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Healthcare System & Services and Public & Social Sector Practices

Not the last pandemic: Investing now to reimagine public-health systems

The COVID-19 crisis reminds us how underprepared the world was to detect and respond to emerging infectious diseases. Smart investments of as little as $5 per person per year globally can help ensure far better preparation for future pandemics.

by Matt Craven, Adam Sabow, Lieven Van der Veken, and Matt Wilson

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This article was originally published in July 2020 to make an economic case for investments in infectious-disease surveillance and preparedness. The overall message remains as clear now as it was a year ago: the returns from smart investments in preparedness and response are likely to be large multiples of their costs. We have refined the article with three updates that build on our prior work:

— *We sharpened some cost estimates based on further analysis and new information that has become available over the past year. For example, the importance of genomic sequencing, "ever warm" vaccine manufacturing capacity, and R&D platforms has been made ever clearer by the trajectory of the COVID-19 pandemic.*

— *We have included more detail on our line-item cost estimates and a deep dive on surveillance costing (available for download on McKinsey.com).*

— *We have included new cost analyses, including cost per capita and the share of spend at the global, regional, and country levels.*

The COVID-19 pandemic has exposed overlooked weaknesses in the world's infectious-disease-surveillance and -response capabilities—weaknesses that have persisted in spite of the obvious harm they caused during prior outbreaks. Many countries, including some thought to have strong response capabilities, failed to detect or respond decisively to the early signs of SARS-CoV-2 outbreaks. That meant they started to fight the virus's spread after transmission was well established. Once they did mobilize, some nations struggled to ramp up public communications, testing, contact tracing, critical-care capacity, and other systems for containing infectious diseases. Ill-defined or overlapping roles at various levels of government or between the public and private sectors resulted in further setbacks. And the challenges, including difficulties with vaccine rollouts, lingering vaccine hesitancy, and difficulties in managing second and third surges, have continued as the pandemic has entered its second year.

Correcting these weaknesses won't be easy. Government leaders remain focused on navigating the current crisis, but making smart investments now can both enhance the ongoing COVID-19 response and strengthen public-health systems to reduce the chance of future pandemics. Investments in public health and other public goods are sorely undervalued; investments in preventive measures, whose success is invisible, even more so. Many such investments would have to be made in countries that cannot afford them.

Nevertheless, now is the moment to act. The world has seen repeated instances of what former World Bank president Jim Kim has called a cycle of "panic, neglect, panic, neglect," whereby the terror created by a disease outbreak recedes, attention shifts, and we let our vital outbreak-fighting mechanisms atrophy.[1] The Independent Panel for Pandemic Preparedness and Response published its findings in May 2021, describing the COVID-19 pandemic as the 21st century's "Chernobyl moment" and making clear that if investment doesn't occur now, "we will condemn the world to successive catastrophes."[2]

While some are calling the COVID-19 crisis a 100-year event, we might come to see the current pandemic as a test run for a pandemic that arrives soon, with even more serious consequences. Imagine a disease that transmits as readily as COVID-19 but kills 25 percent of those infected and disproportionately harms children.

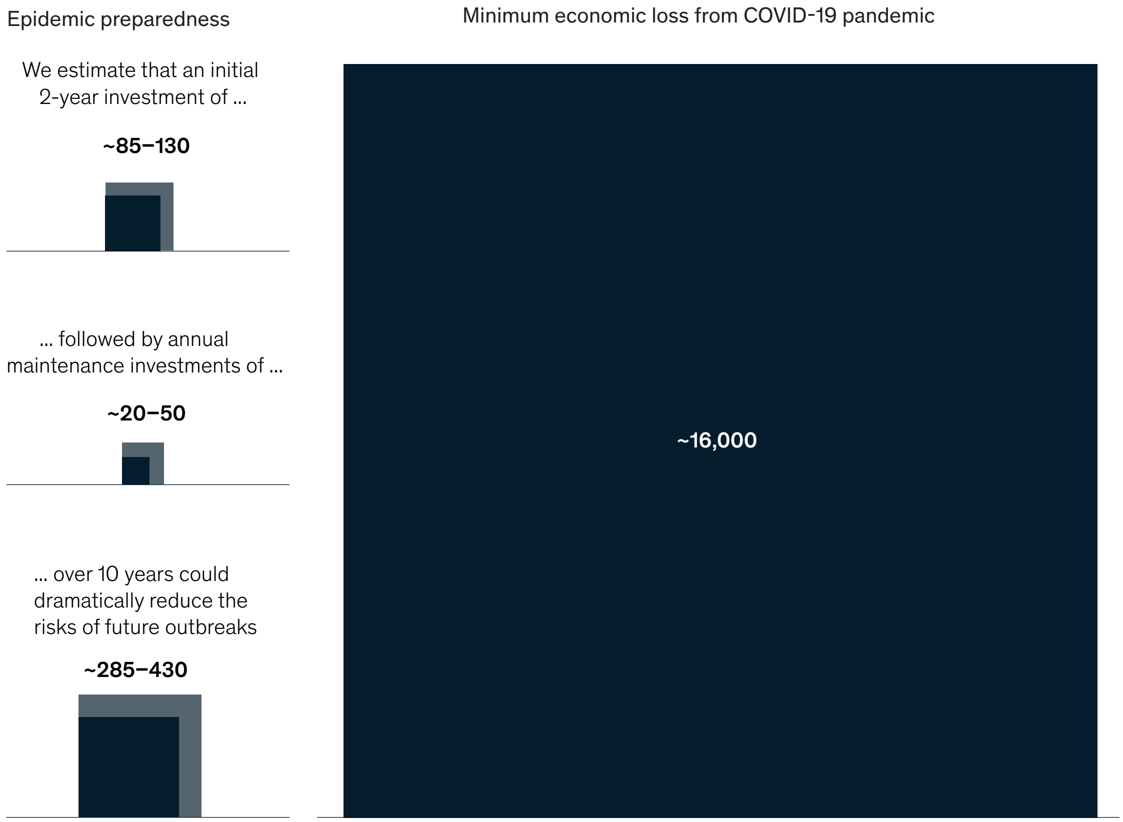
The business case for strengthening the world's pandemic-response capacity at the global, national, and local levels is compelling. The economic disruption caused by the COVID-19 pandemic could cost more than $16 trillion[3]—many times more than the projected cost of preventing future pandemics. We have estimated that spending approximately $85 billion to $130 billion over the next two years and approximately $20 billion to $50 billion annually after that could substantially reduce the likelihood of future pandemics (Exhibit 1). This equates to an average of about $5 per person per year for the world's population. Approximately 27 percent of this spend would take place at the global and regional

