

Accelerating the health economy of tomorrow

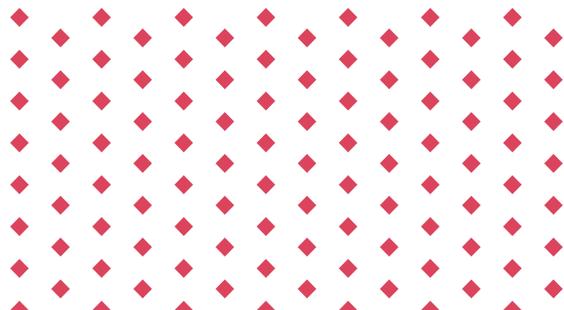
Transforming health systems and embracing innovation amid a pandemic



Heart of the matter



The COVID-19 pandemic brought to light the inextricable link between public health and the health of national economies. As it continues to unfold, the pandemic is not merely changing one aspect of health systems. Rather, it is changing their very nature and modus operandi. In fact, the pandemic is editing the DNA of health systems around the world by accelerating what we call the [New Health Economy \(NHE\)](#). The NHE is the transformation of healthcare into a modular ecosystem of delivery, innovation and wellness—all more closely tied to the consumer.



Outbreaks of infectious disease wreak profound human and economic damage—but often usher in significant innovation. Medieval communities developed local boards of health as they struggled with plague. Vaccines were invented to prevent smallpox infections. But the first major global pandemic of the 21st century presented a host of challenges. And by accelerating existing trends and spurring change, the COVID-19 crisis appears to be hastening the arrival of the future of healthcare.

Practically overnight, telemedicine has become the de facto medium of communication for clinicians and patients. Data analytics is proving to be the difference between life and death when it comes to planning resources, classifying patients and making strategic decisions. The novel coronavirus is rewriting the rules of the system so quickly that every health organisation will have to develop a framework that allows the organisation to [repair, rethink and reconfigure](#) so it can emerge

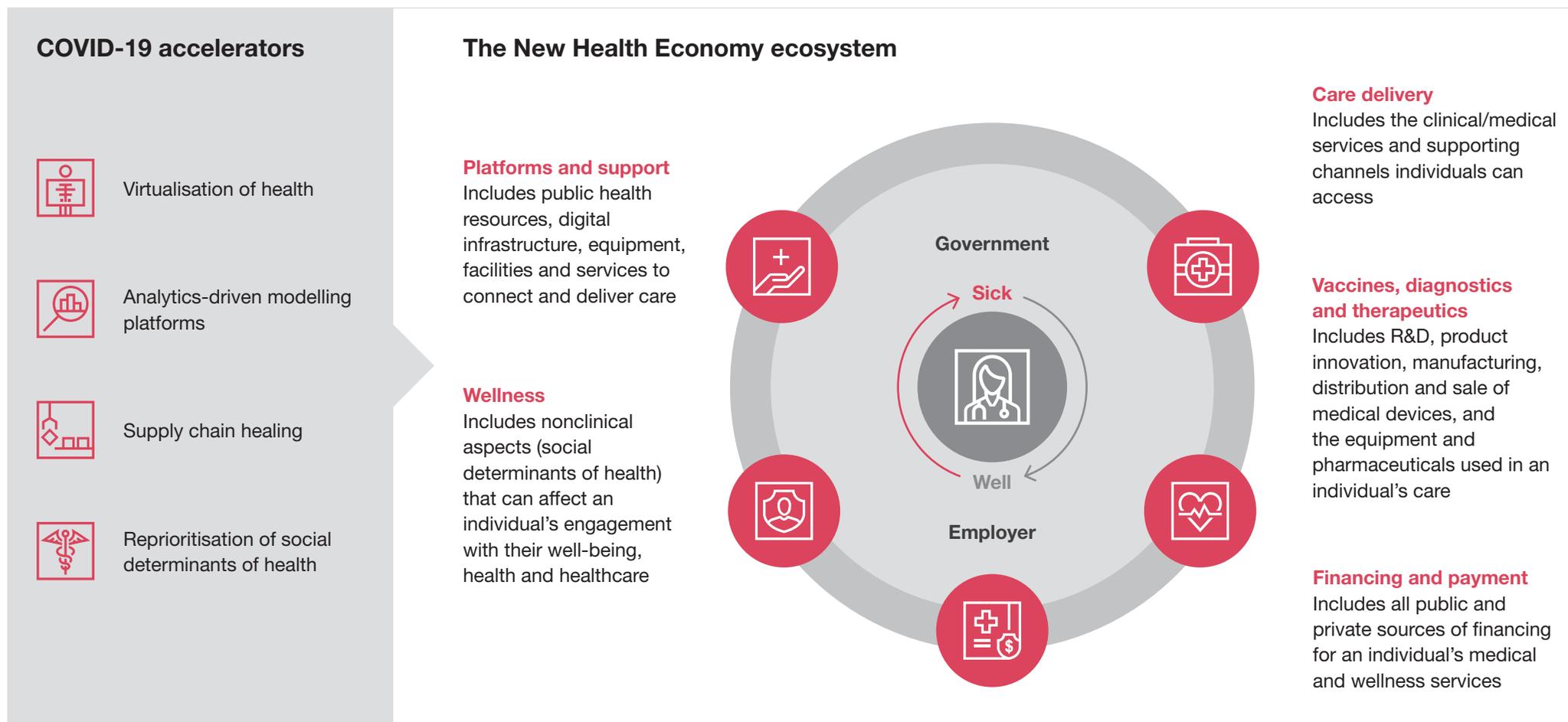
stronger. This is not a time to revert to the old ways of delivering healthcare. All the players in the vast global industry must create a new strategic identity for the future that enables them collectively to thrive in the New Health Economy.

The post-pandemic forces accelerating the New Health Economy

The pandemic has sped up forces such as telehealth, regulatory change and new delivery mechanisms driven by workforce shifts. New, emerging forces—such as the importance of addressing the social determinants of health and the rise of resilience as a core component of business processes—have the potential to add momentum to the reconfiguration of health systems (see Figure 1, next page).

Figure 1: The New Health Economy is being accelerated by the pandemic and post-pandemic planning

The elements of the NHE have been building towards a more interconnected health ecosystem. But the pandemic has increased the speed of the transformation.

