([Blanchard 2018](#)), but under a scenario in which COVID-19 remains prevalent for a few more years, lasting scarring effects become increasingly likely. Long-term unemployment ends up having psychological effects, even if the unemployed are financially compensated. The starkly unequal effects of confinement on the quality of education, be it for students in school or in college, have already been documented and they are sobering. For example, [Chetty et al. \(2020\)](#) found that six weeks after the spring 2020 US school closures, the number of completed lessons on an online math platform had dropped by more than 40 percent in schools with low-income students against less than 10 percent in schools with high-income students. These numbers are likely to be even worse if in-person teaching remains limited for an extended period.

CONCLUSION

It is too early to know the exact contours of the next COVID-19 phase, and how long it will last. Hopefully vaccines will get us back quickly to the life we knew before COVID-19. But if they do not, the initial policy strategy will need to be revisited and probably modified.

8 COVID-19 widens the gender gap in labor force participation

Simeon Djankov, Pinelopi Koujianou Goldberg, Marie Hyland, and Eva (Yiwen) Zhang

In the United States, women have made halting but mostly steady progress in the labor market over the last three decades, increasing their participation in the workforce from 55.7 percent in 1987 to 60.3 percent in April 2020. But the sudden impact of the COVID-19 pandemic dealt a serious setback to those gains, driving 2.5 million women from their jobs in what Vice President Kamala Harris called a “national emergency” for women. By January 2021, the US female labor force participation rate had fallen below 56 percent. The last time when the rate was that low was in April 1987, nearly 35 years ago.

Of course, many men also lost their jobs because of the pandemic. But the pandemic’s economic effects hit women even harder. The trend of women losing jobs at a higher rate than men contrasts with the previous four US recessions, in which the gender gap shrank by 1.4 percentage points on average as the economic downturns primarily reduced the employment opportunities of men (see figure).

Why did the pandemic hit women harder than men? A variety of factors have been at work. The pandemic caused layoffs in service sectors of the economy, such as restaurants, food production, and retail, in which women are more heavily employed. In addition, the shutdown of schools and day care facilities in the United States meant that women, more than men, sacrificed their jobs in order to stay at home to take care of children. Women also were more likely to hold part-time or contract jobs that lack benefits, reducing their incentive to stay employed in the face of other demands on their attention.

Unfortunately, the widening of the gender gap may prove long-lasting. Nearly a year into the pandemic, the ongoing gap between the participation of men and women in the US labor market—that is, the difference between the share of women employed or actively looking for work relative to the share of men—has recovered only slightly. For women, the gap went from 11.4 percentage points in February 2020 to 12 percentage points in September 2020 before narrowing slightly to 11.8 percentage points in January 2021. This represented a loss in more than a million jobs.

Previous research suggests that it takes significant time to reintegrate women into the labor force once they are out of work—all the more reason why governments should pursue policies that ensure job retention during the crisis. One problem that should not be overlooked is that many women with young children come from working class families where wages have not kept up with living costs and they are forced to take part-time or even full-time jobs to help their families make ends meet.

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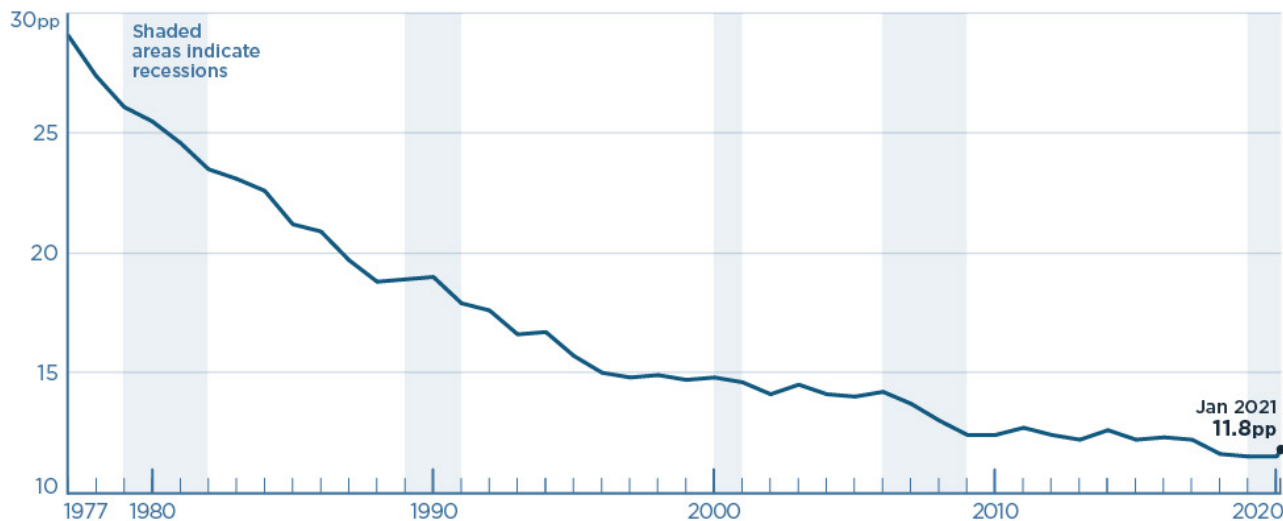
Eva (Yiwen) Zhang is the research statistician and quality control coordinator at the Peterson Institute for International Economics ensuring that data and models flowing through the Institute meet rigorous standards of replicability.

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Figure

The gender gap in labor force participation narrowed during previous recessions but expanded during the pandemic

Percentage point gender gap in US labor force participation, Dec 1977–Jan 2021



pp = percentage points

Note: Gender gap is calculated as the difference between women's and men's labor force participation rate. Data are based on the gap in December of each year, except for January 2021 and refer to civilian labor force participation for ages 16 and over.

Sources: US Bureau of Labor Statistics; authors' calculation based on BLS data.

What can be done to overcome these disadvantages and help women increase their participation in the paid work force? The pandemic has vividly demonstrated the need in the United States for more help for childcare, more protections for temporary and fixed-term contracts, and more benefits that provide incentives to stay at work. A number of specific policy measures seem particularly called for to help mitigate the gender gap. One step might be to ensure that more jobs held by women come with retirement and health benefits, and with protections against dismissals. Another step would be to increase paid parental leave so that in times of economic hardship fathers, too, can take care of children over extended periods. Providing start-up capital for women who wish to establish their own businesses would also make a significant difference.

EMERGING EVIDENCE ON THE PANDEMIC'S IMPACT

Evidence is emerging on why the pandemic has affected the gender gap in labor force participation in advanced economies. Using US employment data, [researchers](#) have identified two main channels through which COVID-19 has expanded the gender gap in employment. The first is the occupation channel.

Unlike in past recessions that concentrated joblessness in sectors largely employing men, the COVID-19 plague has inflicted disproportionate damage on sectors that employ women intensively, such as retail stores, restaurants, and the hotel and hospitality business. The second channel of reduced labor supply by women is the childcare channel, whereby the extra caregiving responsibilities brought about by school and childcare closures fell disproportionately on working mothers' shoulders.

The United States is not alone in this trend. Several other advanced economies have experienced declines in labor force participation by women during the COVID-19 era, including Canada, Italy, and Japan. These declines were greater than in male participation. The gender gap in December 2020 was around 0.6 percentage point higher in this quartet of advanced economies than it was in January 2020.

For example, under Prime Minister Abe Shinzo's third arrow of economic policies the government in Japan had been making progress since 2012 in reversing the historically high barriers women have faced in the workplace. Government policies to encourage women's labor supply, such as expanded support for daycare, converged with structural factors, including declining marriage and birth rates due in part to the high costs of raising a family, to push Japan's female labor force participation rate ahead of the United States' in 2015. But COVID-19 inflicted a major setback to this progression in early 2020. Despite government-supported paid leaves to parents during school closures, one million women left the labor market earlier this year while labor force participation by men barely budged.

What is striking, however, is that female labor force participation has been more resilient in other advanced economies—the United Kingdom among the Group of Seven (G7), and Australia, Denmark, and the Netherlands.³⁵ The gender gap has closed by 0.9 percentage point in this group of advanced economies. The better performance in these countries may not be an accident. Each of these economies has either implemented programs to help those sectors with high female employment or supported childcare services during the crisis.

In the United Kingdom, labor force participation for men declined more than for women during COVID-19, thus narrowing the gender gap. This decline owed primarily to the collapse of operations in tradable sectors like manufacturing—where more men work. At the same time, the UK government enacted several measures that shielded sectors employing women intensively. The government offered a temporary reduction of the value-added tax (VAT) rate for crisis-affected businesses, such as those in the tourism and hospitality sectors, where women are disproportionately represented. Businesses in the retail, hospitality, and leisure sectors are entitled to a one-off cash grant of up to £25,000 from their local government council. A local property tax exemption in the United Kingdom for eligible childcare centers from 2020 to 2021 helped primary childcare givers withstand the initial shock. Lastly, parents whose work hours have been reduced during the pandemic were eligible to offset childcare costs through tax credits. As women primarily hold part-time jobs, this childcare support benefited them relatively more.

35 France and Germany do not report labor force participation statistics on a quarterly basis.

Our research shows that the policy lever that seems to have the most explanatory power in predicting the resilience in women's labor force participation across advanced economies is equality of social security benefits and hiring and firing rules for workers on temporary or fixed-term contracts. Strengthening these benefits and regulation is therefore an important way to support women's engagement in the labor market in future crises. This policy is also consistent with providing gig workers—an increasing presence in the labor market—with better social security packages paid by the companies that employ them.

RESEARCH ON THE CHANGING GENDER GAP IN ADVANCED ECONOMIES

Preliminary analysis of the effect of the COVID-19 pandemic on the employment of women in advanced economies has begun to emerge. [In Spain](#), women were more likely than men to lose their jobs; they also document a large increase in childcare and housework responsibilities: children were at home, forcing their mothers to be at home too. [For the United Kingdom](#), studies examined the increase in home childcare caused by the pandemic and noted that women were doing a greater share of this home-based childcare. A similar finding is presented by [researchers in Australia](#), who study the impacts of COVID-19 on time spent on paid and unpaid labor in Australia. The increased time spent on unpaid work was greater for mothers.

In a cross-country analysis of the labor market effect of COVID-19, [researchers](#) use real-time survey data to show that the immediate impacts vary across countries. They find that employees were most insulated from the crisis in Germany, which already had a short-time work scheme in place, allowing firms to reduce employees' hours rather than laying them off. Germany also has a tradition of prioritizing the reduction of hours over laying off people in recessions. The authors also find that women and less educated workers were the ones more likely to lose jobs. The gendered impacts, beyond those related directly to the labor market, have also been examined. [Research from Japan](#) documents that school closures were associated with a negative impact on the mental health of mothers of school-age children, but not that of fathers.

[Our research](#) presents preliminary evidence on the relationship between the evolving gender gap during the COVID-19 era and countries' characteristics and policies. We compare economies where the gender gap in labor force participation expanded during the COVID-19 pandemic against those with a shrinking gender gap.

Women's representation among part-time workers, along with the extent of social security benefits in place for such workers, seems to account for the primary differences between countries where the gender gap widened and where it shrank. [Early evidence from Japan](#), for example, shows that female workers fare worse than men largely because the share of part-time, temporary, and contract workers is larger for women. These part-time and lower-paying jobs were more likely to be eliminated during the downturn.