[1] Sophie Edwards, "Pandemic response a cycle of 'panic and neglect,' says World Bank president," Devex, April 5, 2017, devex.com.
[2] *COVID-19: Make it the last pandemic*, Independent Panel for Pandemic Preparedness and Response, May 2021, theindependentpanel.org.
[3] "Crushing coronavirus uncertainty: The big 'unlock' for our economies," May 2020, McKinsey.com.

Exhibit 1

Assuming a COVID-19-scale epidemic is a 50-year event, the return on preparedness investment is clear, even if it only partly mitigates the damage.

Estimated costs, $ billion



$5 per person per year could substantially reduce the likelihood of future pandemics.

levels, and about 73 percent would take place at the country level (8 percent in high-income countries and 65 percent in middle- and low-income countries).

These are high-level estimates with wide error bars. They include pandemic-specific strengthening of health systems but not the full health-system-strengthening agenda. Cost estimates will continue to evolve as new information emerges. We hope the overall message is clear: infectious diseases will continue to emerge, and a vigorous program of capacity building will prepare the world to respond better than we have so far to the COVID-19 pandemic.

In this article, we describe and estimate the cost of five areas that such a program might cover: building "always on" response systems, strengthening mechanisms for detecting infectious diseases, integrating efforts to prevent outbreaks, developing healthcare systems that can handle surges while maintaining the provision of essential services, and accelerating R&D for diagnostics, therapeutics, and vaccines (Exhibit 2). Details of the costing analysis are available for download on McKinsey.com.

We estimate that these five pillars of preparedness can be achieved at a total cost of $357 billion over 10 years (Exhibit 3).

From 'break glass in case of emergency' response systems to always-on systems and partnerships that can scale rapidly during pandemics

Responding to outbreaks of infectious diseases involves different norms, processes, and structures from those used when delivering regular healthcare services. Decision making needs to be streamlined; leaders must make no-regrets decisions in the face of uncertainty. But much of our present epidemic-management system goes unused until outbreaks happen, in a "break glass in case of emergency" model. It is difficult to switch on those latent response capabilities suddenly and unrealistic to expect them to work right away.