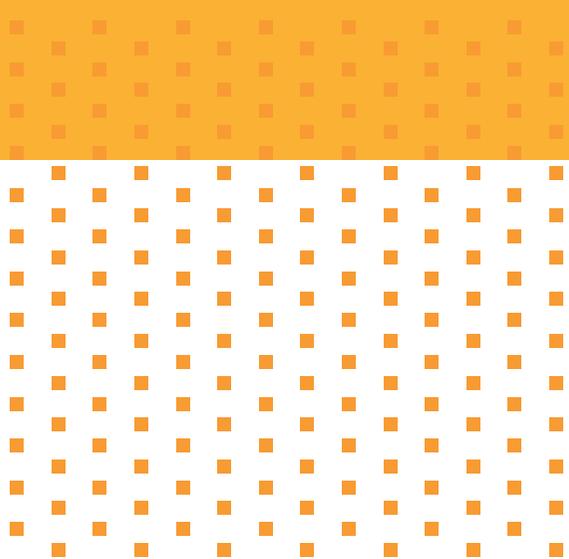


Note: Each module includes a distinct value chain, set of capabilities and regulations.

Source: PwC Health Research Institute analysis of COVID-19 accelerators of the New Health Economy ecosystem, which was first published in *Surviving seismic change: Winning a piece of the \$5 trillion US health ecosystem*, PwC's Health Research Institute, Sept. 2016

Virtualising health

Beyond telehealth to diagnostics, delivery and therapeutics



For more than 50 years, professionals have been using communications technology to bring healthcare to remote areas. Even as connectivity grew exponentially, telehealth enjoyed only incremental growth over the decades. An Ipsos survey of primary care physicians from 21 countries conducted just before the pandemic struck found that only 27% were using telemedicine, despite the proliferation of smartphones and new payment strategies from governments, private insurers and employers that are aimed at increasing access.¹

By shutting down physical gathering places, COVID-19 drove a host of services that previously had been conducted in person into digital spaces. The coronavirus erected walls at major healthcare access points. In Scotland alone, video healthcare visits increased by 1,000% in the weeks following the epidemic's onset.² Ping An Good Doctor, a Chinese mobile telemedicine platform,

reported in February that the number of newly registered users had grown tenfold since COVID hit.³ An April 2020 PwC survey of 27 entrepreneurs and investors from German digital healthcare start-ups found that 80% had seen an increase in how frequently customers used their products, as well as a big jump in new customers.⁴

At-home diagnostics and remote-monitoring tools were rolled out more aggressively during the pandemic. For example, the US Food & Drug Administration (FDA) in May issued an emergency use authorisation for the remote heart monitor patch from G Medical Innovations for patients being treated for coronavirus with drugs that can affect cardiac function.⁵ In June, the UK's National Health Service teamed up with the London-based health technology company Huma to provide remote monitoring for COVID-19 patients.⁶

The touchless concept, long employed in the financial services sector, began to take hold in healthcare to reduce the need for physical contact with surfaces and people. Long resistant to digital channels, pharmaceutical and medical-device sales representatives had to figure out how to support clinicians' needs remotely, including physician training and patient education.^{7, 8}

Taken as a whole, these changes are advancing a different approach to patient care. Consumers, who are primarily at home, sit at the centre of the experience, and the industry adapts to serve their needs. The embrace of virtual care holds the promise of a shift from the traditional episodic model of care to one that is continuous and engages consumers when they are not directly interacting with the health system. Such a continuum-of-care model enables health systems to proactively engage high-risk patients virtually, rather than cancel appointments.

What will health system DNA edits look like?

- **Telehealth explosion continues:** Increased consumer demand will prompt public and private providers and payers to rethink the care model and decide which services to deliver in person and which should be virtual. Pharmaceutical and life sciences companies will invest in technological changes to facilitate the digital care revolution.
- **Home diagnostics and wearables spread:** Mobile devices will connect the health system to patients where they live. The disproportionate risk the coronavirus poses for older patients will increase use of remote continuous patient-monitoring tools



for this population, which typically has higher rates of chronic illnesses. Remote patient monitoring will allow providers to release hospitalised patients sooner. Services that support consumers with the technology required for remote care, such as home diagnostics, will grow in popularity.

- **Life sciences R&D and clinical trials go remote:** The pandemic will accelerate the shift to recruiting patients online, using artificial intelligence to make

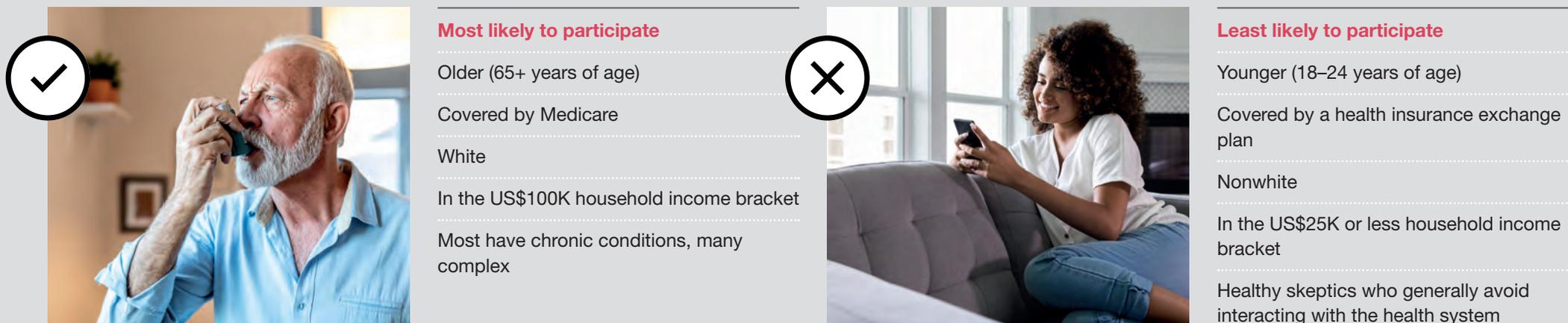
communication and scheduling more convenient, and moving trial sites closer to consumers. These changes must be coupled with efforts to attract a more diverse pool of candidates to clinical trials (see Figure 2).

- **Virtual workforce expands:** Healthcare organisations will adopt new workflows, train existing staff on necessary skills for increasingly digital roles and hire talent from outside industries with expertise in virtual customer experiences.^{9, 10} Many health organisations

will keep a portion of their administrative staff working from home permanently and reduce or reconfigure their real estate footprints. Organisations will have to re-engineer their culture to maintain connection and engagement with distributed workforces.