By contrast, the availability of childcare appears to be a lesser factor. Women disproportionately work in lower-paying jobs that offer more family amenities, such as jobs in the public sector and in more "family-friendly" firms. We look at the relationship between the evolving gender gap during the COVID-19 pandemic

and government expenditure on childcare, measured as a percent of gross domestic product. There is no statistically significant effect. Women seem to lose their jobs during COVID-19 for reasons other than the lack of childcare.

POLICIES MITIGATING THE GENDER GAP DURING COVID-19

The main policy lever in affecting the resilience in women's labor force participation is equality of social security benefits and hiring and firing rules for workers on temporary or fixed-term contracts. Strengthening these benefits is therefore one way to support women's engagement in the labor market in future crises. The policy lever relates to the occupation channel, as the COVID-19 plague has inflicted disproportionate damage on sectors that employ women part-time.

Policies that relate to the second channel of reduced labor supply by women due to the extra caregiving responsibilities brought about by school and childcare closures—such as increased government expenditure on childcare support—do not show a statistically significant effect on mitigating the gender gap. But they are still worthwhile to pursue because they have a beneficial long-term effect on labor force participation by women in advanced economies.

9 Developing countries need greater financing and debt relief for COVID-19 and future pandemics

Adnan Mazarei

Many advanced economies are now racing to vaccinate a sizeable share of their populations against the COVID-19 pandemic. The progress in low- and middle-income countries, however, has been frustratingly slow because of a shortage of vaccines and the infrastructure for administering them. Unless these challenges are overcome quickly, not only will people living in less affluent countries suffer but so will those in rich nations. Epidemics anywhere pose a threat to people everywhere.

Low- and middle-income countries need more financing to fight against the pandemic itself and its economic effects. Yes, some direct help is being provided to low-income countries through COVAX, an initiative set up by the Coalition for Epidemic Preparedness Innovations (CEPI), Gavi (the Vaccine Alliance), and the World Health Organization (WHO) to get vaccines to countries in need. But this initiative is short of funds and will also need more resources to cope with future pandemics.³⁶

The Group of Twenty (G20), the International Monetary Fund (IMF), and multilateral development banks have taken additional steps to help, providing financing and temporary debt relief.³⁷ There is also good news from the global financial markets: The sudden stop in capital flows to the developing countries that occurred in March and April of 2020 has been reversed, with considerable capital flowing to many of those countries in late 2020 and early 2021. The feared wave of sovereign defaults has not materialized—at least not yet.

The international community's emergency financing and other actions taken so far, coupled with the reversal of capital outflows, have helped mitigate many countries' liquidity problems. But because of the uncertain duration of the pandemic, liquidity problems are likely to continue and possibly worsen for some countries. A number of countries could face sovereign insolvency, requiring debt restructurings. Many developing countries still require greater support to acquire

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36 COVAX has thus far raised **\$6.3 billion** out of its target of \$7 billion needed to vaccinate 20 percent of the populations of the funded countries by 2021. The World Health Organization's broader [Access to COVID-19 Tools \(ACT\) Accelerator program](#) has secured \$11 billion out of a targeted \$38 billion.

37 For example, the World Bank has approved an envelope of **\$12 billion** to finance developing countries' acquisition and deployment of COVID-19 vaccines. That said, the Bank's response to the COVID-19 crisis is lagging considerably behind its own target ([Duggan, Morris, Sandefur, and Young 2021](#)).

and distribute vaccines and to address the economic fallout of the pandemic. With new viral variants emerging around the globe, these needs could well expand, exacerbating their financial problems.

To guard against worst-case scenarios, the international community should not only take several steps to address immediate pressures but also prepare today for future pandemics. What is needed are new facilities and processes that could be invoked quickly, thus avoiding ad hoc responses and costly delays between the emergence of a crisis and the introduction of new remedies. Minimizing the human and economic costs of future pandemics is a critical collective good, and the international financial architecture needs to be much better prepared for it.

This essay presents four ideas for improving the global financial safety net to tackle immediate pressures from COVID-19 and prepare us to rapidly confront future pandemics.

1. USING THE NEW ISSUANCE OF SPECIAL DRAWING RIGHTS BY THE IMF FOR PANDEMICS

Special drawing rights (SDRs) are an international reserve asset created by the IMF, derived from a weighted average of various convertible currencies. Agreement has now been reached on issuing **\$650 billion** in new SDRs.³⁸ This would be a potent tool for immediately augmenting the international reserves of the 190 member countries of the IMF, with significant benefits for poorer countries (Collins and Truman 2020). This lifeline would help countries to improve their liquidity without raising their debt levels.

But the traditional approach to issuing SDRs to member countries in proportion to their shares (quotas) in the IMF has two problems. First, this arrangement implies that close to 60 percent of the new SDRs would be allocated to high-income countries, requiring a mechanism to enable them to transfer their new SDRs to an IMF trust fund for the benefit of lower-income countries. As a technical matter, a mechanism would not be too difficult to put in place, but some member countries would likely resist such a step. Second, left to themselves, individual countries are likely to spend less on vaccination and health than is socially optimal for the whole world.

A better alternative would be for high-income IMF shareholders to donate part of their new SDRs to COVAX to support its vaccine distribution efforts. Working through COVAX would be more effective in ensuring that resources are devoted to fighting the pandemic than a direct allocation of SDRs to low-income countries (or debt relief). Given the global nature of the pandemic, following such an approach would serve the interests of affluent as well as developing nations.

2. FIXING THE MECHANISMS FOR DEBT RELIEF

The efforts of many low- and middle-income countries to mitigate the impact of the pandemic are limited by their existing obligations to official and private creditors. Recognizing this problem, the G20 established the Debt Service Suspension Initiative (DSSI), which provides 73 eligible low-income countries

38 Earlier, consideration was given to an issuance of \$500 billion in SDRs.

with the option to request a temporary standstill on their sovereign debt service payments until June 2021. Thus far, 60 percent of the eligible countries have sought debt service relief under the initiative.

But the DSSI has several shortcomings: (1) It covers only low-income countries, leaving out middle-income ones; (2) it is temporary, while low-income countries' financing needs to fight the pandemic will certainly go beyond June 2021; (3) it requires that there be no change in the net present value of countries' debt, thereby providing only liquidity support to countries rather than relief on the existing stock of debt, which some countries may need; (4) it has no mechanism to ensure that private creditors, who had signed on to participate in the initiative on a voluntary basis, follow through; and (5) it does not clarify some aspects of participation by China—a major creditor to many developing countries—especially with regard to its private and hybrid (semiofficial) creditors.³⁹ To date, the total postponed debt service under the DSSI is estimated at only \$5.7 billion—leaving much room for further supportive measures.

Some of the shortcomings of the DSSI are now being addressed by the G20 Common Framework for Debt Treatments beyond the DSSI, announced in [November 2020](#). This is a positive development. The Common Framework: (1) recognizes the possible need for restructuring of public and publicly guaranteed debt;⁴⁰ (2) includes all G20 official bilateral creditors, even those that are not members of the Paris Club such as China; and (3) requires any participating debtor country to seek from all other non-G20 official bilateral and private creditors a treatment at least as favorable as the one agreed to with the creditors participating in the G20 restructuring agreement. The Paris Club, the group of officials from major creditor countries involved in debt resolution agreements, will serve as the secretariat for this G20 initiative. While the Common Framework does not explicitly prescribe how to address a country's debt to multilateral development banks, it calls for options to meet the financing needs of the developing countries.⁴¹

The Common Framework is a potential game changer, but implementation will not be easy. Much will depend on whether the IMF plays its usual central role in sovereign debt restructurings. And much depends on whether the debtors are willing to declare the entire amounts and terms of their debts, especially to Chinese creditors. In this regard, the IMF's policies aimed at discouraging misreporting could help ensure all such information is provided by the borrowing country to the IMF. The proper transfer of information should enable the Fund to conduct its debt sustainability analysis and determine the amount a country is able to pay in debt service.

To ensure participation by non-G20 official bilateral and private creditors, including Chinese private and hybrid creditors, the framework relies on the Paris Club approach on comparability of treatment. Unlike the DSSI, participation by

39 This point draws on a forthcoming PIIE Policy Brief with Martin Chorzempa, "Steps to Facilitate the Restructuring the Debt of Developing Countries to China."

40 The amount of debt restructuring needed will be based on an IMF–World Bank debt sustainability analyses.

41 This would likely be done through a multilateral development bank maintaining its net exposure to countries by providing financing so that they could cover at least their debt service to that bank.

private creditors would be mandatory. The IMF's lending into private and official arrears policies are needed to ensure that non-Paris Club and private/hybrid creditors participate in the debt restructuring (Hagan 2020).⁴²

The IMF's *lending into private arrears policy* allows it to lend to a sovereign with arrears to external private creditors only if the member is making a good faith effort to reach a collaborative agreement with its private creditors. The IMF's *lending into official arrears policy* allows it to lend into unresolved official arrears that will be restructured in the context of an IMF-supported program when any of the following criteria are met: (1) The creditors consent; (2) there is a representative Paris Club agreed minute; or (3) if there is no representative Paris Club agreed minute, the debtor is negotiating in good faith with the creditor to resolve the arrears, and the IMF's decision to provide financing despite the arrears would not have an undue negative effect on its ability to provide financing in the future (Buchheit, Chabert, DeLong, and Zettelmeyer 2019).

Thus far, Chad, Ethiopia, and Zambia have sought to restructure their debt under the Common Framework. These countries will provide important test cases for the participation of China and private sector creditors on terms that are comparable with those to be offered by the G20/Paris Club creditors.

3. SETTING UP PANDEMIC FINANCING FACILITIES AT INTERNATIONAL FINANCIAL INSTITUTIONS

In addition to the DSSI, the IMF, the World Bank, and other international institutions have provided significant emergency financial support to low-income countries to combat the public health and economic consequences of the pandemic. But these efforts were not designed to address the fiscal and balance-of-payments needs of emerging-market economies, especially when significant policy changes may not be needed in the initial stages of potential IMF-supported programs. There have been proposals to remedy this shortcoming, and the IMF has considered setting up a temporary pandemic support facility.⁴³ The IMF, however, eventually decided to work within the framework of its existing lending instruments.

Because of the uncertain path of the pandemic and the likelihood of other pandemics in the future, and the extent of policy adjustments needed in those circumstances, the IMF should reconsider such a facility for use in the future. In a world of pandemics with significant uncertainties about the extent of policy adjustments needed, a dedicated pandemic facility would be helpful.

42 Private sector participation could also be enhanced through the use of debt service stand-stills and creditor committees by countries that seek financial support from the IMF (Gelpern, Hagan, and Mazarei 2020).

43 The facility that the IMF considered was similar to the one proposed by Fisher and Mazarei (2020). In light of the significant, unprecedented uncertainties about the course of the pandemic and the need for long-term economic adjustment, the facility proposed by Fisher and Mazarei prescribed limited use of policy adjustment and conditionality at least in the initial stages of programs under that facility.

4. SELLING IMF GOLD

Various suggestions have been made to sell part of the IMF's holdings of gold to finance the institution's support for low-income countries ([Andrews 2021](#)). This may be a good idea, but getting agreement from IMF shareholders on gold sales and possible uses of the proceeds could easily take several years. In the event of agreement on such a sale, it would be helpful for some of the proceeds to be used for upgrading the infrastructure in developing countries for the purchase and delivery of vaccines, as well as for expanding their weak healthcare infrastructure for combating future pandemics.