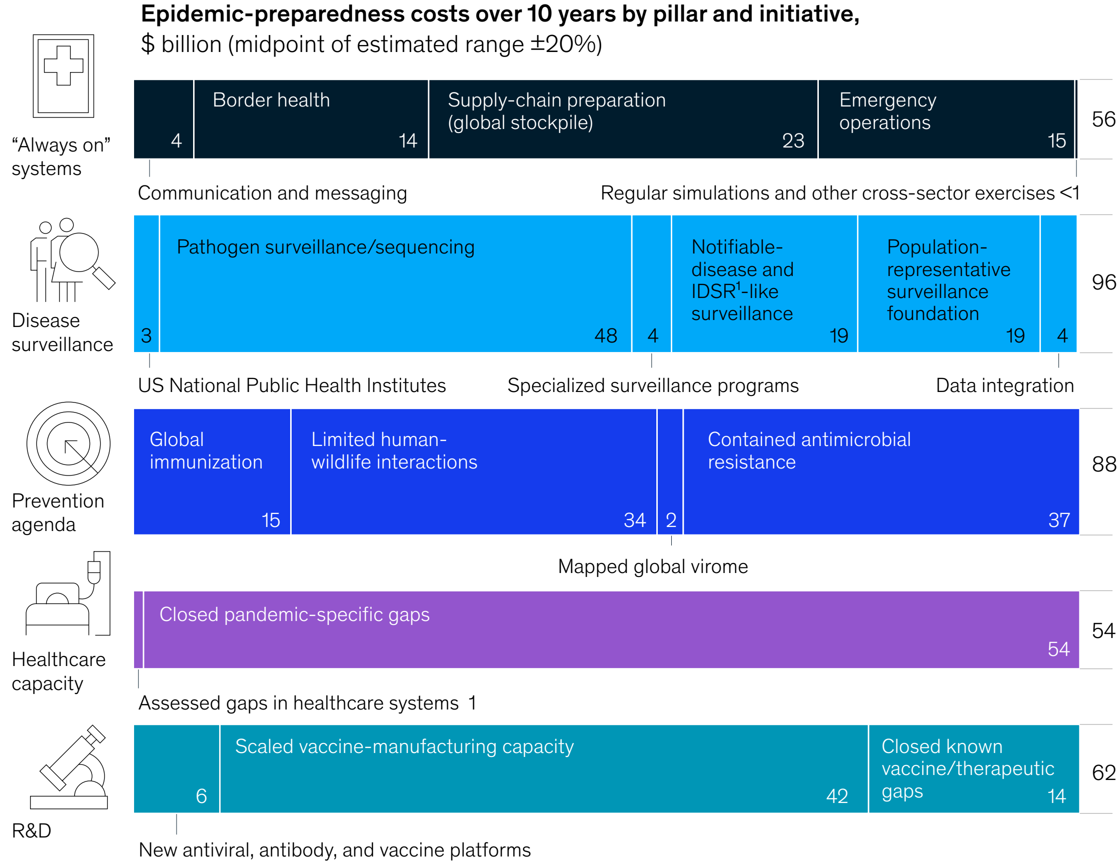
Exhibit 2

Five shifts in healthcare systems can help reduce the chance of future pandemics.

From	To	Rationale
"Break glass in case of emergency" response systems	"Always on" systems and partnerships that can scale rapidly during epidemics	Outbreak response is most effective when it uses regularly applied mechanisms
Uneven disease surveillance	Strengthened global, national, and local mechanisms for detecting infectious diseases	Effective detection capacity is needed at all levels
Waiting for outbreaks	Integrated epidemic-prevention agenda	Targeted interventions can reduce pandemic risk
Scramble for healthcare capacity	Systems ready to surge while maintaining essential services	Epidemic management requires ability to divert healthcare capacity quickly without lessening core services
Underinvestment in R&D for emerging infectious diseases	Renaissance in infectious-disease R&D	Response to COVID-19 pandemic has shown speed possible in moving against infectious diseases when motivated

Exhibit 3

Five pillars of preparedness can be built for $357 billion, in our estimate.



Note: Figures may not sum to listed totals, because of rounding.
[1]Integrated Disease Surveillance and Response (framework from US Centers for Disease Control and Prevention).

A better system might be founded on a principle of active preparedness and constructed out of mechanisms that can be consistently used and fine-tuned so they are ready to go when outbreaks start (Exhibit 4). We see several means of instituting such an always-on system. One is to use the same mechanisms that we need for fast-moving outbreaks (such as COVID-19) to address slow-moving outbreaks (such as HIV and tuberculosis) and antimicrobial-resistant pathogens. Case investigation and contact tracing are skills familiar to specialists who manage HIV and tuberculosis. But few areas have deployed their experts effectively in responding to the COVID-19 pandemic.

Both the public and private sectors have played major roles in the response to the COVID-19 crisis, but collaboration has not always been as smooth as it might have been if collaboration channels had been preestablished. There have been notable exceptions, including collaborations to increase access to ventilators.[4]

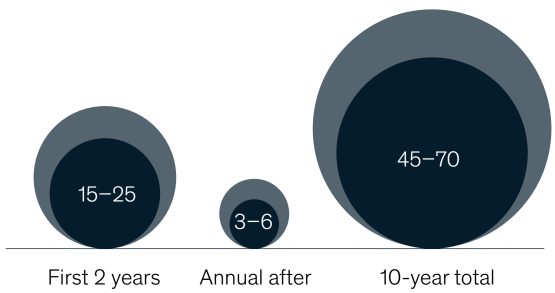
The principle of active preparedness might also lead governments to strengthen other aspects of pandemic response. For example, the past year has highlighted gaps in the manufacturing and stockpiling of personal protective equipment, the sharing of information with the public through

[4] "Special bulletin: Public-private effort launched to help distribute existing ventilators to high-need areas of the U.S.," American Hospital Association, April 14, 2020, aha.org.