Figure 2: Virtual trials may gain appeal in the wake of COVID-19

Would you be more or less likely to participate in pharmaceutical research for a COVID-19 treatment if you were able to participate in the clinical trial from your home?



Source: PwC's Health Research Institute, COVID-19 Consumer Survey, 2–8 April 2020, of US adults

Data and analytics

Building capabilities to connect consumers and health providers, and develop scenario planning

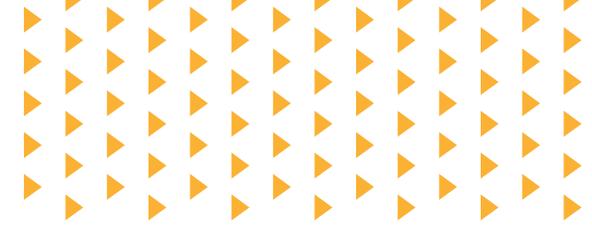


In the New Health Economy, data analytics and data insights help deliver the right care at the right time, at the right place and to the right person. The pandemic laid bare the challenges faced by the world's health systems to collect accurate real-time data, model scenarios and ultimately make decisions on where and when to place resources. Infection curves, mortality scenarios, and need estimates for ventilators and personal protective equipment (PPE) were in short supply in the early stages of the pandemic.

Private industry, governments, independent organisations and universities responded rapidly. Digital COVID-19 dashboards—such as UpCode Academy's Singapore-focused tool and Johns Hopkins University's [global tracker](#)—quickly sprang up and began providing timely data, including disease incidence, recovery and death rates, that continue to be critical to the pandemic response.

In April, Google and Apple introduced a Bluetooth-enabled, voluntary contact-tracing app that dozens of countries have adopted.¹¹ The Institute for Health Metrics and Evaluation, an independent health research centre at the University of Washington, unveiled a tool in September that offers global and country-specific scenarios on COVID daily death rates, infections and testing, hospital resource use, mask use and social distancing.¹²

Healthcare organisations, some with help from tech companies, turned to data and analytics to hone their pandemic response. In April, Swedish Health Services in Seattle, Washington, and Microsoft introduced the COVID-19 Emergency Response App, which enables frontline hospital workers to use mobile devices to report up-to-the-minute information on COVID-19 patient volumes, occupancy, ventilator utilisation and PPE management across the organisation's multiple locations.¹³ The US academic medical centre Cleveland



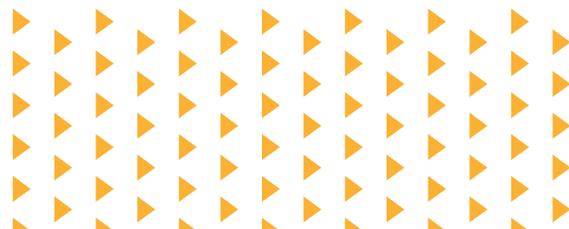
Clinic and global data analytics company SAS created and made widely available models that help hospitals dynamically forecast patient volume, bed capacity and ventilator availability, using worst-case, best-case and most-likely scenarios.¹⁴

Early in the pandemic, Austin Health, a major teaching public hospital just outside Melbourne, Australia, working with Microsoft data and analytics partner Arden Street Labs, developed AI-enabled solutions that informed its community response, helped with resource allocation and improved patient care.^{15, 16} A voluntary self-assessment tool that allowed people to input their symptoms advised more than four out of five users that they did not need to go to the hospital, thus preventing misuse of valuable resources and reducing unnecessary COVID exposure. For patients convalescing at home, the teaching hospital began offering an online monitoring programme with an app able to analyse audio recordings using AI and machine learning techniques to detect shortness of breath.

More robust telehealth platforms are providing new opportunities for partnerships that enable healthcare organisations to meet consumer demand while benefiting from the insights that data-savvy players can provide. Google Cloud and US telehealth provider Amwell in August announced a strategic partnership that will

apply Google's AI and data analytics capabilities to Amwell's telehealth offerings—creating a remote health platform that is easier for patients, providers and payers to navigate.¹⁷ Just two months later, US firms Teladoc Health, which has an international presence, and Livongo completed their merger, enabling them to provide a platform that combines televisits and chronic disease management, and is powered by data science and AI.¹⁸

Before the pandemic, healthcare organisations had begun to grasp—and sometimes use—the power of artificial intelligence and prescriptive analytics to enable insights that are predictive on the community level (in health, consumer and economics dimensions) and at the company level (in strategic, financial and operational terms). The critical role these tools have played during the pandemic will accelerate the trend. Health systems, payers, and pharmaceutical and life sciences companies increasingly will invest in developing their own analytics capabilities or in companies with healthcare platforms or with data skills that provide such insights.



What will health system DNA edits look like?

- **Communication moves from transactional to continuous:** More health systems on their own or via partnerships will start connecting data about patient encounters and the preferences and social circumstances shaping everyday health- and healthcare-related decisions. And they will use that information to provide a more seamless, customised experience and stay connected to patients between encounters.
- **Resources matched to needs:** Scenario planning and modelling systems will find broader applications that help target resources to areas of need more effectively. On-the-ground tools that provide real-time information on patient volumes, occupancy, staffing, supplies and other metrics to inform hospital decision-making will grow in popularity. The continued growth of virtual healthcare will offer more flexibility to match clinician supply with patient demand.
- **Alternative players make headway:** Data-savvy existing or new virtual health- or retail-focused players with deep pockets and an appetite for risk will deliver patient care experiences that are easy to navigate and offer more seamless care. These players will offer consumers an alternative to traditional provider systems and will be able to reach patients in areas underserved by traditional players.
- **Players address interoperability blockers:** One of the biggest barriers to effective use of data is the inability of information systems to talk to one another. Growing demand from consumers for tech-enabled care and from healthcare players who need data access to improve care and operations will force regulators to set and enforce interoperability standards.