CLOSING THOUGHTS

The international financial architecture has often evolved in response to prevailing economic difficulties, and it needs to do so again. In the past, reforms to international institutions and policies have helped lower future risks and vulnerabilities. For example, changes made in the aftermath of the Asian financial crisis of 1997 and the global financial crisis of 2008, including improving financial regulations and oversight, have arguably helped lower global vulnerability to economic crises.

We are in a similar critical moment when changes in policies and institutions—such as SDR issuances, more effective sovereign debt restructuring frameworks, and a pandemic financing facility at the IMF—could not only help to remedy the current public health crisis but also make the world less vulnerable to the inevitable scourge of future pandemics. Beyond saving precious individual lives, such investments would yield a high return in reducing future pandemic-related economic losses in communities and countries across the globe.

10 Here's how to get billions of COVID-19 vaccine doses to the world

Chad P. Bown and Thomas J. Bollyky

The unprecedented development of several effective COVID-19 vaccines in less than a year is an historic achievement in the annals of scientific research. No less impressive, however, is the work of the US government in organizing and subsidizing a complex supply chain for manufacturing and distributing the COVID-19 vaccine. American policymakers made large advance purchases of potential vaccines and supported some sponsors—such as Moderna and Johnson & Johnson—carrying out clinical trials, while simultaneously working with myriad far-flung and lesser-known contract manufacturers and suppliers of equipment and ingredients (from cellular material to glass tubing to syringes), to actually produce the vaccines and related supplies. The crash effort that went from science labs to vaccine distribution began under the Trump administration's Operation Warp Speed and has continued and expanded under the Biden administration.

As Americans prepare to emerge from the pandemic, however, much of the world is still living a nightmare. Global demand for vaccine doses dwarfs the supply. Only a handful of countries are able to manufacture these vaccines at the scale needed to overcome infections and deaths that are still growing—and shifting due to the emergence of viral variants. It is certainly problematic that the United States and some other countries are hoarding doses and critical vaccine supplies for their own domestic populations. But a focus on hoarding alone threatens to miss one crucial point. There is much that the United States can do to help replicate the success of Operation Warp Speed on a worldwide scale to get billions of doses to a global population.⁴⁴

The United States needs to do something new: Devote resources and engage both domestic and international sources in coordinated, targeted investments to build on the existing global infrastructure of labs and manufacturers that produce specialized inputs for the vaccines, whether the drugs or syringes or vials that contain them. The vaccine manufacturing supply chain is already global. But it needs to be better organized and subsidized at multiple levels.

Governments and philanthropists have worked together to scale up HIV medicines and pediatric vaccines, but the level of policy cooperation needed for COVID-19 vaccine production is, admittedly, unprecedented. That's why a global coordinating body will also be needed to help some countries scale

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44 Recent estimates are that governments thus far have paid \$6-\$40 for installed capacity yielding a course of vaccines that has a societal value of \$5,800 (Castillo et al., [Market design to accelerate COVID-19 vaccine supply](#), *Science: Policy Forum*, February 25, 2021.)

up the production of early stage ingredients and critical equipment, knowing they can incentivize other countries to subsidize expansion of later steps in the manufacturing process that will also need to be scaled up. Skillfully combining those inputs into vaccine output and then guaranteeing access to the final doses and related supplies through international trade will require trust among governments that is currently in short supply. But without guarantees and coordination, individual governments will revert to self-defeating [vaccine nationalism](#).

One way to accomplish this goal would be to set up a new and enforceable COVID-19 Vaccine Investment and Trade Agreement (CVITA). Such a CVITA can draw some lessons from the US subsidization and coordination of its domestic vaccine manufacturing supply chain under Operation Warp Speed. It was not easy to get so many competing entities to work together in the United States. But its success is already clear. The even more complex policy challenge now is to get the rest of the world vaccinated.

HOW OPERATION WARP SPEED EXPANDED OUTPUT AND INPUT CAPACITY ALONG THE VACCINE MANUFACTURING SUPPLY CHAIN

The US government announced the framework behind [Operation Warp Speed](#) (OWS) on May 15, 2020. In contrast to the Trump administration's mismanagement of the public health response on procurement and distribution of personal protective equipment, social distancing, masking, as well as business and school closures, government officials succeeded in accelerating the development and manufacturing of vaccines for the American public in record time.⁴⁵

The federal government—through the Departments of Defense and Health and Human Services, as well as the Biomedical Advanced Research and Development Authority ([BARDA](#)), and other agencies—[created](#) OWS to coordinate clinical trials and scale up manufacturing in advance of regulatory approval of potential vaccines. This “at risk” approach—spending money that might be lost if a vaccine was not ultimately approved—was essential to making rapid progress. OWS also helped expedite the development of viable vaccines able to obtain authorization from the Food and Drug Administration for emergency public use.

OWS was not flawless, but there is still much the rest of the world can learn from the American experience. Through OWS and successor efforts in the Biden administration, the United States made large advance purchases and coordinated and matched suppliers with vaccine sponsors to ensure those purchase orders would be fulfilled. OWS subsidized input production capacity, including capital equipment, raw materials, and the syringes, vials, and other ancillary supplies needed for packaging and administering doses into arms. The United States

45 Developing enough vaccines and focusing them on the American population, as opposed to global public health needs, is a positive, not normative, characterization of the Trump administration's “America First” policies. Elsewhere, we have made the normative arguments against such an approach. See Thomas J. Bollyky and Chad P. Bown, [The Tragedy of Vaccine Nationalism: Only Cooperation Can End the Pandemic](#), *Foreign Affairs* 99, no. 5 (September/October 2020): 96-109; and Thomas J. Bollyky and Chad P. Bown, [Vaccine Nationalism Will Prolong the Pandemic: A Global Problem Calls for Collective Action](#), *Foreign Affairs*, December 29, 2020.

worked with manufacturers and suppliers, invoking the Defense Production Act if necessary, to untangle potential input bottlenecks. The scope of OWS engagement varied depending on the pharmaceutical sponsor and the vaccine.

In July 2020, the United States contracted with [Pfizer](#) for 100 million future doses of the vaccine it was developing in partnership with the German biotech firm BioNTech. That sizable advance purchase was enough to help expedite the clinical trials and justify reserving and investing at risk in production capacity at [three](#) US manufacturing facilities. Pfizer produced raw materials at its Missouri plant, which were then shipped to its Massachusetts facility and turned into drug substance before being transported to its Michigan site for formulation into the vaccine and packaged for distribution.⁴⁶

With other vaccine candidates, OWS was more extensively involved in scaling up production along a fragmented supply chain.

Consider the further challenges involved when vaccine sponsors include smaller firms, with no prior experience in manufacturing vaccines on a global scale (see figure). In this increasingly typical business model, a biotech firm or university researchers are engaged in the early stage research and development (R&D) of a vaccine candidate before licensing it to a second company to conduct later stage clinical trials, produce the vaccine to commercial scale, seek regulatory authorization for those clinical trials, manufacture, and, ultimately, expand public use.⁴⁷

The process requires adequate supplies of a wide variety of specialized inputs—everything from expensive pieces of capital equipment like bioreactors and filtration pumps to single-use bioreactor bags, adjuvants and lipids—from a range of suppliers. Bulk drug production often requires recruiting partners further along the chain to complete the final “fill and finish” step of adding other ingredients and putting the correct dosage into tiny containers suitable for shipping to health care workers. And, of course, the health care workers require syringes, needles, and personal protective equipment to administer the doses.

One missing input or piece of equipment could grind the entire supply chain to a halt.

The United States spent heavily and relatively early in 2020 to subsidize and invest in many steps of that supply chain (see table). Early funding for the [Moderna](#) candidate allowed [Lonza](#) to establish a manufacturing facility in [New Hampshire](#) at risk. The United States reserved other contract manufacturing facilities, including [Emergent Biosolutions](#) in Maryland in May and [Fujifilm Diosynth Biotechnologies](#) in Texas in July, ensuring they would be available once additional subsidized vaccine candidates had cleared regulatory hurdles.⁴⁸ [Grand River Aseptic Manufacturing](#) in Michigan was contracted to fill and finish. And in March 2021, the United States further expanded capacity by contracting with [Merck](#) to use some of its facilities to both manufacture and fill and finish the Johnson & Johnson vaccine.

46 Pfizer’s vaccine production in Europe took place in Puurs, Belgium.

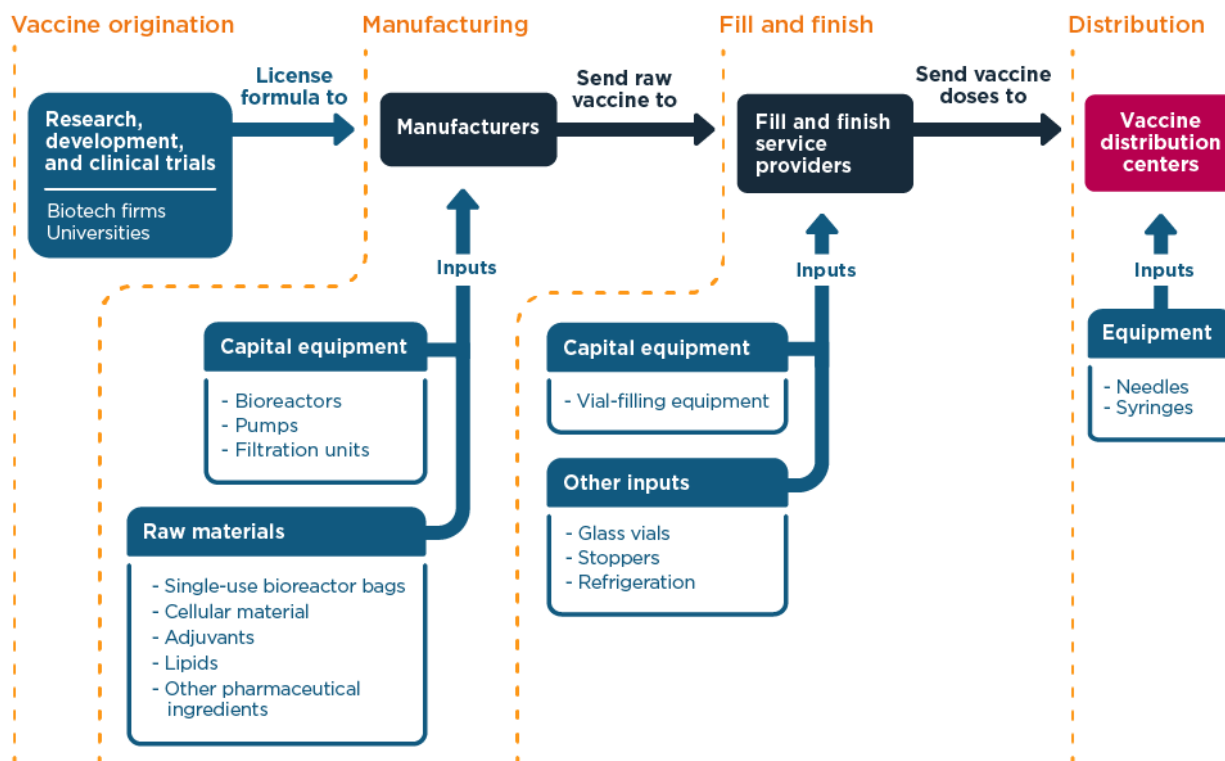
47 These are sometimes referred to as a contract manufacturing organization (CMO) or even a contract development and manufacturing organization (CDMO).