Exhibit 4

Building 'always on' epidemic-management systems means they are ready as soon as outbreaks start.

Summary of estimated epidemic-preparedness initiatives and investments, $ billion



- Support epidemiological-response capacity
- Maintain robust medical-supply stockpiles and emergency supply-chain mechanisms
- Conduct regular outbreak simulations and cross-sector preparedness activities
- Improve communications and messaging
- Implement effective public-health responses at points of entry

Source: Gavi, the Vaccine Alliance; Georgetown University; Global Virome Project; National Academy of Medicine; *Nature*; *The Lancet*; US Centers for Disease Control and Prevention; World Bank; World Health Organization; World Organisation for Animal Health

risk-communication systems, and the different stakeholders' capability of maintaining border health at points of entry. Predefining response roles for different stakeholders at the global, national, and local levels is also an important part of active preparedness, since well-defined roles prevent delays and confusion when an outbreak occurs.

Last, governments can keep outbreak preparedness on the public agenda. Iceland offers an example of how to do that effectively. Since 2004, the country has been testing and revising its plans for responding to global pandemics. Authorities there also encourage the public to take part in preparing for natural disasters. The government's efforts to heighten public awareness of the threat posed by infectious diseases and to engage the public in the necessary response measures aided the country's successful always-on early-response systems to the COVID-19 pandemic.

To build always-on systems around the world, an up-front two-year investment of $15 billion to $25 billion and ensuing annual investments of $3 billion to $6 billion (for a ten-year total of $45 billion to $70 billion) would go into the following areas:

— supporting epidemiological-response capacity with emergency operations centers (EOCs) that function during all types of major crises

— maintaining robust stockpiles of medical supplies and emergency supply-chain mechanisms at the subnational, national, or regional levels (depending on the setting)

— conducting regular outbreak simulations and other cross-sectoral preparedness activities

— strengthening communications and messaging through established risk-communication systems, internal and partner communication and coordination, public communication and engagement with affected communities, dynamic listening, and rumor management

— ensuring national border health by establishing routine capabilities and effective public-health responses at points of entry

From uneven disease surveillance to strengthened global, national, and local mechanisms to detect infectious diseases

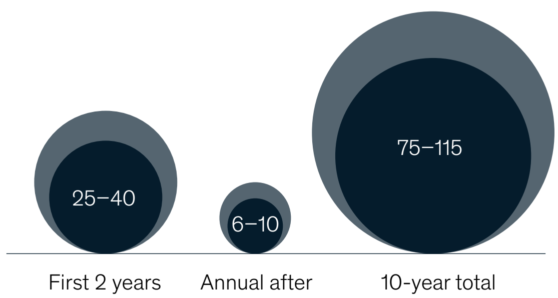
Retrospective analysis shows that SARS-CoV-2 was circulating in a number of countries well before it was first recognized. Failures to detect the disease meant that chains of transmission had been firmly established before countries began to respond.

Such problems occur in part because disease surveillance is often based on old-fashioned practices: frontline health workers noticing unusual patterns of symptoms and reporting them through analog channels. Most countries are far from realizing the potential of data integration and advanced analytics to supplement traditional event-based surveillance in identifying infectious disease risks so that authorities can initiate efforts to stop individual chains of transmission. Data fragmentation has hindered the efforts to respond to the COVID-19 pandemic in many parts of the world (Exhibit 5). The past year has also highlighted the critical role that genomic sequencing can play in the management of outbreaks.

Exhibit 5

Strong disease-surveillance mechanisms help stop chains of transmission sooner.

Summary of estimated epidemic-preparedness initiatives and investments, $ billion



- Close gaps in foundational surveillance
- Build and maintain high-quality outbreak-investigation capacity
- Increase IDSR[1]-like surveillance of notifiable diseases
- Develop strong pathogen surveillance
- Support serosurveillance
- Strengthen data integration and analysis

[1]Integrated Disease Surveillance and Response (framework from US Centers for Disease Control and Prevention).
Source: Gavi, the Vaccine Alliance; Georgetown University; Global Virome Project; National Academy of Medicine; *Nature*; *The Lancet*; US Centers for Disease Control and Prevention; World Bank; World Health Organization; World Organisation for Animal Health

Stopping individual chains of transmission requires strong detection and response capabilities at the national and local levels. Those capabilities are important to have in place across the globe, especially in parts of the world where frequent human–wildlife interactions make zoonotic events (transmission of pathogens from animals to people) more likely. Many developing countries will need external funding and support to build up their disease-surveillance systems. Donor countries might think of their investments in those systems as investments in their own safety.