Healing the supply chain

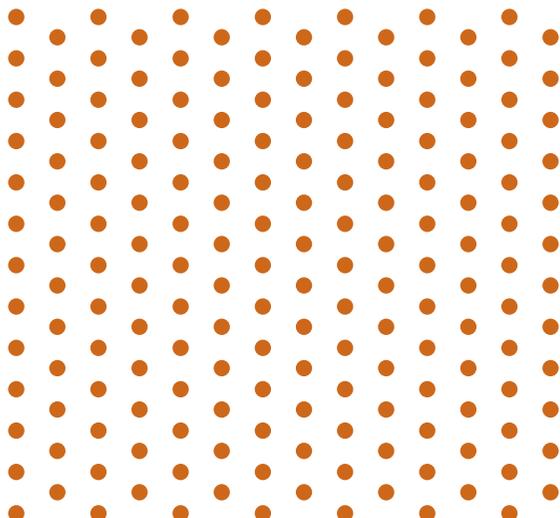
Rethink resilience and add strength through collaboration



The pandemic has revealed one area of neglect in the New Health Economy: the global web of nodes for the movement of drugs, medical supplies, technology and innovation. The medical supply chain's reliance on offshore manufacturers, many located in China and India, for active pharmaceutical ingredients, generic drugs, and medical and basic supplies caused panic worldwide as borders closed and access was restricted. The shortage of PPE was particularly troubling because it exposed frontline workers and patients to undue risk of COVID-19. Healthcare providers had to scramble to find new PPE sources, with some providers forging relationships with nontraditional vendors that adapted their facilities to make items such as masks and face shields.¹⁹

In the first months of the pandemic, insufficient COVID test supplies, especially swabs, and ventilator shortages hampered testing and treatment before alternative sources could be found or developed and production at existing suppliers was increased.^{20, 21, 22}

Despite the early disruptions, the life sciences industry responded quickly to determine whether existing pharmaceuticals could improve outcomes for COVID patients and to work on therapeutic candidates and vaccines.²³ The severity of the crisis sparked an unprecedented level of government cooperation and collaboration with the industry in many countries. Regulatory bodies were more nimble than usual in allowing emergency use, expedited reviews and substitutions.²⁴ As the innovation components of the supply chain accelerated, vaccines and therapeutics entered the development pipeline quickly. The urgency of the crisis has prompted many companies with COVID vaccine candidates to take on major risk by manufacturing millions of doses and expanding or building distribution networks—some of which require ultra-cold storage—before knowing whether their products will gain approval.



While initial fears that people would lose access to critical medications didn't materialise, the pandemic revealed supply chain weaknesses. Many drugs that are critical for coronavirus patients—including sedatives for intubated patients and asthma medications—remain in short supply.²⁵ The life sciences industry is under pressure to create a stronger, more agile and more resilient supply chain.²⁶ For life sciences companies to collaborate quickly, they will need to share information and invest in relationships with one another, nongovernmental organisations and governmental entities. Pharmaceutical companies should leverage the closer working relationships they forged with regulators during COVID as they develop solutions and to counter pressure to centralise the supply chain.

What will health system DNA edits look like?

- **Access to real-world data is preferred:** Regulatory bodies, the delivery system and consumers will rely on nontraditional data for just-in-time diagnostics, drugs and treatments. Access to consumer data and data analytics capabilities will be an advantage. “Traditional data sources, such as claims, only tell us a small part of the patient story,” said Vipin Gopal, chief data and analytics officer at Eli Lilly and Co., in an interview with PwC's Health Research Institute.²⁷

“Digital solutions enable us to understand the patient in a much deeper fashion, paving the way for personalised patient engagements and improved outcomes.”

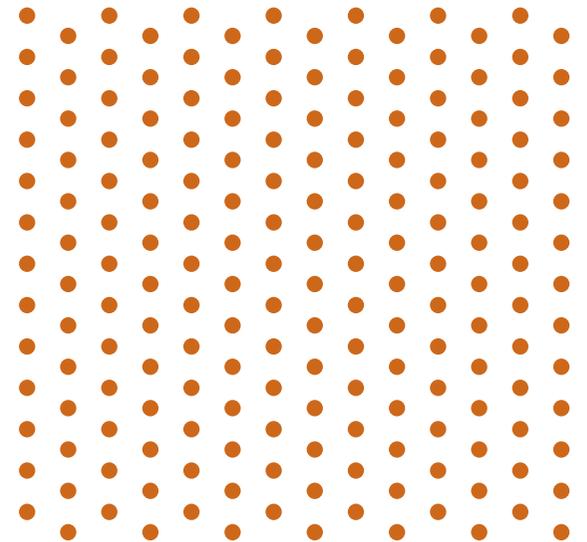
- **'Glocalisation' takes off:** Life sciences companies will develop multiple global nodes, some closer to home, for production, supplies and inputs, so they can reduce risk from natural disasters, pandemics, trade conflicts and other disruptions. The sector will look more closely at the possibility of data sharing standards to allow for cross-industry collaboration where commercially appropriate, which will help companies make better use of existing capacity across the industry.
- **Governments and consumer advocates seek transparency and security:** Life sciences supply chains will face increased pressure for more reporting on and transparency about the inventory of active ingredients, in-process goods and finished goods. Many governments will invest to ensure sufficient supplies of critical medicines for public health emergencies. Such efforts could come in the form of national stockpiles and, as is the case in the US, public funding for a private-sector initiative to build in-country production capabilities for priority drugs and their active ingredients.²⁸





- **Manufacturing innovations gain momentum:** Pressure will build for governments and industry to invest in advanced manufacturing methods, including continuous pharmaceutical manufacturing and modular manufacturing, and 3D printing, to streamline production of active ingredients, finished drugs, and medical supplies and devices, and to lower their manufacturing costs.^{29, 30, 31} The private-sector team awarded the US\$354m government contract in May to expand US-based production of critical medications will use advanced manufacturing processes and conduct technology transfers of novel continuous manufacturing processes to designated organisations or businesses.³² The industry will leverage this massive investment and the lessons learned to respond more efficiently and effectively to future infectious disease outbreaks.³³

- **Analytics and collaboration move to the forefront:** Manufacturers will take advantage of existing software tools to help model the COVID vaccine supply chain and identify the best distribution systems. Ideally, they will collaborate with providers, pharmacists and other players to share data in a virtual feedback loop so as to forecast demand and enable just-in-time vaccine delivery. Investments in advanced analytics will prevent medication shortages and spoilage, and improve manufacturers' ability to deliver the right treatment to the right patient at the right time and in the right place. Connecting data across vaccination, diagnostic and contact-tracing efforts will speed up the exit from lockdowns and other restrictions.