48 BARDA was able to tap into prior relationships under its preparedness programs through its [Centers for Innovation in Advanced Development and Manufacturing](#), which had been in place since 2012.

Figure

Vaccine manufacturing is a multi-stage process that requires extensive cooperation

The stages of vaccine development and manufacturing



Note: Select stages and inputs depicted illustrate general vaccine production process and are not comprehensive.

Source: Constructed by the authors.

Finally, the US government did not just buy up inputs these companies would ultimately need for manufacturing, it also spent hundreds of millions of dollars in 2020 contracting with other specialized firms to expand those companies' input production capacity.⁴⁹ Cytiva received funding to expand capacity of cellular material, bioreactors, and bioreactor bags. SiO2 Materials Science and Corning were contracted to enlarge production of glass tubing and vials, and

49 In addition to those listed in the table, there were separate contracts awarded on August 4, 2020 to procure needles and syringes for the Strategic National Stockpile from Duopross Med-itech Corporation (\$48 million), Cardinal Health Inc. (\$15 million), Gold Coast Medical Supply, LP (\$14 million), HTL STREFA Inc. (\$12 million), Quality Impact, Inc. (\$9 million), and Medline Industries, Inc. (\$6 million) and on August 31, 2020 to procure syringes from Goldbelt Security, LLC (\$125 million).

Smiths Medical, BD (Becton, Dickinson and Company), Retractable Technologies, and ApiJect Systems scaled up to make more syringes, needles, and single-dose injectors.

Table

US federal subsidies or contracts to COVID-19 vaccine supply chain, 2020 through March 12, 2021

Company	Amount	Date	Task
Vaccine sponsors			
Johnson & Johnson (Janssen)	\$21 million	February 11, 2020	Support nonclinical studies and a Phase 1 clinical trial
	\$436 million	March 27, 2020	Amendment
	\$1 billion	August 5, 2020	Demonstrate large-scale manufacturing, 100 million doses
	\$85 million	August 21, 2020	(Unknown)
	\$454 million	November 13, 2020	Amendment, funding for Phase 3 clinical trial
Sanofi and GSK	\$31 million	April 10, 2020	Accelerate nonclinical studies and a Phase 1 clinical trial
	\$2.04 billion	July 30, 2020	Phase 3 clinical trial, manufacturing demonstration project
Merck and IAVI	\$38 million	April 15, 2020	Accelerate development of vaccine candidate
Moderna	\$430 million	April 16, 2020	Accelerate development of vaccine candidate
	\$53 million	May 24, 2020	Expand manufacturing capacity
	\$472 million	July 25, 2020	Support Phase 3 clinical trial
	\$1.53 billion	August 11, 2020	Support Lonza's manufacturing, 100 million doses
	\$1.67 billion	December 11, 2020	100 million doses
	\$1.75 billion	February 11, 2021	100 million doses
Novavax	\$60 million	June 4, 2020	Manufacturing components for use in Phase 2/3 clinical trial
	\$1.60 billion	July 6, 2020	Demonstrate commercial-scale manufacturing
Pfizer (BioNTech)	\$1.95 billion	July 21, 2020	100 million doses
	\$2.01 billion	December 22, 2020	100 million doses, option for 400 million more
	\$2.01 billion	February 11, 2021	100 million doses
AstraZeneca (Oxford)	\$1.6 billion	October 28, 2020	Accelerate development and manufacturing to begin Phase 3 clinical trial
Contract manufacturers			
Emergent Biosolutions	\$628 million	May 30, 2020	Contract manufacture, fill and finish
	\$20 million	August 6, 2020	
Fujifilm Diosynth Biotechnologies (Texas A&M University)	\$265 million	July 24, 2020	Contract manufacture
Grand River Aseptic Manufacturing (GRAM)	\$161 million	August 6, 2020	Fill and finish, including for Johnson & Johnson's vaccine
Ology Bio	\$106 million	August 17, 2020	Fill and finish

Company	Amount	Date	Task
Merck	\$269 million	March 2, 2021	Produce drug substance, formulate and fill vials of Johnson & Johnson's vaccine
Equipment and other input suppliers			
SiO2 Materials Science	\$143 million	June 5, 2020	Glass tubing and vials
Corning	\$204 million	June 5, 2020	Glass tubing and vials
Becton, Dickinson and Company	\$42 million	July 1, 2020	Syringes and needles
Retractable Technologies	\$54 million	July 1, 2020	Syringes and needles
Smiths Medical	\$21 million	July 11, 2020	Syringes and needles
Cytiva	\$31 million	October 13, 2020	Cellular material, mixer bags, and bioreactors
ApiJect Systems	\$590 million ^a	November 19, 2020	Prefilled, single-dose injectors

a. Loan to finance 75 percent of the project's capital costs.

Sources: Compiled by the authors from Biomedical Advanced Research and Development Authority, 2021, [BARDA's Rapidly Expanding COVID-19 Medical Countermeasure Portfolio](#) and [BARDA's COVID-19 Domestic Manufacturing & Infrastructure Investments](#); [Novavax](#); [Merck](#); [GRAM](#); and [US International Development Finance Corporation](#).

DEFENSE PRODUCTION ACT: REALLOCATING INPUTS ALONG THE US SUPPLY CHAIN

As American manufacturing of COVID-19 vaccines ramped up in 2020, the US government also reportedly invoked the [Defense Production Act](#) (DPA) to reallocate scarce inputs from one firm to another. (The DPA can be used to compel manufacturers to accept and prioritize government contracts ahead of private sector orders.) Because some firms may have stockpiled inputs in anticipation of producing vaccine candidates that failed during trials (see again table), the DPA could be useful in freeing them up in the absence of well-functioning secondary markets.

Some vaccine manufacturers requested use of the DPA. In December, the [New York Times](#) reported that Pfizer asked the US government to use the DPA “to give the company better access to roughly nine specialized products it needs to make the vaccine,” including lipids. When queried about requests that the US administration invoke DPA, Pfizer’s CEO, Albert Bourla, told [CNBC](#), “we are asking them and I hope that they will do it very soon because, particularly in some components, we are running at critical supply limitations.” In February 2021, DPA was [reportedly](#) again invoked to get Pfizer “more manufacturing supplies, including pumps and filtration units.”

AS MANUFACTURING STARTS IN EUROPE AND INDIA, INPUT SHORTAGES HAVE ARISEN

As manufacturing began to scale up elsewhere, including Europe and India, concerns arose that its slowness was due to a scarcity of inputs. A shortage emerged for lipids, a key input in the messenger RNA (mRNA) vaccine, only to be aided by [Merck](#) agreeing to accelerate supplies for BioNTech. Another involved bioreactor bags, with Stanley Erck, the Novavax CEO, [stating](#): “We just had a minor breakthrough where we thought we were going to be out of [bioreactor] bags in one particular facility. And we just got enough to get through February, March and April. Otherwise, [the factory] would have shut down.” The chief executive of the Serum Institute of India, Adar Poonawalla, went [further](#), linking the global shortage of bioreactor bags to the US policy of prioritizing domestic production, thereby limiting exports of inputs to other countries in need.

European Commission President Ursula von der Leyen has indirectly acknowledged the American approach playing a key role in securing the supply chain for its vaccines, “The US has a strong advantage by having BARDA,” she said. “This is an infrastructure Europe did not have.”

Admittedly, there has been insufficient time and data required to do a full, empirical cost-benefit assessment of the OWS or use of the DPA by the Trump and Biden administrations. OWS surely could have spent resources more effectively, and it will likely emerge that invoking the DPA had important unintended consequences, including on input availability for foreign manufacturers.⁵⁰

Nonetheless, there is little question that US intervention helped scale up inputs and unlock input bottlenecks to expand production overall. Furthermore, it is also hard to argue that the tens of billions of dollars of US federal expenditures were too large, given the pandemic’s ongoing human costs (hundreds of thousands of lives lost) and economic costs (trillions of dollars of lost gross domestic product). The same would be true with regard to resources needed to expand manufacturing to meet global demand for vaccines and the critical inputs needed to make them.

THE DEMAND SIDE: EMERGENCE OF VIRAL VARIANTS INCREASES AN ONGOING NEED FOR VACCINES

There is growing optimism that the United States has now secured sufficient doses to vaccinate every willing American adult by the end of May. Yet, this optimism must be tempered by the emergence of variants of SARS-CoV-2. The most worrisome are currently P.1, which emerged in Brazil, and B.1.351, which has spread rapidly through South Africa, despite the country’s earlier relative success in virus containment. The speed with which these variants are replacing previously circulating viruses demonstrates their potential to increase caseloads, hospitalizations, and deaths globally, including in the United States.

50 DPA actions that reallocated inputs may have also delayed production of vaccines purchased by COVAX or other countries, and it could have slowed the manufacture of other essential pharmaceutical products that were deprioritized. In January 2021, for example, Catalent, a contract manufacturer, was [forced](#) by the DPA to shift its facilities toward supporting the Moderna and Johnson & Johnson vaccine production and away from fulfilling a prior contract for a thyroid eye disease drug for the firm Horizon.

The emergence of variants of SARS-CoV-2 will greatly increase the demand for vaccine manufacturing for three reasons.

First, early data suggest that current SARS-CoV-2 vaccines may be less effective against the new variants and more manufacturing capacity is needed to produce the next generation vaccine candidates targeting the variants. The demand for that vaccine manufacturing will be greater if the active ingredients for addressing original and variant strains must be made separately and then combined in a bivalent vaccine, protecting against both the original and variant strains of the virus.

Second, countries will need to achieve higher vaccination rates to reach herd immunity—the point at which a sufficient share of the population has developed immunity so that, even absent mask wearing and social distancing, extensive transmission of the coronavirus can no longer be sustained.

Third, decreasing new infections is the only effective strategy for reducing the risk of variants. That will require increasing global vaccination rates. The longer the coronavirus spreads, the more likely it is to mutate and produce variants that are more contagious, deadly, or resistant to proven vaccines.

More vaccination requires manufacturing more doses of vaccines.

OBSTACLES TO SCALING OUT VACCINE MANUFACTURING GLOBALLY

Quickly scaling up vaccine manufacturing during a pandemic requires policy support, as the American experience has shown. But the expansion cannot and should not be pursued by America alone.⁵¹ Even spreading production to other wealthy countries is unlikely to result in swift enough action to meet global vaccine needs. Some pharmaceutical companies, such as AstraZeneca and Novavax, have already engaged contract manufacturers in emerging-market economies. But there is even more production capacity to tap, and scaling up vaccine manufacturing in this pandemic will require its use. Finally, the most resilient supply chain for future pandemics will be a distributed one that can survive regional or single-country disruptions.

The Coalition for Epidemic Preparedness Innovations (CEPI), Gavi (the Vaccine Alliance), and the COVAX facility have provided seed funding and led match-making efforts to convince manufacturers to start scaling out global production. The early agreement between Oxford/AstraZeneca and the Serum Institute of India—a company with the capacity to produce billions of doses annually—was the largest and most well-known. Others include Novavax, also a CEPI funding recipient, partnering with the Serum Institute. Novavax also contracted with Takeda in Japan, SK Bioscience in South Korea, Baxter in Germany, and Biofabri in Spain, conditional on its vaccine being approved. CSL in Australia has also agreed to manufacture the Oxford/AstraZeneca vaccine, with subsidies from the Australian government, after the home-grown University of Queensland candidate did not pan out.