Recognizing that one country's infectious-disease threat is a threat to all nations—a lesson reinforced by outbreaks of SARS in Toronto, cholera in Haiti, MERS in South Korea, and Zika across the Americas—previous generations created the International Health Regulations (IHR) to promote cooperation and coordination on outbreak response. However, compliance with the IHR has been imperfect because countries may be reluctant to suffer the economic consequences of admitting to a major outbreak. Weak cooperation efforts were identified as a factor in the slow initial response to the West Africa Ebola outbreak. As the COVID-19 crisis continues, leaders are finding reasons to renew their commitments to global and regional mechanisms for coordinating outbreak responses—for example, through the proposed new international pandemic treaty, currently under discussion.[5]

Such an agenda might include closing gaps in population-representative foundational surveillance; strengthening notifiable disease, lab-based, and pathogen surveillance; and improving data integration and the use of data. An investment program of $25 billion to $40 billion for the first two years and $6 billion to $10 billion per year thereafter (for a ten-year total of $75 billion to $115 billion) would pay for the following:

[5] "Global leaders unite in urgent call for international pandemic treaty," WHO, March 30, 2021, who.int.

— closing the gaps in foundational surveillance, such as through civil-registration and vital statistics, sample registration systems, and mortality surveillance

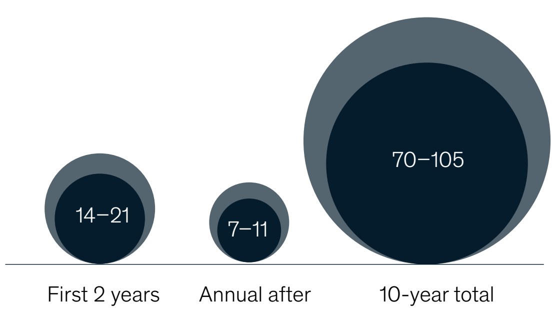
— building and maintaining high-quality, flexible outbreak-investigation capacity in all geographies: most countries have a field-epidemiology-training program of some kind, but many of them are underfunded and place their graduates onto uncertain career pathways; strengthening such programs is likely to be one of the most effective investments that a country can make in developing its outbreak-investigation capacity

— increasing the use of notifiable disease surveillance, such as the US Centers for Disease Control and Prevention's Integrated Disease Surveillance and Response framework

Exhibit 6

Outbreak prevention calls for new approaches to zoonosis, antimicrobial resistance, and immunization.

Summary of estimated epidemic-preparedness initiatives and investments, $ billion



- Reduce human–wildlife interactions
- Discover unknown zoonotic viral threats, including mapping global virome
- Limit antimicrobial resistance
- Close the global immunization gap

Source: Gavi, the Vaccine Alliance; Georgetown University; Global Virome Project; National Academy of Medicine; *Nature*; *The Lancet*; US Centers for Disease Control and Prevention; World Bank; World Health Organization; World Organisation for Animal Health

— developing strong pathogen surveillance, including through genomic sequencing

— supporting serosurveillance and vaccine-effectiveness monitoring

— strengthening data integration and analysis, such as by US National Public Health Institutes

From waiting for outbreaks to an integrated epidemic-prevention agenda

While we cannot prevent all epidemics, we can use all the tools in our arsenal to prevent those we can. Four approaches to doing so stand out: reducing the risk of zoonotic events by discovering unknown viral threats, reducing the risk of zoonotic events by limiting human and wildlife interactions, limiting antimicrobial resistance (AMR), and administering vaccines more widely (Exhibit 6).

Zoonotic events, in which infectious diseases make the jump from an animal to a human, touched off some of the most dangerous recent epidemics, including of COVID-19, Ebola, MERS, and SARS. Zoonosis can't be eliminated, but their occurrence can be reduced. Areas with high biodiversity and places where humans frequently encounter wildlife present the greatest risk of zoonotic events and therefore require special attention to and investment in research. Another root cause is ecosystem degradation, which makes zoonotic events more likely by increasing interactions between humans and wildlife. Scientists have estimated that a large portion of zoonotic-disease outbreaks can be linked to changes in agriculture, land use, and wildlife hunting over the past 80 years. Economic incentives, legal changes, and public education can lessen contact between humans and wildlife and help protect forests and wilderness areas, thereby decreasing the likelihood of zoonosis. There is also much more to learn about the threats we face through wider mapping of the viruses that exist in animal populations.

Limiting AMR—the evolution of pathogens to be less susceptible to antimicrobial agents—is another important way to prevent epidemics. AMR is a public-health crisis to be managed in its own right. It is also a potential accelerant of future outbreaks:

as pathogens become resistant, diseases that are currently controllable can spread more widely. Conveniently, managing AMR requires many of the same tools and techniques that support responses to acute outbreaks, including surveillance, case investigation, information sharing, and special protocols for healthcare settings. Efforts to improve AMR management, therefore, not only strengthen outbreak-response capabilities but also help prevent outbreaks in the first place.