Reprioritisation of social determinants of health

Front and centre



It's widely accepted that 80% of a person's health is attributed to socioeconomic, environmental and behavioural factors that lie outside the realm of traditional healthcare.³⁴ The pandemic and the resulting economic downturn have worsened the most common social determinants of health. Increased stress, job loss or insecurity, lack of exercise and reduced access to nutritious foods are among the issues that have spiked for people during the pandemic.³⁵

Feelings of isolation and loneliness have become a major social factor affecting health and have magnified what was already a pressing social issue—worldwide, nearly 1 billion people have a mental disorder, and the global economy loses about US\$1tn every year in productivity due to depression and anxiety.^{36, 37} In an April survey of 1,558 employed or recently employed people in the US and Canada, 47% reported that COVID had negatively impacted their mental health.³⁸

People born into communities that lack adequate education, employment, sanitation, food or transportation have health and life expectancies that are much lower than average. COVID has widened the social and health disparities. A World Health Organization survey conducted between June and August in 130 countries found that more than 80% of high-income countries deployed telemedicine and teletherapy to counter the disruption in mental health services, yet less than 50% of low-income nations did so.³⁹ Because people from lower socio-economic backgrounds are more likely to work in essential services, they were more likely to be exposed while on the job, or travelling to and from work. In many countries, racial and ethnic minority communities, in particular, have fared the worst during the pandemic.⁴⁰

Health systems cannot solve these complicated, entrenched social problems on their own. Collaboration among healthcare organisations, businesses, governments, charities and social institutions will be essential. It became clear that governments and health organisations, including the pharmaceutical industry, must have the capability to interact with people and their communities directly.

What will health system DNA edits look like?

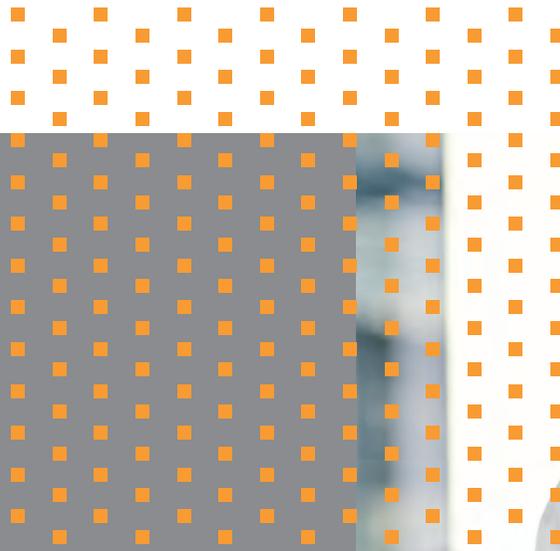
- **Mental health moves to the front:** Companies' growing awareness of the importance of employee mental health combined with increased demand means that healthcare providers that offer comprehensive mental health services will be more competitive. Consumers' growing acceptance of telehealth will push employers to offer virtual mental health services and providers to build their own programmes or connect with companies with digital mental health platforms.
- **Data provides a window into social determinants of health:** Providers, payers and digital health players have access to massive amounts of data. Using these systems to collect and then analyse social determinants of health data will enable providers and payers to connect the dots between patients' circumstances and their health outcomes and to build targeted interventions that improve patients' health and lower the healthcare spend.
- **Health systems connect to the social system:** Sending someone home from the hospital without adequate support, housing, nutrition and home care may be a boomerang back to the same health problem. With COVID and the economic downturn eroding social

supports, healthcare organisations will step up efforts to partner with governments, businesses, charities and social institutions to address social factors affecting their patients' health. Integration of health and social systems through technology, data sharing, and shared communication and planning will be crucial. Investment in areas such as social supports and affordable housing produces positive economic and health outcomes.

- **The life sciences view expands beyond supporting patient services:** Historically, the pharmaceutical and life sciences industry has viewed social determinants as barriers to medication adherence. This narrow view will begin to expand. Industry leaders will use their data and reach to bring wellness to underserved communities and to better connect social and health services with wellness, digital therapeutics and nutraceuticals, and not just sick care.
- **Community organisations connected to their constituents have the most access and trust:** Health systems will provide invaluable information on their own and often in partnership with trusted community groups to educate consumers on the coronavirus itself and how to protect themselves from infection. This work will position such groups as a trusted source of information for consumers on other health matters and in the event of future health crises.



The modular ecosystem



The modular ecosystem

The pandemic has revealed gaps in our systems. The asymmetry of health and social status made it more difficult for some to shelter in place than others. The polarisation of governments and their people on how to react to the pandemic and how resources would be distributed within and between nations revealed the difficulty of creating a shared response. Underlying health vulnerabilities meant that the demographics of age, health status and income could be destiny, resulting in severe sickness and even death.

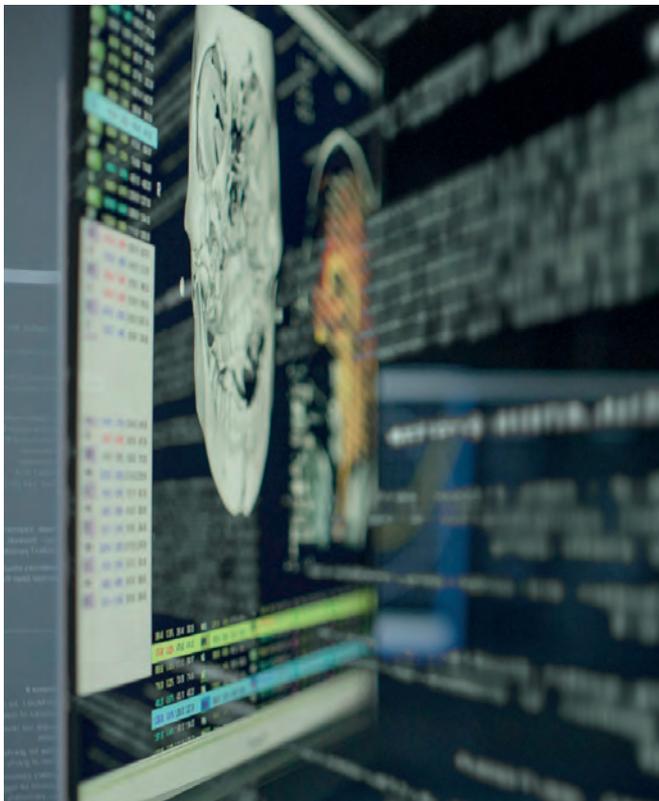
Regardless of how long the pandemic lasts, and how robust the economic recovery is, COVID-19 has been a catalyst for disruptive and transformative change to healthcare systems (both on the supply and demand sides). Addressing the challenges and benefiting from the

disruption can continue if health leaders take bold action now to embrace new ways of working and build trust with consumers.