51 Given the rest of the world is still reeling from the “America First” approach of the Trump administration, it is unlikely to accept being held hostage to such an outcome anyway. It is only necessary to recall the 2020 shortages of personal protective gear and recognition that much of the world’s excess manufacturing capacity for personal protective equipment was located in China, the epicenter of the pandemic.

Despite the efforts of CEPI and its partners, however, a shortage of inputs and the ongoing threat of export restrictions is impeding the necessary expansion of global vaccine production.⁵²

Establishing new COVID-19 vaccine manufacturing sites also requires new supply chains to provide them with sufficient inputs—capital equipment, raw materials, and ancillary supplies (see again figure)—to make and deliver those vaccines. Bioreactor bags, lipids, and other inputs are already facing shortages, being used up in the United States and Europe. Specialty syringes are scarce in [Japan](#).

Further scaling out global manufacturing requires the cooperation of multiple countries to subsidize the production capacity of outputs *and* inputs. One problem is that many of the countries with reliable contract vaccine manufacturers do not have all the necessary local companies to subsidize capacity expansion of needed inputs.⁵³ Governments elsewhere may have the input-making companies, but in the absence of policy coordination, they don't have the public health incentive to provide subsidies to reach the scale needed to satisfy global demand. Those input manufacturing countries would only enjoy the “externality” benefits—i.e., solving their local public health crisis—if they were guaranteed access to other countries' vaccine output through trade.⁵⁴

For that reason, the ongoing threat of “[vaccine nationalism](#)”—in the form of imposing export restrictions on vaccines—is thus another important factor discouraging the subsidization of input capacity. By limiting exports of locally produced vaccines, the [United States](#), [European Union](#), [Italy](#), and [India](#) have established a worrisome precedent. The threat that countries with new manufacturing coming online might themselves deploy vaccine export restrictions creates an additional *disincentive* for other governments to subsidize critical input-providers.

PROPOSING A COVID-19 VACCINE INVESTMENT AND TRADE AGREEMENT

A *COVID-19 Vaccine Investment and Trade Agreement (CVITA)* is needed to create the incentives to ensure the timely and sizable scaling up of output and *input* investments to respond to this pandemic and future pandemic threats.

52 A factor impeding additional arrangements involves transferring know-how from vaccine sponsors to manufacturers. That necessitates the commitment of skilled personnel, time, and investment—all in short supply for firms, many of which were quite small and already stretched thin during the pandemic. Sponsors, especially of the newest mRNA vaccines, will require financial support and adequate assurances of intellectual property rights protection before they voluntarily transfer technology and tap unused contract vaccine manufacturing, even in well-regulated markets. Yet, fears that sponsors would not transfer their IP to manufacturers contributed to calls by countries like India and South Africa to waive IP protection during the pandemic. This approach is unlikely to address the many other bottlenecks preventing the scaling up of global manufacturing. (See Chad P. Bown and Soumaya Keynes, [Is the WTO making it harder to end the pandemic?](#) *Trade Talks*, Episode 150, February 25, 2021.)

53 This may have been less of a challenge in the United States in 2020 for two reasons. First, it had a large internal domestic manufacturing base. Second, since it was the first mover, it could tap into imports if additional inputs were needed, potentially reducing supplies available to second movers.

54 The strategy of vaccine manufacturing governments to subsidize imports of inputs is insufficient to tackle the problem, as this could only divert scarce supplies. Subsidies are needed to incentivize firms to invest in expanding input production capacity.

Baby steps toward such an agreement are found in the [Trade and Health Initiative](#) that a small, but influential, group of World Trade Organization (WTO) members proposed in late 2020. But much more is required.

First, CVITA should be aligned to leverage COVAX, the umbrella for the public and private international organizations that already have joined together for the purchase and distribution of vaccines. Linking the agreement to existing networks of regulators, such as the International Coalition of Medicines Regulatory Authorities, would also help ease concerns and create a more transparent pathway to the licensing of vaccines, instilling global confidence, reducing development costs, and expediting access in poorer markets.

Second, the *investment* component of the agreement must create a framework to subsidize the full vaccine manufacturing supply chain and especially coordinate expansion of input production capacity, including for bioreactors, bags, cellular materials, vials, stoppers, syringes, and other ancillary supplies. Governments would pay into the investment fund on a subscription basis. Participation of the poorest countries should be heavily subsidized or free.

Third, the agreement should include an enforceable commitment on the part of participating countries to not place export restrictions on supplies of vaccines and related materials destined for other countries participating in the agreement.⁵⁵ In effect, subsidized imported inputs would be exchanged for future doses of an exported vaccine. Countries should agree that imposing export restrictions on vaccine output will be swiftly met with trading partners jointly restricting their supply of inputs to the export-restricting country.⁵⁶ This potential mechanism for reciprocity, if made explicit, can be used to convince skeptical domestic audiences that hoarding—while politically tempting—will not work, because everyone will lose. Protections against export restrictions would also provide an incentive for nations to join the CVITA.

Fourth, this type of international policy cooperation demands unprecedented levels of transparency. Trust can only be maintained—decreasing the likelihood of hoarding—if access to information on COVID-19 vaccines and inputs reduces uncertainty. In response to dozens of countries imposing export restrictions on staples during a perceived food crisis in 2008-2011, the G20 created the Agricultural Market Information System ([AMIS](#)) to improve transparency and coordinate policy in the event of sudden scarcity. That system generated information and trust that arguably reduced the use and duration of agricultural export bans in the [early days](#) of the COVID-19 pandemic. A similar informative monitoring system for vaccines and inputs is needed under CVITA.

Fifth, CVITA needs an effective and transparent administrator who is one part general contractor and one part ombudsperson. When building a house, the general contractor is there to ensure the right inputs are available in enough supply at the right time. The electrician cannot install the wiring before the floors,

55 Or imported bulk vaccine, as in the case of Italy. Italy seized potential exports of 250,000 doses of AstraZeneca's vaccine to Australia for which the contract manufacturer based near Rome (Catalent) was providing fill and finish services based on imports from [Belgium](#) or the Netherlands.

56 The United States, and to a lesser extent Europe and India, may have been able to get away with limiting vaccine exports because they had sufficiently large internal markets to provide the inputs needed for production at scale. Smaller countries dependent on cross border supply chains are unlikely to get away with it without consequences.

beams, and rough construction are in place. On the other hand, if the sheet rock has already gone up, the plumber cannot install the pipes. Sometimes, the general contractor will move an extra plumber or electrician off one job so that a different job does not fall behind. At its best, Operation Warp Speed and the DPA were the general contractor the Americans used to help scale up investments in its entire domestic vaccine manufacturing supply chain.

CVITA needs some of that facilitation at the global level. With access to information, it can help coordinate capacity investment subsidies. It can also help address the reallocation of scarce inputs when inevitable bottlenecks materialize, potentially by creating secondary markets. This is critical to ensuring the production process stays on track.⁵⁷ This facilitation mechanism can also recognize and prepare for inevitable frictions in scaling out global manufacturing. Shortages will occur. Tensions will rise. Because of scarcity problems, difficult choices will need to be made, and some may be asked to wait. Those challenges have to be resolved quickly, fairly, and transparently.

If global policymakers fail to launch and implement an enforceable COVID-19 Vaccine Investment and Trade Agreement, it will be a lost opportunity. If they succeed, lives will be saved.

57 Ideally, this role would be informed when countries deploy their DPA equivalent—to prioritize input reallocation for vaccine production—so that those suffering from secondary effects can be quickly identified and inputs reallocated.

11 How to accelerate vaccine innovations to counter future pandemics

Reinhilde Veugelers

For all its disastrous economic and health effects, the COVID-19 pandemic unleashed an extraordinary outpouring of research and development supported by public and private investments.⁵⁸ Academic researchers produced a record increase in COVID-19-related scientific publications, most of them open access.⁵⁹ The biopharmaceutical industry, including big pharma companies and smaller biotech startups, often in partnership with academia, launched hundreds of clinical trials targeting COVID-19. Perhaps most remarkable was the speed with which several safe and highly effective vaccines were generated and speedily approved.

This achievement does not yet extend to worldwide access to vaccines, but it has demonstrated that all three components of the science and innovation system—government, private business, and academia—can work together in a crisis. That partnership, however, must be further improved to enhance the prospects for dealing with future pandemics. Policymakers need to build upon the successes of the response to the COVID-19 pandemic to foster a broader innovation system geared for long-term preparedness and resilience, preventing a recurrence of the economic and human devastation that persists as a result of COVID-19.

One lesson is already clear: Ongoing government leadership and public resources are indispensable. Government support for research and innovation is needed in general,⁶⁰ but even more so when the mission is to provide a public good like combating infectious diseases. The *global* social value of innovations in fighting infectious disease exceeds *national* social values, so there is also a strong case for intergovernmental cooperation in supporting research and innovation.

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58 In the first few months of the pandemic, national research funding bodies worldwide spent around US\$5 billion on emergency funding for COVID-19 research and development, including over US\$3.5 billion in North America and over \$850 million in Europe. At least US\$550 million was donated by philanthropic foundations to COVID-19 research during this period, on top of their pledges to major international cooperative initiatives (OECD *Science, Technology and Innovation Outlook 2021*).

59 More than 70,000 biomedical scientific publications on COVID-19 were published between January and November 2020. More than three-quarters of COVID-19 scientific publications are open access, much higher than normal (OECD *Science, Technology and Innovation Outlook 2021*).

60 Government support for research and development is needed to close the gap between social and private returns from research investments. Jones and Williams (1998) suggest that socially optimal research and innovation investment in the United States is at least four times the actual investment. Bloom, Schankerman, and Van Reenen (2013) find gross social returns to research and innovation in the United States “at least twice as high as the private returns.”

To guard against the threats of future coronaviruses and completely new viruses, a panoply of innovations is needed, covering vaccines, therapeutics, diagnostics, and beyond. Vaccines, while not the only innovations needed for future pandemic preparedness and resilience, will remain crucial.

THE VACCINE CHALLENGE

The development, testing, and approval of several vaccines for SARS-CoV-2 in less than one year has been an extraordinary achievement, particularly with the success of vaccines based on the new synthetic messenger RNA (mRNA) technology (Pfizer/BioNTech and Moderna). This mRNA technology, which is a platform technology with plug-and-play functionality, is a significant improvement from the traditional biologically based technologies for vaccines. Not only does it vastly speed up the development of new vaccines and modifications to respond to virus variants, it also holds the potential for more rapid, robust, scalable, and modular manufacturing of vaccines. Although this mRNA technology is still early and needs to be developed further, the major advances behind it [portend progress for the future of vaccines and medicine](#) more broadly. The basic science and research behind this novel technology traveled a long and bumpy road from its early stages decades ago, during which luck and serendipity countered systemic biases against risky new research.

Building on the lessons from this journey, the future vaccine roadmap should create “portfolios” of research and innovation projects, including:

- incremental development projects—that is, those that boost and tweak vaccines currently or soon to be on the market and those that develop new vaccines for the current virus and its variants;
- development of new vaccines for new coronaviruses expected to arrive; and
- research and development directed toward a next generation of universal vaccines that will protect against entire families of viruses.