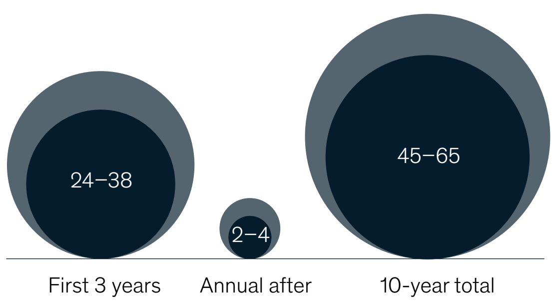
Finally, the unprecedented R&D effort that has been launched to develop a vaccine against COVID-19 serves as a reminder that we are not realizing the full benefit of existing vaccines. Recent outbreaks of measles, for example, show that places with lower vaccination rates are more susceptible to diseases that vaccines can prevent. Achieving full global coverage of all of the vaccines in our arsenal would save millions of lives over the coming decades. It will be especially important to jump-start immunization efforts after the current pandemic with catch-up campaigns for children who have missed scheduled vaccines.

The approaches we have described represent important steps toward preventing outbreaks. We estimate that it would cost approximately $14 billion to $21 billion for two years and then $7 billion to $11 billion per year thereafter (for a ten-year total of $70 billion to $105 billion) to limit human exposure to wild animals, map more of the global virome, slow the spread of AMR, and close the global immunization gap.

Exhibit 7

Local healthcare systems can be made ready to handle surges in demand while still delivering essential services.

Summary of estimated epidemic-preparedness initiatives and investments, $ billion



- Conduct assessments to highlight gaps in healthcare systems
- Target strengthening of health systems to address largest gaps

Source: Gavi, the Vaccine Alliance; Georgetown University; Global Virome Project; National Academy of Medicine; *Nature*; *The Lancet*; US Centers for Disease Control and Prevention; World Bank; World Health Organization; World Organisation for Animal Health

From a scramble for healthcare capacity to systems ready to surge while maintaining essential services

Exponential case growth during some phases of the COVID-19 pandemic has compelled officials in some countries to rapidly redirect much of their healthcare capacity to treating patients with COVID-19. The current challenges in India and elsewhere highlight the need to ensure that healthcare systems are prepared to respond to demand surges (Exhibit 7). Some gaps, such as the need for ad hoc conversions of spaces to care for patients with highly contagious diseases, have been common across many countries. Others, such as a lack of oxygen concentrators, have been especially acute in low- and lower-middle-income countries.

To prepare, health systems can establish plans detailing how capacity can be diverted to pandemic management and how additional capacity can be added quickly (for example, by converting nonmedical facilities to temporary healthcare facilities and by establishing field hospitals). Some places used existing plans of that type to respond to the COVID-19 pandemic; others created emergency plans during the outbreak. More can be done to codify and improve such plans. While universal healthcare is an important long-term goal, we consider only the portion of health-system-strengthening costs that are most relevant to pandemic preparedness. Tools such as Service Availability and Readiness Assessment (SARA) and joint external evaluations (JEEs) can help assess overall system readiness and identify the highest-priority needs for pandemic preparedness.

Surge-capacity plans for pandemics should account for the need to maintain essential healthcare services (Exhibit 8). It is becoming increasingly clear that the secondary impacts of the COVID-19 pandemic on population health are of a similar magnitude to those directly attributable to the disease. This is caused by crowded-out urgent-care resources for other conditions, delayed screening and health maintenance, and increased burden on mental health.[6]

Certain investments can help prepare healthcare systems to handle surges while delivering essential and routine services. An initial three-year outlay of $24 billion to $38 billion and yearly spending of $2 billion to $4 billion thereafter (for a ten-year total of $45 billion to $65 billion) would pay for the following actions:

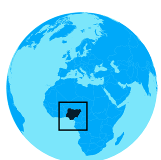
— conducting relevant assessments (such as SARA and JEEs) to highlight gaps and address the challenges identified in scaling health-care capacity

— strengthening health systems in targeted ways to prepare for future pandemics: while building resilient health systems around the world is a multidecade agenda, closing the largest gaps in care capacity offers disproportionate benefit (the total cost of building high-quality, resilient health systems will be far higher than the cost of closing capacity gaps and goes beyond the scope of the analysis presented in this article)

Exhibit 8

To mitigate the secondary health effects of public-health crises, health systems need to plan for surges and continuation of essential services.