The trends we described in the previous sections, taken together, start to inform possible new elements of healthcare systems in a post-pandemic New Health Economy. Depending on the level of adoption, the new DNA structures could lead to several possible end-state scenarios.

Rise of the digital platforms

With the accelerating growth in technology fuelled by the seismic shift in consumer demand, new virtual healthcare players with advanced data analytics know-how emerge in the market and existing players gain strength. These companies provide integrated consumer-



centric and seamless offerings with better access points and member-focused care. Pharmaceutical and life sciences companies, payers and health systems are expected to partner with these firms to drive a shift in their cost structure and create a differentiated offering in the market. These partnerships enable a broader focus on personalised population health, including behavioural health and public health interventions.

Digital orchestrators

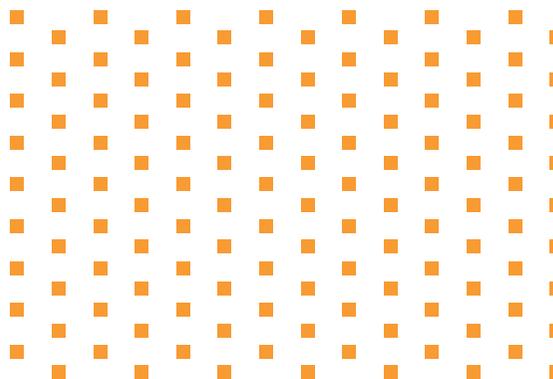
New entrants, including major technology players from other industries with large pockets and risk appetite, are entering the market and disrupting care delivery. They simplify the whole patient experience by using data and technology tools to improve care processes, better understand patient preferences and needs, and efficiently manage human resources and supplies. These digital orchestrators have the potential to siphon off profit from traditional providers.

Incumbent-led virtually integrated clinical experiences

Health systems continue to reorient care delivery around the consumer. Pharmaceutical companies are expected to create consumer access platforms for remote clinical trials and R&D, and to develop connected patient solutions, such as apps, that help people manage specific conditions. Health systems will continue to build digital capabilities and infrastructure to help reduce overall utilisation through virtual care delivery and improved primary care.

Combining public-private models of care

The high cost of healthcare and the inequities in public health interventions and preparedness are expected to lead to governments expanding partnerships with private organisations to help manage population health and social determinants. New players are expected to emerge to help accelerate interoperability and make data more accessible to manage broader population health.





The no-regrets moves that can edit the DNA of your health organisation and prepare you for the New Health Economy

Pharmaceutical and life sciences companies

- **Have virtualisation permeate the whole organisation:** Automate education, marketing and promotion, and intentionally design high-performing virtual brand, R&D life cycle, clinical study and special projects teams.
- **Rethink real productivity of investment:** Zero-based budgets move incremental cuts and investments to rethinking and redirecting to encourage faster strategic change.
- **Digitise patient and provider support:** Invest in new infrastructure, including digital therapeutics, to help serve patients and providers in a virtual environment, being mindful not just about content but also the customer experience. Forge partnerships with health systems to integrate digital therapeutics into clinical workflows in electronic medical records.

Payers

- **Double down on interoperability:** Promote information sharing among the various players from health research through to delivery.
- **Enable remote operations:** Accelerate redeployment of infrastructure to distributed and remote work.
- **Enhance modelling and projection capabilities:** Build next-generation modelling capabilities that can interconnect health and consumer data to target specific groups with communications, and direct them to the right sites for care or social services.
- **Build digital capacity:** Create vertical or virtual integration or partnership with digital companies to help develop a positive consumer experience.

Providers

- **Redesign the patient experience:** Extend into a post-pandemic world with a heavily virtual system that can address chronic care and more complicated conditions. Coordinate care seamlessly between virtual and physical settings. Make sure the referral model connects consumers to ancillary services.
- **Redeploy resources and workforce to virtual health:** Now is the time to build primary care teams of the future and enable them with technology.

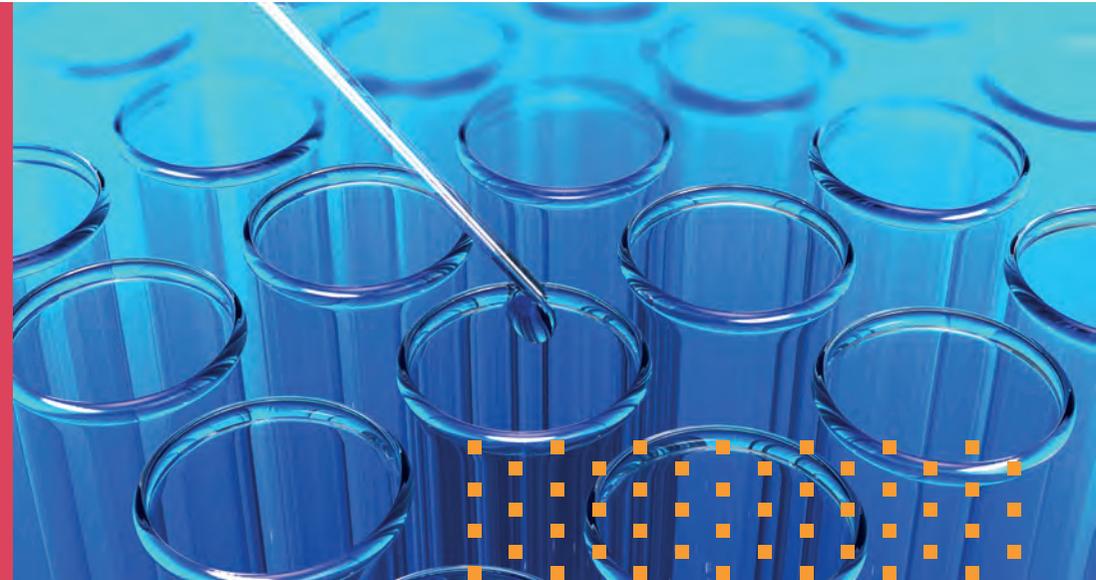
- **Build trust for consumers to engage:** Build better capacity for communication and delivery during disruption.
- **Manage vulnerable populations:** Partner with community groups to advance social and community care models.