To speed up the development of vaccines, researchers must also be able to identify, track, and trace new mutations of existing viruses and new viruses as fast as possible. The resulting data should be collected and shared on a global scale. Clinical trials need to be better coordinated and clinical trial information must be shared.⁶¹ Health data platforms, which are mostly national, must be upgraded and linked internationally. As Chad P. Bown and Thomas Bollyky discuss in [chapter 10](#) in this Briefing, effective responses to pandemic threats require not only the development of vaccines but also vaccine deployment to all countries, including the poorest, in a manner that is fast, affordable, and fair. Conditions and incentives for investing in new vaccine production capacity and/or expanding and upgrading existing vaccine production capacity have to be assured on a global scale beyond what is commercially optimal.

61 The Clinical Research Network in the United Kingdom serves as a good practice. In contrast, the United States faces a highly distributed and fragmented clinical research system ([Angus, Gordon, and Bauchner 2021](#)), which the Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) initiative led by the National Institutes of Health (NIH) in US Operation Warp Speed tried to address.

THE ROLE OF GOVERNMENT

For these goals to be achieved, an end-to-end approach is needed along the whole value chain—from the generation of new solutions (including vaccines and treatments) to the last mile of delivering these solutions to the world. Covering funding gaps and coordinating this integration is a big enough challenge for the public sector within one country, but it is especially hard to coordinate the academic, private-sector, and public-sector ecosystem globally.

Because of the high risks associated with research projects, and the high social cost of failure, we need multiple vaccine candidates and technologies simultaneously. Public resources should especially support (or at least not bias against) the early stage, riskiest projects, which offer the greatest promises for big breakthroughs. Risks can be managed by diversifying and staging grants.⁶² To support a portfolio approach—including projects that may well fall short—government resources must support not only the early stages of development but also the much more costly later stages of development, production, and distribution. Such a portfolio will not be cheap. Yet for society as a whole, the expected benefits will far outweigh the costs. Penny-pinching budgets that constrain the scale of research, development, and innovation will miss out on winning projects and discourage possible synergies across the range of supported public health initiatives.

Public-private partnerships are essential to harnessing the comparative advantages of each sector. Private and philanthropic cofinancing is welcome, but the public sector should take responsibility for the bulk of the coordination and funding, leaving the private sector to focus on its competences, skills, and flexibility to bring new solutions to market. Private-sector involvement should extend beyond experienced incumbents, allowing new players to add vital new ideas and competition.⁶³ New players teaming up with incumbent biopharma companies—as was the case with the Pfizer/BioNTech partnership, which produced one of the first two mRNA vaccines for COVID-19—can exploit complementarities in competences.

Governments should provide incentives for academia and the private sector to invest in research and innovation. Financial support can take the form of competition for subsidies and grants that nurture bottom-up proposals, while also establishing more directed top-down approaches for such innovations as a universal COVID-19 vaccine.

Because the public (health) sector is also the main buyer of pandemic innovations (vaccines), it can leverage its support for research with *smart* procurement commitments that would assure future demand for developers and actors in the supply chain. Such advanced market commitments (AMCs) can encourage both research and development *and* investments in manufacturing capacity.⁶⁴

62 See [Veugelers and Zachmann \(2020\)](#) for a proposal on how to design and finance a portfolio of vaccine candidates.

63 The mRNA-based vaccines are driven by new science-based firms, like Moderna, BioNTech, and CureVac.

64 For a more elaborate discussion of how to use AMCs for stimulating research and innovation, see [Kremer and Williams \(2010\)](#) and [Ahuja et al. \(2021\)](#).

A potential hurdle for a global end-to-end process arises from patents, held by the developers of vaccines. Patents are necessary to provide incentives for investing in risky research and development projects, but they grant the right to developers to exclude others from producing their vaccines, limiting production capacity to the developers or their licensees. Even if governments have the right to impose compulsory licensing in pandemic conditions, acting on that right risks discouraging future private investments. Conditions for licensing patents must therefore be incorporated into a comprehensive policy package designed *ex ante* that combines open access conditions with public funding.

Meeting all these conditions is a tall order for any government. Activating funding is perhaps the easiest part. More critical is how to use the funds, select portfolios of projects, and connect the dots, which means that governments must have structures and contingency plans in place for likely future pandemic scenarios, so that they do not have to invent them on the spot when an emergency occurs.

Beyond budgets, the role of governance is critical. Washington should move to upgrade the Biomedical Advanced Research and Development Authority (BARDA), which was established in 2006 within the US Department of Health and Human Services (HHS). BARDA is responsible for coordinating, overseeing, and investing in research, development, and procurement of medical countermeasures (MCMs) for bioterrorist threats and pandemics. BARDA 2.0 would need to build a larger, better balanced portfolio of supported projects and make better connections from the upstream basic research process through the downstream coordination of manufacturing and distribution, which would include coordinating and integrating clinical trial data and procedures, and health care data platforms.

The objective would be to ensure that two US initiatives become permanent and integrated: (1) Operation Warp Speed, the US public-private partnership for manufacturing and distribution of vaccines and (2) the Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) initiative by the US National Institutes of Health (NIH) to develop a coordinated research strategy to produce treatments and vaccines. While the United States should upgrade the current BARDA, the European Union and other nations and regions should start now to design such a body.

THE GLOBAL AGENDA

The worst global pandemic in a century points to the need for new multilateral structures to address future crises. Global cooperation does take place in the academic and private research and innovation communities (see [OECD Science, Technology and Innovation Outlook 2021](#)). But national and regional governments are running behind. To step up, governments should at least exchange information and best practices, while coordinating activities, programs, and funding, allowing the most efficient and effective research to rise to a global level.

No global platform for end-to-end coordination and cooperation in research and innovation exists at present. But some baby steps have been taken that can lead the way. In 2013, a network of global health research funders established the [Global Research Collaboration for Infectious Disease Preparedness \(GloPID-R\)](#),

which coordinates and jointly funds pandemic research. This network began discussing COVID-19 but only in January 2020. The [Coalition for Epidemic Preparedness Innovations \(CEPI\)](#), a global public-private partnership, was established only in 2017 to provide financial support for pandemic research and innovation projects. It has several COVID-19 vaccine development projects in its portfolio, including the successful Oxford/AstraZeneca one. But it remains underfunded and restricted in scope.

In the midst of the pandemic, in April 2020, a global public-private partnership was set up to accelerate development, production, and equitable access to COVID-19 tests, treatments, and vaccines worldwide: the Access to COVID-19 Tools (ACT) Accelerator. It is organized into three pillars of work: diagnostics, treatment, and vaccines. The vaccines pillar, COVAX, is co-led by Gavi (the Vaccine Alliance), CEPI, and the World Health Organization (WHO) and is responsible for procuring and distributing approved COVID-19 vaccines worldwide.

All these initiatives are constrained by insufficient public financial support. And none of them reach across all parts of the innovation and distribution value chain. Nor is there any end-to-end coordination of these partial initiatives.

The COVID-19 pandemic might not be the last one of our lifetimes. It should serve as a wake-up call to address the global research and innovation governance problem. Major countries and regions should have their own versions of BARDA and link them to a single global platform to share costs and risks. Participating governments could also use this international platform to partner with other organizations such as COVAX, to deliver vaccines especially to poor countries, and with CEPI, to provide funding to develop vaccines tailored to poor countries.

Commendable progress has been made so far in developing and distributing vaccines only a year after the pandemic erupted. But it is not too soon to learn from the shortcomings along the way and to agree now to do better in the future.

12 For a fairer fight against pandemics, ensure universal internet access

Mary E. Lovely and David Xu

Distributing hundreds of millions of newly developed vaccines to US citizens in a matter of months was bound to produce disparities, especially in a society rife with inequality across different income, racial, and ethnic groups. But one, perhaps less appreciated, factor driving inequities in the fight against COVID-19 is persistently unequal access to the internet. US counties with the highest share of vulnerable residents are also places where fixed residential internet service is least common. This link between poor health and digital isolation underscores the challenge faced by US localities struggling to provide equal public services to all their residents. We now know that failure to provide universal residential broadband access, in addition to skewing access to remote work and distance learning opportunities, raises the mortality risks of the pandemic and reinforces existing social cleavages.

The pandemic has brought into sharp relief the growing reliance of governments on delivering services through the internet and the social costs of unequal broadband access. People without in-home internet service face high hurdles to obtain current information about pandemic risks, local virus prevalence, and necessary precautions.⁶⁵ Public health authorities in counties on the wrong side of the digital divide face greater difficulty and expense reaching and maintaining contact with those most in need. Not only rural areas but also places with larger concentrations of [poor](#), minority, and [older residents](#) lack an essential tool available to “well-connected” jurisdictions. These disparities have arisen dangerously in the rollout of vaccine appointments, where a place in line is often secured only by navigating maze-like online registration websites. Lack of internet access is frequently cited as one of the factors in the low vaccination rates among high-risk communities.⁶⁶

Many federal legislators recognize the heightened urgency of ensuring universal in-home broadband access and adoption in a pandemic age. The coronavirus relief plan passed early in 2020 included expanded funding for schools and libraries, to provide for distance learning. It also helped fund rural health care providers, to expand telemedicine services. But it was not until the

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65 Smartphones are another way to access the internet and some households without broadband access do use them. However, it is difficult to navigate government health department websites via smartphone, especially for older people.

66 COVID-19 has been deadlier for people of color, yet a *New York Times* investigation found that in all reporting states, except Oregon, Black and Hispanic Americans had been vaccinated at lower rates than the general population by late February 2021. See Amy Schoenfeld Walker et al., *Pandemic's Racial Disparities Persist in Vaccine Rollout*, *New York Times*, March 5, 2021.

Consolidated Appropriations Act, 2021 and the American Rescue Plan Act of 2021 that the US Congress agreed to provide money aimed at connecting people in their homes. The ongoing fight against the pandemic requires making such assistance permanent. And to help deal with wider issues of inequality, the United States needs to accelerate deployment of high-speed broadband infrastructure across the country.

MORE VULNERABLE COUNTIES ARE LESS CONNECTED COUNTIES

Due to residential sorting and the physical infrastructure links required to provide broadband service, the digital divide is a spatial divide. Jurisdictions vary widely in the health needs of their citizens and the degree to which local households are connected to the internet. Although broadband infrastructure has extended further into rural areas over time, service providers still find it unprofitable to set up networks in sparsely populated areas. Even within otherwise well-served urban and suburban areas, service providers skip over particular neighborhoods. Indeed, current federal regulations do not require providers to meet the needs of their entire service areas or to offer equal availability of speed tiers.

Moreover, even if providers were required to provide equal access, affordability will be an ongoing challenge for disadvantaged households, as is acquiring the skills necessary to navigate government websites. These service disparities are pronounced among US counties, which play a key role in the US public health response to the pandemic.

Data from the *Mapping Broadband Health in America* project of the Federal Communications Commission (FCC) allows us to see how population health needs and internet connectivity are correlated across counties. The dataset includes a variety of county health conditions, including the share of residents who have been diagnosed as obese, diabetic, or who smoke, or report being in fair or poor health. These data show that counties where residents are more likely to have health conditions associated with COVID-19 mortality are also places where a larger share of homes lack a fixed internet connection. The FCC lists a household as having a wired connection if it has service above a very modest quality threshold, including dial-up modem connections.⁶⁷ So, the analysis we present below, based on their measures, may understate the extent to which online government services are skewed away from those most at risk.