Example secondary health effects of health crises



Under-5 mortality progress **stalled** during Nigeria's economic crisis in the 1980s and 1990s

The under-5 mortality rate had been dropping steadily prior to the crisis in the 1980s and 1990s, then stalled for 15 years before resuming a downward trajectory after the crisis

Immunization rates dropped after the 2010 earthquake in Haiti and subsequent cholera outbreaks

Low baseline coverage and temporary suspension of campaigns resulted in lowered DTP3 immunization coverage and a concurrent diphtheria outbreak

Maternal mortality increased across 3 West African countries during the 2014–16 Ebola crisis

Maternal mortality in Guinea, Liberia, and Sierra Leone was correlated with a decrease in skilled birth attendance and prenatal care, with additional disruptions in family planning

Deaths occurred **in excess of expected rates** across a number of states in the US during COVID-19 crisis

US Centers for Disease Control and Prevention estimated 5–10% excess deaths above expected baseline, excluding COVID-19-related deaths that were not fully attributable to the disease itself, with > 5,000 deaths in New York City alone at peak crisis

Source: Academic articles; expert/field interviews; ministries of health; news reports; US Centers for Disease Control and Prevention; World Bank data sets; World Health Organization

[6] "There have been 7m-13m excess deaths worldwide during the pandemic," *Economist*, May 15, 2021, economist.com.

From underinvestment in R&D for emerging infectious diseases to a renaissance

Humans have done more to overcome the threat posed by infectious diseases in the past 100 years than during the previous 10,000. The widespread availability of antibiotics allows us to manage most bacterial infections. HIV remains a serious condition, but it isn't usually an immediately life-threatening one for people with access to antiretroviral therapy, thanks to the innovations of the past 35 years. And the past decade has seen remarkable progress in our ability to cure hepatitis C.

However, important gaps remain. Public-health leaders have frequently called attention to the threat posed by emerging infectious diseases. Even before the COVID-19 outbreak, the pandemic threat posed by known pathogens such as influenza and by an unknown "pathogen X" was well understood.[7] The pace of innovation in antibiotics is not keeping pace with the increases in antimicrobial resistance. Current regulatory and incentive structures fail to reward innovations that can help counteract emerging infectious diseases or resistant bacteria. It is difficult for companies to project the financial returns from interventions for diseases that emerge sporadically and may be controlled before clinical trials are complete (as happened during the West Africa Ebola outbreak). That is especially true of interventions for diseases that mainly affect people in low-income countries.

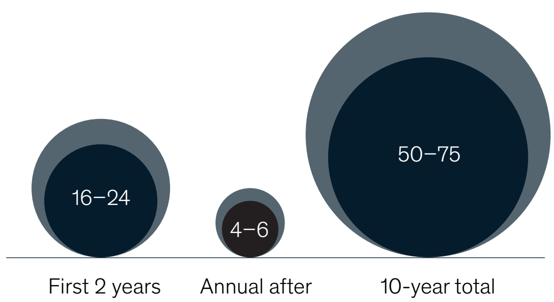
R&D efforts in response to the COVID-19 pandemic have been unprecedented. Vaccine-development records have been smashed, both for time to market and for the number of candidates advanced in a short period of time. The bar for vaccine development during a crisis has been raised: CEPI (Coalition for Epidemic Preparedness Innovations) has suggested that for a future pandemic, it may be possible to develop a vaccine within 100 days.[8] On a less positive note, the limits of what can be achieved through drug repurposing have become clearer. No one expects that we will go back to the prepandemic R&D model, but it will be important to ensure that the product-development lessons of the pandemic are fully internalized.

Building on the momentum created by COVID-19-related R&D, there is potential to spark a renaissance in infectious-disease R&D (Exhibit 9). The renaissance might focus on several necessities that the response to the COVID-19 pandemic has highlighted. One necessity is closing gaps in the tool kit to respond to known threats, such as influenza. A second is maintaining platforms that will allow us to respond rapidly to newly discovered diseases (as mRNA has done for SARS-CoV-2, for example). A third is sustaining the ability to manufacture billions of vaccine doses quickly to ensure equitable access to the fruits of innovation.

Exhibit 9

The efforts behind the COVID-19 response may start a renaissance in infectious-disease R&D.

Summary of estimated epidemic-preparedness initiatives and investments, $ billion



- Accelerate development of diagnostics, therapeutics, and vaccines against known threats
- Scale vaccine-manufacturing capabilities
- Invest in new vaccine, antibody, antiviral, and therapeutic platforms

Source: Gavi, the Vaccine Alliance; Georgetown University; Global Virome Project; National Academy of Medicine; *Nature*; *The Lancet*; US Centers for Disease Control and Prevention; World Bank; World Health Organization; World Organisation for Animal Health

[7] "Prioritizing diseases for research and development in emergency contexts," WHO, who.int.
[8] Kate Kelland, "Vaccine 'revolution' could see shots for next pandemic in 100 days," Reuters, March 10, 2021, reuters.com.