Government and community organisations

- **Invest in virtual care:** Promote the accelerated adoption of new technologies that bring more care directly to the patient, connect patients and providers more seamlessly, generate actionable data that can improve healthcare at the individual and community levels, and lower the healthcare spend.
- **Align incentives:** Help providers, community organisations and social services, so they can work together on addressing people's whole health needs.
- **Think outside the box:** Continue to move forward with an innovation mindset. The COVID crisis inspired public-private partnerships that spun up creative solutions to problems that arose because of the pandemic. The relationships developed and lessons learned can be applied to existing problems, lead to new approaches and help countries develop strategies before the next crisis arises.

Conclusion

The future modular health ecosystem

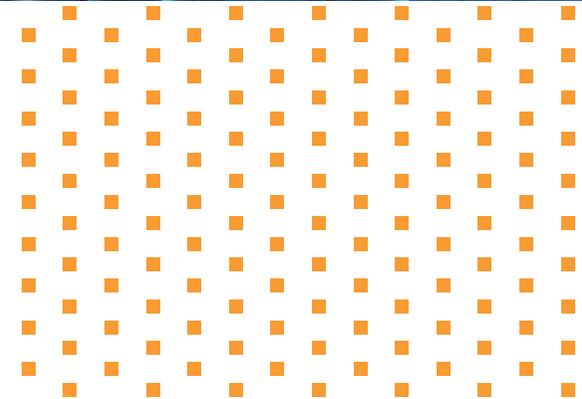


The COVID-19 pandemic has been a time of enormous strain on healthcare systems and the people they serve. But it also has shown what's possible when the healthcare industry, governments and social services organisations work together to address a crisis. Now is the time to build on the pandemic-wrought changes that support the shift of health systems into modular ecosystems of delivery, innovation and wellness—all tied more closely to the consumer.

The COVID crisis could elevate consumerism to a new level by changing the way people want to engage with the healthcare system. The forced embrace of virtual care combined with the emergence of consumer-focused digital platforms will accelerate consumers' push for convenience in care delivery. At the same time, the response of health organisations will affect consumer

demand. How quickly will clinical and experience technology evolve to support different care delivery models, such as retail and virtual? To what extent will healthcare organisations expand to deliver public health interventions? How many organisations will be able to coordinate and orchestrate care across providers and payers with data integration and connected workflows? How will changes to supply chains, materials, people, facilities and capital affect care access and capacity?

The speed of evolution may turn on how these questions are addressed. While consumer demand for change may differ by country or even region, the overarching trend will and should be towards empowering consumers and personalising care. These goals should inform the DNA changes throughout the healthcare industry.



Endnotes

1. Reena Sangar and Emma Middleton, "The time is now: Telehealth and the rise of virtual care," *Ipsos Views*, July 2020, <https://www.ipsos.com/sites/default/files/ct/publication/documents/2020-07/the-time-is-now-ipsos.pdf>.
2. Paul Webster, "Virtual health care in the era of COVID-19," *The Lancet*, 11 Apr. 2020; [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30818-7/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30818-7/fulltext).
3. "Ping An Good Doctor Issues 2019 Sustainable Development Report—Platform Visits Hit 1.11 Billion During Epidemic," Ping An Good Doctor news release, 17 Feb. 2020, <https://www.prnewswire.com/news-releases/ping-an-good-doctor-issues-2019-sustainable-development-report-platform-visits-hit-1-11-billion-during-epidemic-301005828.html>.
4. PwC's Strategy& Germany, *Digital Healthcare: A survey among German digital healthcare start-ups and investors on digital healthcare solutions*, 2020, <https://www.strategyand.pwc.com/de/de/studie/2020/digital-healthcare.html>.
5. US Food & Drug Administration letter, 14 May 2020, <https://www.fda.gov/media/138105/download>.
6. "NHS Using Huma's Remote Monitoring to Care for Patients with COVID-19 Symptoms," Huma news release, 10 June 2020, <https://www.prnewswire.com/news-releases/nhs-using-humas-remote-monitoring-to-care-for-patients-with-covid-19-symptoms-301073723.html>.
7. PwC's Strategy& Germany, *Ground to a Halt: How COVID-19 is challenging and evolving the fundamentals of the Pharma G2M model*, 28 Apr. 2020, <https://www.strategyand.pwc.com/de/de/implications-of-covid-19/ground-to-a-halt.html>.
8. PwC's Strategy&, *Agile Healthcare 4.0: Business agility will help healthcare companies respond to the immediate challenge of COVID-19 and keep pace with industry transformation*, 2020, <https://www.strategyand.pwc.com/ch/de/studien/2020/agile-healthcare-4/agile-healthcare4.pdf>.
9. PwC's Health Research Institute, *Advanced analytics fuel tomorrow's commercial strategy for drugs and devices*, Mar. 2019, <https://www.pwc.com/us/en/industries/health-industries/health-research-institute/commercial-pharma-analytics.html>.
10. PwC's Health Research Institute, *Customer experience in the New Health Economy: The data cure*, 2018, <https://www.pwc.com/us/en/industries/health-industries/health-research-institute/customer-experience.html>.
11. "Here are the countries using Google and Apple's COVID-19 Contact Tracing API," XDA Developers, 24 Nov. 2020, <https://www.xda-developers.com/google-apple-covid-19-contact-tracing-exposure-notifications-api-app-list-countries/>.
12. "First COVID-19 Global Forecast: IHME Projects Three-Quarters of a Million Lives Could Be Saved by January 1," Institute for Health Metrics and Evaluation news release, 3 Sept. 2020, <http://www.healthdata.org/news-release/first-covid-19-global-forecast-ihme-projects-three-quarters-million-lives-could-be>.
13. "Swedish Health Services Builds COVID-19 Emergency Response App with help from Microsoft," Swedish Health Services news release, 2 Apr. 2020, <https://www.swedish.org/about/swedish-news-blog/2020/04/covid-emergency-response-app>.
14. "Cleveland Clinic and SAS share COVID-19 predictive models to help hospitals plan for current and future needs," Cleveland Clinic news release, 21 Apr. 2020, <https://newsroom.clevelandclinic.org/2020/04/21/cleveland-clinic-and-sas-share-covid-19-predictive-models-to-help-hospitals-plan-for-current-and-future-needs/>.
15. "Austin Health deploys AI to monitor COVID-19 symptoms," Microsoft news release, 13 May 2020; <https://news.microsoft.com/en-au/features/austin-health-deploys-ai-to-monitor-covid-19-symptoms/>.
16. PwC, *The shift to virtual care in response to COVID-19*, 8 Sept. 2020, <https://www.pwc.com.au/important-problems/business-economic-recovery-coronavirus-covid-19/shift-virtual-care-response.html>.
17. "Advancing telehealth with Amwell," Google Cloud platform, 24 Aug. 2020, <https://cloud.google.com/blog/topics/healthcare-life-sciences/google-cloud-partners-with-amwell-to-advance-telehealth>.
18. "Teladoc Health Completes Merger with Livongo," Globe Newswire, 30 Oct. 2020, <https://www.globenewswire.com/news-release/2020/10/30/2117764/0/en/Teladoc-Health-Completes-Merger-with-Livongo.html>.
19. "Healthcare, industry forge new supply chains in the fight against COVID-19," *Modern Healthcare*, 8 Aug. 2020, <https://www.modernhealthcare.com/supply-chain/healthcare-industry-forge-new-supply-chains-fight-against-covid-19>.
20. "Summary of Recent SARS-CoV-2 Molecular Testing Survey," *Association for Molecular Pathology* 23 Apr.–5 May 2020, https://www.amp.org/AMP/assets/AMP_SARS-CoV-2_Survey_Report_FINAL.pdf?pass=98.
21. "Global Swab and Viral Transport Medium Market Growing Rapidly Due to Rising Demand from COVID-19 Pandemic," HospiMedica International, 14 Sept. 2020, <https://www.hospimedica.com/covid-19/articles/294784489/global-swab-and-viral-transport-medium-market-growing-rapidly-due-to-rising-demand-from-covid-19-pandemic.html>.
22. Peter Loftus, "Ventilator Makers Ramp Up Production Amid Coronavirus Crunch," *Wall Street Journal*, 19 Mar. 2020; <https://www.wsj.com/articles/ventilator-makers-ramp-up-production-amid-coronavirus-crunch-11584626858>.
23. "Treatments for COVID-19: What helps, what doesn't, and what's in the pipeline," Harvard Health Publishing, March 2020 (updated multiple times since), <https://www.health.harvard.edu/diseases-and-conditions/treatments-for-covid-19>.
24. "Coronavirus (COVID-19) Update: FDA Authorizes Monoclonal Antibody for Treatment of COVID-19," US Food & Drug Administration, 9 Nov. 2020, <https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-authorizes-mono-clonal-antibody-treatment-covid-19>.
25. "Report details COVID-19 drug shortages—and solutions," Center for Infectious Disease Research and Policy, 21 Oct. 2020, <https://www.cidrap.umn.edu/news-perspective/2020/10/report-details-covid-19-drug-shortages-and-solutions>.
26. PwC's Strategy&, *COVID-19: UK industry focus—Where next for healthcare?* 5 July 2020, <https://www.strategyand.pwc.com/uk/en/insights/where-next-for-healthcare.html>.
27. PwC Health Research Institute interview with Vipin Gopal on 30 Oct. 2018 (unpublished).
28. "HHS, Industry Partners Expand U.S.-Based Pharmaceutical Manufacturing for COVID-19 Response," US Department of Health and Human Services news release, 19 May 2020, <https://www.hhs.gov/about/news/2020/05/19/hhs-industry-partners-expand-us-based-pharmaceutical-manufacturing-covid-19-response.html>.
29. "Covid-19 has exposed cracks in the global medicines supply chain. We need to fix them," *Stat*, 2 June 2020, <https://www.statnews.com/2020/06/02/covid-19-exposed-cracks-global-medicines-supply-chain/>.
30. "The Growing Importance of Local Manufacturing and Nearby Outsourcing Partners," *Pharma's Almanac*, 29 Sept. 2020, <https://www.pharmasalmanac.com/articles/the-growing-importance-of-local-manufacturing-and-nearby-outsourcing-partners>.
31. "Investing in Advanced Manufacturing to Support Public Health Preparedness," US Food & Drug Administration, 3 Aug. 2020, <https://www.fda.gov/news-events/fda-voices/investing-advanced-manufacturing-support-public-health-preparedness>.