Figure 1 illustrates the share of county households with or without home internet connection across four quartiles sorted by the share of county residents diagnosed with obesity, a significant predictor of COVID-19 mortality rates.⁶⁸ Counties in the top quartile for obesity prevalence are places where, on average, 37 percent of households lack internet access. In contrast, counties in the lowest quartile have, on average, 19 percent of households without home internet

67 The FCC data we use provide the percentage of households in a county with residential fixed internet connection over 200 kilobits per second (kbps), or 0.2 megabits per second (Mbps), in at least one direction. In 2015, the FCC defined high-speed internet as a connection over 25 Mbps download speed and at least 3 Mbps upload speed. With today's greater download demands, a commonly cited minimum download speed for working from home or attending school remotely is 50 Mbps.

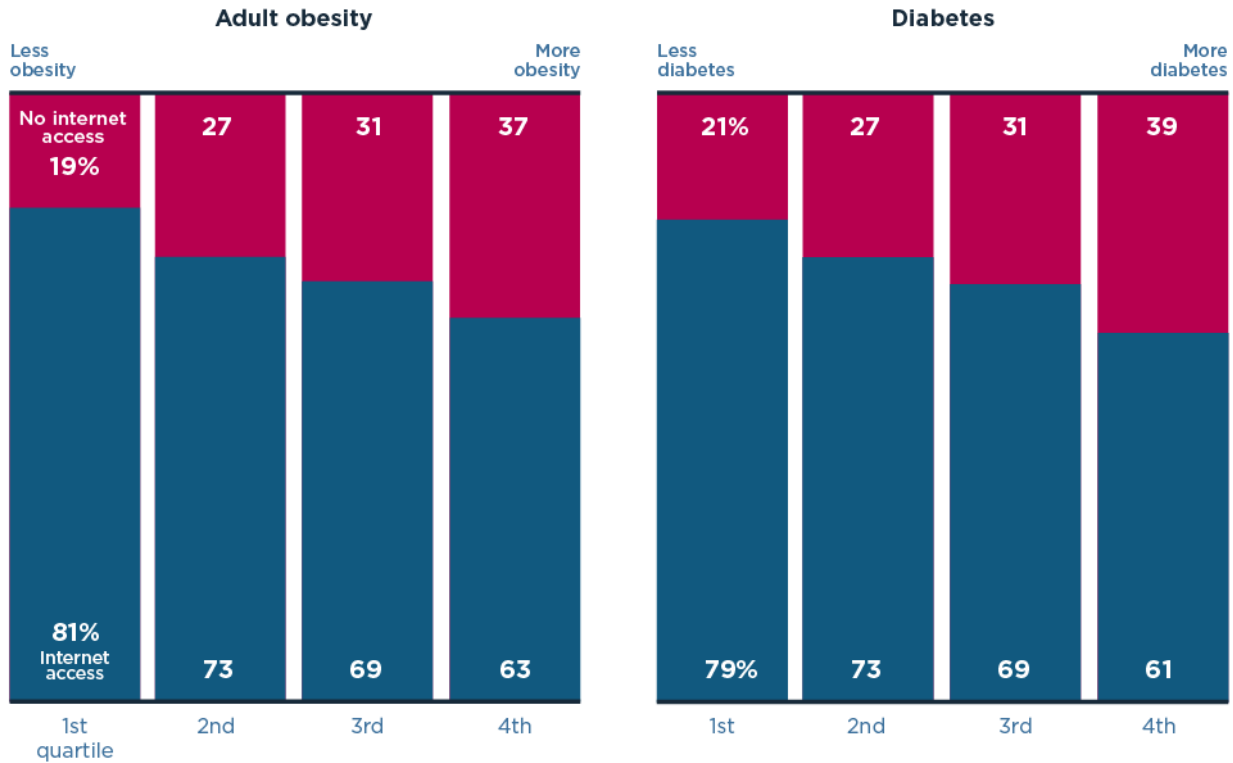
68 Analysis of over 17 million health records in England found that risk of death related to COVID-19 rose with obesity and most comorbidities, including diabetes. See Williamson, Walker, Bhaskaran et al., "Factors associated with COVID-19-related death using OpenSAFELYWalker," *Nature* 584, July 8, 2020, pp. 430–36.

connection. Thus, the likelihood that a resident lacks internet access is twice as large in counties with the highest prevalence of obesity than in counties with the lowest obesity rates.

Figure 1

US counties with higher concentrations of vulnerable populations often have lower internet connectivity

Percent of US households with or without internet connection by health characteristics, quartiles



Note: Data refer to mean share of US households with residential fixed internet connection over 200 kbps in at least one direction among counties in corresponding quartile.

Sources: Federal Communications Commission; Centers for Disease Control and Prevention.

Figure 1 similarly displays the relationship between the prevalence of diabetes and internet connectivity. Again, we find a significant relationship between county health conditions and fixed residential internet. Lack of a home connection is almost twice as common, on average, in counties with the highest levels of diabetes compared with those with the lowest prevalence. Similar correlations can be found between internet connections and the share of residents claiming poor or fair health or the share who smoke.⁶⁹

69 The Pearson's r , a measure of a linear relationship between two variables, lies in the range of 0.34–0.37 for each of the four health characteristics mentioned.

THE ELDERLY ARE MOST AT RISK AND LEAST CONNECTED

Death rates from COVID-19 are higher for the elderly than for any other demographic group.⁷⁰ Public health authorities have struggled to connect elderly residents living in the community to information, services, and vaccination sites. A major concern is the relatively low adoption of in-home internet service by older Americans. This worry is well founded: The [Pew Research Center](#) finds that in 2019 only 59 percent of people aged 65 and older were home broadband users compared with at least 77 percent of those in younger age groups.

When viewed from a county-level perspective, however, the picture is complicated by important differences among elderly populations. Wealthier seniors may easily afford the expense of home internet service while less-well-off seniors struggle to pay for monthly utilities. Some may find it difficult to navigate the complications of purchasing and installing necessary equipment. Elderly living in congregate settings, such as nursing homes, are not included in the FCC's data on residential connections. These factors, among others, produce a low correlation between a county's elderly share and the share of households lacking internet connection (the correlation coefficient across counties is only 0.05).

Like the elderly, Black and Hispanic Americans across the United States have been disproportionately affected by COVID-19, facing higher risk of infection and higher mortality rates if infected. Yet the vaccination rate for Black people in the United States is only half that of white people, and the gap for Hispanic people is even larger, according to data compiled by the *New York Times*.⁷¹ Compared with their white counterparts, Black and Hispanic people are less likely to have internet access reliable enough to access health information online and make vaccination appointments and have dependable transportation to vaccine sites, among other factors. [Pew Research Center](#) data supports these concerns, reporting that in 2019 79 percent of white survey respondents claim to be home broadband users, but only 66 percent of Black and 61 percent of Hispanic respondents do.

Such disparities do appear at the county level, but they intersect with racial differences in urban vs. rural locations. Among counties sorted into quartiles by share of households with Black, African American, or Hispanic residents, counties with the highest minority share have the lowest level of connectivity: On average, 33 percent of households in these counties lack home-based internet service. But connectivity is also low in counties with the smallest nonwhite shares⁷² (on average 29 percent of households in this group lack home internet), reflecting the disproportionately rural status of this population and the greater likelihood that the local area has no broadband infrastructure.

To delve more deeply into the observed relationships for both residents' age and race/ethnicity, we use the FCC dataset mentioned earlier to further divide counties into two bins. The first bin contains "younger counties"—jurisdictions

70 Studies confirm that age is the strongest predictor of an infected person's risk of dying from COVID-19. See Smriti Mallapaty, "The coronavirus is most deadly if you are older and male—new data reveal the risks," *Nature*, August 28, 2020.

71 Data suggest that these disparities cannot be explained by differences in age or occupation. See Amy Schoenfeld Walker et al., *Pandemic's Racial Disparities Persist in Vaccine Rollout*, *New York Times*, March 5, 2021.

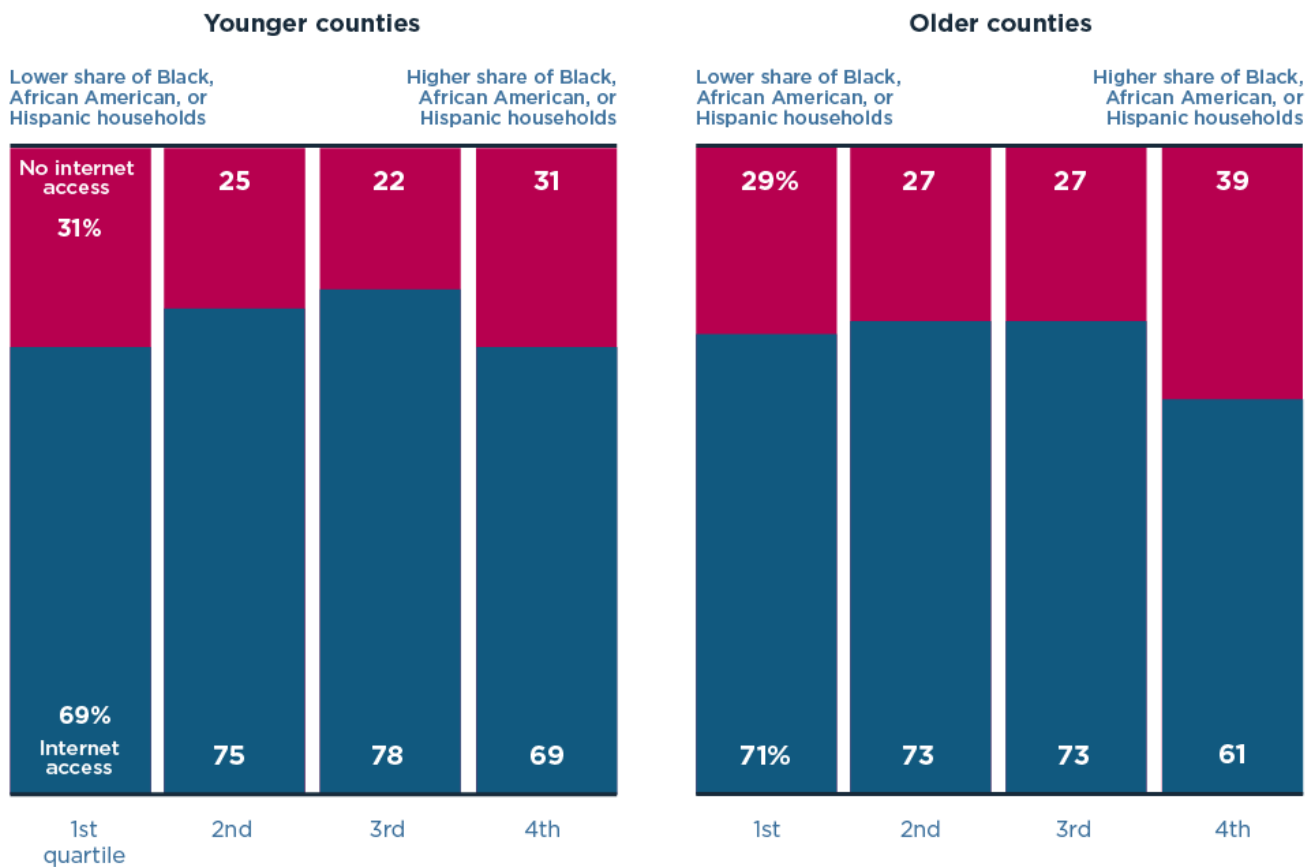
72 We use "nonwhite" share here to refer to the share of households that identify at least one member as Black, African American, or Hispanic in the US Census.

with an elderly share below the national median for all counties. The second bin contains “older counties”—jurisdictions with an elderly share above the national median.