Delivering such necessities will require building on the early success of initiatives such as CEPI to reimagine product-development pathways, from funding models and collaboration platforms to regulatory review and access agreements. Spending $16 billion to $24 billion in the first two years and $4 billion to $6 billion per year thereafter (for a ten-year total of $50 billion to $75 billion) would fund these activities:

- closing gaps in vaccine and therapeutic arsenals against known threats, including influenza, for which effective R&D might yield significant advances

- scaling vaccine-manufacturing capabilities to produce 15 billion doses in a six-month period to provide sufficient coverage to immunize the global population

- investing in the development of new vaccine, antibody, antiviral, and therapeutic platforms against emerging infectious diseases

Bringing it all together

As we continue to respond to the COVID-19 pandemic, countries should make deliberate investments to reduce the chance of such a crisis happening again. We estimate that an initial global investment of $85 billion to $130 billion over the next two years ($40 billion to $65 billion per year), followed by an investment of $20 billion to $50 billion per year to maintain always-on systems, would significantly reduce the chance of a future pandemic. Those figures, totaling $285 billion to $430 billion over the next decade, include spending at the global, country, and subnational levels (Exhibit 10).

The playwright Edward Albee once said, “I find most people spend too much time living as if they’re never going to die.”[9] So it is with the global response to infectious diseases: we have spent too much time behaving as though another deadly pathogen won’t emerge. Outbreaks of SARS, MERS, Ebola, and Zika led to some investments in pandemic preparedness over the past 20 years, but few of them are the lasting, systemic changes needed to detect, prevent, and treat emerging infectious diseases. And now, even with all of humanity’s knowledge and resources, millions of people have been killed by a disease that was discovered less than 18 months ago. The COVID-19 pandemic won’t be the last epidemic to threaten the world. By taking action and funding changes now, we can better withstand the next one.

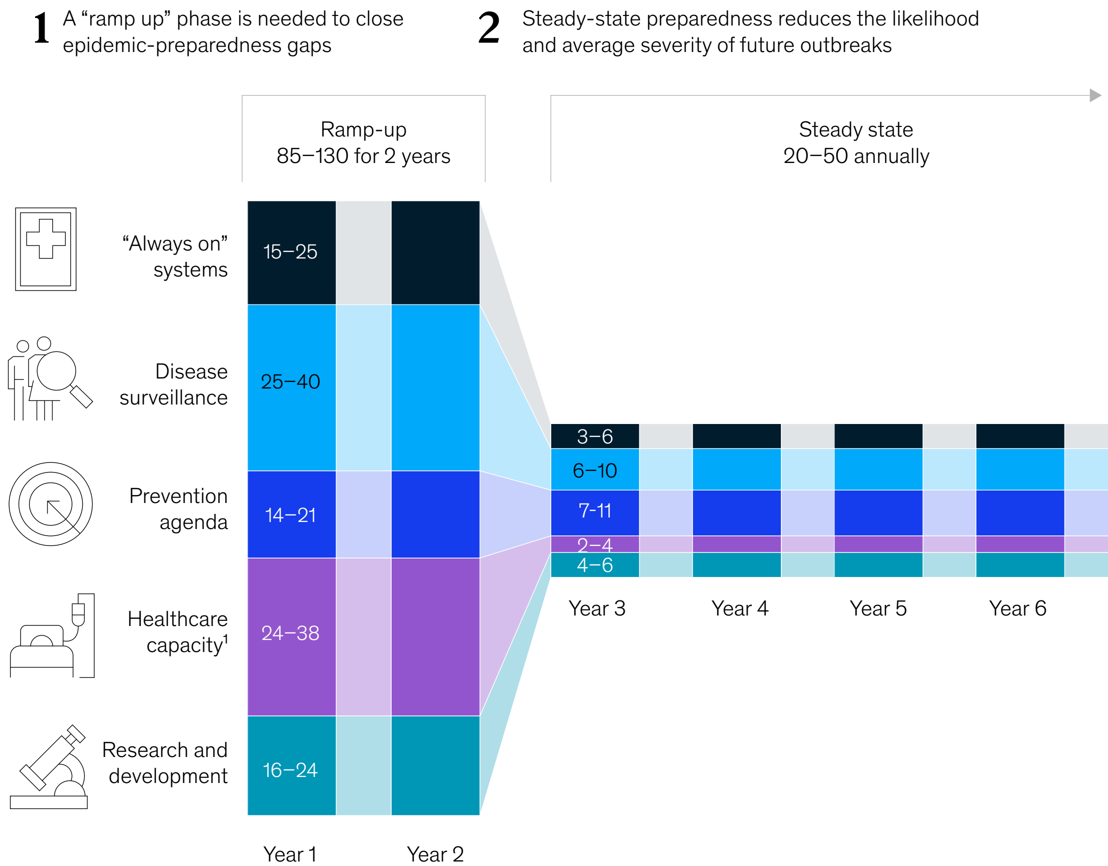
We have spent too much time behaving as though another deadly pathogen won’t emerge.

[9] David Richards, “Edward Albee and the road not taken,” *New York Times*, June 16, 1991, nytimes.com.

Exhibit 10

Funding for epidemic preparedness requires an up-front investment to close current gaps.

Illustrative funding needed to invest in epidemic preparedness, $ billion



[1]Initial investment in healthcare capacity takes place over 3 years.

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