32. “HHS, Industry Partners Expand U.S.-Based Pharmaceutical Manufacturing for COVID-19 Response,” US Department of Health and Human Services news release, 19 May 2020, <https://www.hhs.gov/about/news/2020/05/19/hhs-industry-partners-expand-us-based-pharmaceutical-manufacturing-covid-19-response.html>.
33. PwC, *Developing COVID-19 vaccines may not be enough: Turning vaccines into vaccinations*, Sept. 2020, <https://www.pwc.com/us/en/industries/health-industries/library/covid-19-vaccine-supply-distribution-challenges.html>.
34. PwC, *Action required: The urgency of addressing social determinants of health*, 24 Sept. 2019, <https://www.pwc.com/gx/en/industries/healthcare/publications/social-determinants-of-health.html>.
35. PwC, *The COVID-19 pandemic is influencing consumer health behavior. Are the changes here to stay?* Apr. 2020, <https://www.pwc.com/us/en/library/covid-19/covid-19-consumer-behavior.html>.
36. “World Mental Health Day: An opportunity to kick-start a massive scale-up in investment in mental health,” World Health Organization news release, 27 Aug. 2020, <https://www.who.int/news/item/27-08-2020-world-mental-health-day-an-opportunity-to-kick-start-a-massive-scale-up-in-investment-in-mental-health>.
37. “COVID-19 disrupting mental health services in most countries, WHO survey,” World Health Organization news release, 5 Oct. 2020, <https://www.who.int/news/item/05-10-2020-covid-19-disrupting-mental-health-services-in-most-countries-who-survey>.
38. “New Study by Teladoc Health Reveals COVID-19 Pandemic’s Widespread Negative Impact on Mental Health,” Globe Newswire, 6 May 2020, <https://www.globenewswire.com/news-release/2020/05/06/2028434/0/en/New-Study-by-Teladoc-Health-Reveals-COVID-19-Pandemic-s-Widespread-Negative-Impact-on-Mental-Health.html>.
39. “COVID-19 disrupting mental health services in most countries, WHO survey,” World Health Organization news release, 5 Oct. 2020, <https://www.who.int/news/item/05-10-2020-covid-19-disrupting-mental-health-services-in-most-countries-who-survey>.
40. “Disproportionate impact of COVID-19 on racial and ethnic minorities needs to be urgently addressed—Bachelet,” Office of the United Nations High Commissioner for Human Rights news release, 2 June 2020, <https://www.ohchr.org/EN/NewsEvents/Pages/DisplayNews.aspx?NewsID=25916&LangID=E>.

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