Figure 2 displays the average share of households with or without internet connection, by nonwhite household quartiles, for these two groupings. Among younger counties, those with the smallest and the largest shares of nonwhite households have higher than average shares of households without home internet connection, 31 percent. The middle quartiles of this “young” county group have lower than average service gaps.

Figure 2
US counties with more elderly, nonwhite populations are the hardest to reach digitally

Percent of US households with or without internet connection by age and Black, African American, or Hispanic population, quartiles



Note: “Younger counties” are counties where the share of the population aged 65 and over is below the US median. “Older counties” are counties where the share of the population aged 65 and over is above the US median. Data refer to mean share of households with residential fixed internet connection over 200 kbps in at least one direction among counties in corresponding quartile.

Sources: Federal Communications Commission; US Census Bureau.

Turning to the “older” county grouping, we see that households in the first three quartiles have roughly similar levels of lack of internet connectivity, close to the nationwide county average of 28 percent. The quartile with the largest shares of nonwhite households, however, exhibits the largest digital gap—the average share of households without internet connection in this group of counties is 39 percent. Thus, the data show that counties with [higher shares of older, minority residents face greater difficulties](#) in reaching and serving their most vulnerable citizens.

FEDERAL EFFORTS TO FILL THE GAPS

The US Congress has long recognized the need for universal access to broadband internet service, but progress toward closing gaps has been slow. The COVID-19 pandemic dramatically heightened this concern as American schools, businesses, and governments turned to remote work and providing services online. Recent legislation addresses two needs—making high-speed service available to all locations and getting households connected to the internet.

Prior to the passage of the 2020 Coronavirus Aid, Relief, and Economic Security (CARES) Act, the FCC relied mainly on the [Universal Service Fund](#) to address pandemic-related challenges. Using this authorization, the commission took steps to maintain and modestly expand enrollment in its [Lifeline Program for Low-Income Consumers](#), which partners with broadband providers to offer subsidized service to eligible households.⁷³ The FCC also eased rules restricting the use of federally funded equipment for schools and libraries (but stopped short of permitting home use). Addressing health care needs directly, the FCC rolled out the [Connected Care Pilot Program](#), which provides subsidies to eligible health care providers to expand internet-connected services to low-income households and to veterans at their residence or mobile location.

The CARES Act took aim at discrepancies in broadband access hindering remote work and distance learning. It also addressed health care, but only with temporary funding to help health care providers purchase telecommunications devices and services needed to expand telehealth services. These funds target areas of the United States hardest hit by COVID-19.

The Consolidated Appropriations Act, 2021 (CAA 2021) provides additional funding for telehealth programs but importantly also tackles broadband availability and affordability for underserved areas and populations. Several provisions seek to expand broadband infrastructure and access to areas lacking service, with specific appropriations for programs that connect minority communities and tribal lands.⁷⁴

73 The Lifeline Program, part of the FCC's Universal Service Fund, is the only permanent federal program focused on telephone and broadband adoption for low-income households. Internet service providers opt in to offer eligible households discounts of \$9.25 per month, a subsidy most households apply to monthly wireless bills.

74 Details on broadband provisions of the Act can be found in Congressional Research Service, [The Consolidated Appropriations Act, March 2, 2021: Broadband Provisions in Brief](#).

Notably, CAA 2021 provides significant new funding to subsidize internet connections for low-income or job-displaced families.⁷⁵ The Emergency Broadband Benefit program reimburses service providers up to \$50 each month for qualifying households, or up to \$75 for those on tribal lands. It also provides up to \$100 if a household purchases a connected device, excluding smartphones. Addressing incomplete uptake by target populations, the legislation also directs the FCC to raise program awareness and promote consumer outreach.

The American Rescue Plan Act of 2021 (ARP) further recognizes the importance of broadband access and internet adoption for economic recovery. With the Emergency Connectivity Fund, Congress dramatically expanded existing programs for schools and libraries to provide free broadband service and connected devices to students and patrons for use in their homes.⁷⁶ The ARP also includes enhanced assistance to homeowners who fall behind on mortgages and utility bills, including internet service. Recognizing that households can connect only where there are “pipes,” this new legislation provides funds to states, territories, and tribal lands for local recovery, which may include broadband infrastructure investment. Additional infrastructure funding may come from another pot, the Coronavirus Capital Projects Fund.

These various programs significantly expand federal efforts to close remaining infrastructure and connection gaps. But serious shortcomings remain. The new assistance is temporary, at least for now. For example, the Emergency Broadband Benefit program, which is key to connecting low-income families to the internet, expires six months after the termination of the COVID-19 public health emergency or when appropriated funds are exhausted.⁷⁷ The Accessible and Affordable Internet for All Act, introduced in the House by Representative James Clyburn (D-SC) and in the Senate by Senator Amy Klobuchar (D-MN), would go further. It proposes \$94 billion to support construction of broadband infrastructure when it does not exist, improve speeds where service is slow, and continue discounts to eligible families past the recovery.⁷⁸ It also would establish grants to support digital skills training. All three forms of assistance—infrastructure, connection subsidies, and training—are needed if the United States is to achieve universal access and adoption.⁷⁹

75 Congress appropriated \$3.2 billion for this Emergency Broadband Benefit program. The program wraps around the existing Lifeline Program.

76 For a detailed discussion of the American Rescue Plan’s broadband provisions, see Kevin Taglang, [American Rescue Plan: Broadband and the Social Safety Net](#), Benton Institute, March 12, 2021.

77 Kevin Taglang provides more details in [Emergency Broadband Benefit Program: From Here to Launch in 60 Days](#), Benton Institute, March 5, 2021.

78 Among those connected to the internet, the quality of service varies widely across households. By 2018, approximately 89 percent of residential fixed connections had a speed of at least 10 Mbps downstream, while 76 percent had a speed of at least 25 Mbps downstream. Only about 50 percent of all residential fixed connections had a downstream speed of at least 100 Mbps. See Federal Communications Commission, [Internet Access Services: Status as of December 31, 2018](#), Industry Analysis Division, Office of Economics & Analytics, 2020.

79 Not just availability but also a minimum service quality is needed to ensure that all Americans can participate in the digital economy. In a letter dated March 4, 2021, four US senators (Michael Bennet [D-CO], Angus S. King, Jr. [I-ME], Rob Portman [R-OH], and Joe Manchin III [D-WV]) urged the Biden administration to set a goal of symmetrical speeds of 100 Mbps, with only limited variation across the United States, arguing that this service quality is required for equal economic opportunity.

According to the [2020 United Nations E-Government Survey](#), almost all governments responded to the pandemic by deploying new digital tools, such as dedicated COVID-19 information portals, e-services for supply of medical goods, virtual medical appointments, self-diagnosis apps, and e-permits for curfews. Many countries were quick to deploy tracking and tracing apps and apps for working and learning from home. Not all nations, however, entered the pandemic age equally prepared to deliver services to their citizens digitally. In 2019, the United States ranked 26th worldwide in fixed broadband subscriptions per 100 residents, based on a low minimum service quality standard.⁸⁰ Despite differences in physical terrain and institutions, the United States may find it useful to consider how Switzerland, France, Denmark, South Korea, Norway, Canada, and the United Kingdom, among others, overcame rough terrain, affordability problems, and digital skills scarcities to achieve higher rates of fixed broadband adoption.

As shown earlier, public data from the FCC indicate that US counties where residents are less healthy and older are more likely to be on the wrong side of the digital divide. When COVID-19 appeared, the past failure in connecting all US households to the internet made America less prepared to ensure effective and equal public health services to all. The pandemic has made clear the danger of unequal private access to public information and the new Congress has responded with greatly enhanced, but temporary, public support for infrastructure expansion and household internet adoption. The gaps will widen substantially when funding provided by these new programs is exhausted. Because internet access will remain essential for education, employment, and government service provision well beyond the current crisis, it is time to build broadband better—elevating universal service provision to a national commitment for all Americans.

80 This ranking is based on [data from the International Telecommunication Union](#).

In memory of Richard Newell Cooper, 1934–2020

This *PIIE Briefing* is dedicated to the memory of Richard Cooper, who passed away on December 23, 2020. Dick's distinguished career spanned academic teaching, administration, and research; public service; and policy advocacy. The topic of this *PIIE Briefing* reflects Dick's lifelong commitment to analyzing international policy coordination problems, including coordination over public health policy.

Dick's contributions to the Peterson Institute for International Economics (PIIE) were tremendous. Dick chaired the Institute's Advisory Committee from its inception in 1981 (when PIIE was known as the Institute for International Economics), and he was intimately involved with PIIE activities for the nearly four decades that followed. For the first 20 years of the Institute's existence, Dick read and commented on virtually every manuscript. He was fulfilling the quality control function before it was so named, and in doing so played an invaluable role in insuring both our rigor and realism, and hence the new institution's reputation. His deep and abiding partnership with our founding director, C. Fred Bergsten, based on a collaboration as high-level policymakers in the Johnson and Carter administrations, provided a key part of Institute's foundation and trajectory.

As a member of our Board of Directors until his passing, as well as chair of our Advisory Committee, as the long-time economics book reviewer for *Foreign Affairs*, and as a colleague and trusted critic on every topic the Institute tackled, he shaped much of our work and its reception. It was a source of great satisfaction to all of us that he joined PIIE fellows on our annual China trip a few years ago and that he enjoyed being part of the Institute's community through its fourth decade. We consulted him on our previous G20-oriented *PIIE Briefing* in April 2020, and we had been hoping to lean on him again as we further addressed climate and global health in 2021.

For the broader policy community, Dick's breakthrough contribution on international economic policy spillovers was *The Economics of Interdependence: Economic Policy in the Atlantic Community*, published in 1968 under the auspices of the Council on Foreign Relations. For academic economists, Dick's 1969 *Quarterly Journal of Economics* paper on "Macroeconomic Policy Adjustment in Interdependent Economies" provided a pioneering analysis of the gains from international policy coordination in a world of increasing financial integration. Dick's interests in global policy cooperation endured and broadened, encompassing works on exchange rate regimes and international monetary systems, climate policy, and linkages between economic and foreign policies.

Especially relevant to this *PIIE Briefing* is Dick's remarkable 1989 paper on "International Cooperation in Public Health as a Prologue to Macroeconomic Cooperation," in the Brookings Institution volume *Can Nations Agree?: Issues in International Economic Cooperation*. In a virtuoso performance, Dick surveyed three centuries of public health policy, an experience that culminated in a global structure of international cooperation on public health that Dick judged to have been largely successful. Dick contrasted that success with much more



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halting steps toward global macroeconomic policy cooperation. He argued that progress on the latter still faced obstacles of widespread disagreement over macroeconomic theories and objectives.

National responses to the COVID-19 pandemic have upended Dick's optimism. One likely reason is the novelty of the pathogen causing the disease, which introduced tremendous uncertainty over the best policies for containment and mitigation. Another reason centers on weaknesses in the existing framework for international health cooperation: These have become more evident over time with the continuing emergence of more new diseases. A final reason is the speed with which COVID-19 turned into a truly global problem, putting governments everywhere on the back foot as they struggled with the prospect of surging domestic infection rates. We hope that the recommendations in this *PIIE Briefing* will help the international community find more effective and cooperative responses to ongoing and prospective disease threats. As we debate how to do better in the future, we will all be the poorer for not having the benefit of Richard Cooper's insights.

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